country to meet each other for an intensive dialogue and to chalk out a common action programme.

- Study and action-projects by local groups, regional camps to understand a local health problem and its broader dimensions, health educational campaigns are other activities through which mfc has grown and consolidated. The camp on lathyrism in Rewa District in 1978, the educational campaign against Oestrogen — Progesterone forte, about diarrhoea and misuse of drugs are examples. mfc is also an active member of the All India Drug Action Network.

ORGANIZATION

The medico friend circle is not a rigid organization. It is loosely knit and composed of friends from various backgrounds, usually medical to start with, often differing in their ways of thinking and in their modes of action. But the understanding that the present health services and medical education system is lopsided in the interest of the privileged few and must change to serve the interests of the poor people of India, is common conviction.

mfc is registered under The Societies Registration Act 1860; No. MAH/902/Pune/81 and under The Bombay Public Trust Act, 1950; Reg No. F-1996 (Pune).

MEMBERSHIP

Anybody who broadly agrees with the perspective and the rules and regulations of mfc is welcome to become a member. Non-doctors are encouraged to join. The membership fee is given below. It is understood that members capable of contributing more than the minimum will do so. Conversely the convenor can waive or reduce the membership fees in deserving cases. For membership forms and rules and regulations, please write to the convenor.

- **Membership fees**

Those earning less than Rs. 750.00 p.m. — Rs. 25.00 per year

Those earning more than Rs. 750.00 p.m. — Rs. 50.00 per year

Membership fee includes subscription to the mfc bulletin

- **Bulletin subscription**

Within India — Rs. 15.00 per year
(add Rs. 3.00 for payments by cheque)

Life subscription — Rs. 250.00

Foreign countries
— sea mail — US $4.00 for all countries
— air mail: Asia — US $6.00
Europe, Africa & Australia — US $9.00
North & South America — US $11.00

- All payments may be made in the name of medico friend circle and sent to:

ravi narayan
convenor, medico friend circle
326, V Main I Block
Koramangala,
Bangalore-560 034

- **Publications**

The following are obtainable from the above address on payment:

1. Subject-wise index of first 100 issues of bulletin
2. Anthologies of bulletin articles
   I — In search of Diagnosis
   II — Health Care Which Way to Go
   III — Under the Lens — Health & Medicine (From Jan 1985)
3. Back issues of some of the bulletins (ask for separate list)
4. Editorial guidelines for contribution to bulletin
5. Background papers of some annual meets (ask for separate list).

Bulletin Back Issues

- Xerox copies of mfc bulletin back issues are available with the Centre for Education and Documentation (CED), 3 Suleman Chambers, 4 Battery Street, Bombay 400039.

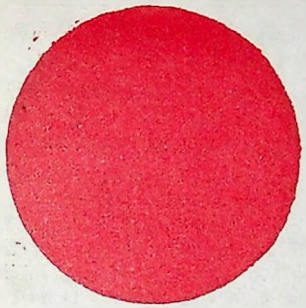
In order to cover costs and at the same time provide subsidies to deserving groups a graded rate structure has been worked out and is available on request.

For mfc members rate is —

i. set of 100 issues — Rs. 240
ii. specific issues — Rs. 4 each
iii. specific article — 0.60 p. per page

- **mfc Drug Campaign**

For further details write to Anant Phadke,
mfc Rational Drug Policy Cell.
50 LIC quarters, University Road, Pune 411006.



medico friend circle

PERSPECTIVE

The medico friend circle is a group of socially conscious individuals, interested in the health problems of our people. mfc is trying to evolve an appropriate approach towards developing a system of health and medical care which is human and which can meet the needs of the vast majority of the population in our country.

The existing system of medical care, we have realized, is not geared towards the needs of the people. It requires a fundamental change. Such a change would occur as a part of a fundamental change in the total social system in the country, since the medical system is only a part of the total social system. mfc believes that the potential created by modern medical science cannot be realized fully without a fundamental change in the social system.

What is wrong with the existing medical system in India?

- Though after independence there has been a rapid growth of the medical services organised by the Government, Private Practice remains the dominant feature of medical care in India. In private practice, medical care like any other commodity in the market is available only to those who have money to pay. The medical profession resembles any other commercial sector and therefore has been dominated by concern for money rather than for people. Commercial competition and personal interests of doctors lead to numerous malpractices.

This behaviour is encouraged and promoted by profit oriented drug companies which dump many useless or even harmful drugs onto the consumer by co-opting the doctors, through their sales promotion techniques.

mfc upholds the interests of the people and

* wants medical care to be available to every one irrespective of his/her ability to pay

* wants to develop methods of medical intervention strictly guided by the needs of our people and not by commercial interests.

• Since purchasing power is mainly concentrated in urban areas, commercial medical practitioners are also concentrated in cities and towns. This overcrowding of doctors is partly responsible for the overgrowth of specialists. This has resulted in the denigration of the role of a basic doctor to just a "cough and cold" doctor. The training of doctors has also been influenced by this situation. Hospital based training by Western and Urban oriented specialists produces a graduate conditioned to urban and hospital practice. Therefore even after prolonged training in a medical college, such a graduate is not capable of dealing with the situation in rural areas.

mfc would work towards

* a pattern of medical care adequately geared to the predominantly rural character of our country and

* towards a medical curriculum and training tailored to the needs of the vast majority of the people in our country.

• To further their narrow professional interests, doctors have established a monopoly control over medical knowledge and medical practice. Medical knowledge has been jargonised and a halo has been created around it. This monopoly and mystification opens the door for domination by the medical profession over patients and by doctors over nurses and other paramedics.

mfc stands for

* popularization and demystification of medical science and

* believes that different categories of medical professionals be regarded as equal members of a democratically functioning team.

• Commercial interests demand a growing market for drugs and medical therapies and this is partly responsible for medical practice being reduced mainly to curative services. It denigrates the primary role of preventive and social measures. Drugs, surgery, even vaccines have so far contributed marginally to the improvement in people's health in different countries. In spite of the primary role of socio-economic development in improving health of a people, a wrong belief is promoted that medical intervention — use of drugs, surgery etc., — is primarily responsible for improvement in the people's health.

* mfc realizes the importance of curative technology in saving a persons life, alleviating suffering or preventing disability but

* stresses the primary role of preventive and social measures to solve health problems on a social level.

• The government health sector is not commercial and the PHC doctors are supposed to emphasize preventive medicine. But this sector has not changed the basic pattern outlined above. The doctor working in a PHC is inclined and trained to do mainly curative work and generally reflects the typical attitude of the upper class, urban, elite professional. Preventive measures when undertaken are therefore reduced to pure technological and administrative measures without any social content.

mfc stand for

* the primary importance of preventive measures, planned and carried out with active participation of the community and

* for democratic decentralization of responsibilities wherever possible.

• Medical practice in its existing form reflects and reinforces some of the negative, unhealthy cultural values and attitudes in our society, eg., glorification of money and power, division of labourers into manual and intellectual workers, domination of men over women, urban over rural, foreign over Indian . . . . .

mfc works towards

* a kind of medical practice built upon human values, concern for human needs, equality, democratic functioning.

• In the present medical system, non-allopathic therapies are given a step-motherly treatment. Allopathic doctors call non-allopaths quacks without knowing anything about their systems of medical care. Equally unscientific are the claims of success made by some non-allopaths and by some drug companies. Prejudices, ignorance, self-interest have prevailed over open-minded scientificity in this important area of medical care.

mfc believes that

* research on these therapies be encouraged by alloting more funds and other resources and

* that these therapies be encouraged to take their proper place in the modern system of medical care.

mfc thus tries to foster among medicos a current upholding human values and aims at restructuring the medical profession to enable it to realize the potential created by modern scientific medicine.

mfc offers a forum for dialogue/debate, sharing of experiences and experiments with the aim of realizing the goal outlined above; and for taking up issues of common concern for action.

ACTIVITIES

mfc members are spread all over India and try to propagate the perspective of mfc through their work. Some members are engaged full-time in organizing health projects in rural areas.

Bulletin

• mfc is as of today, mainly a thought-current and the monthly Medico Friend Circle Bulletin now in its ninth year of publication, is the medium through which members communicate their ideas and experiences to each other. The bulletin publishes articles broadly reflecting the mfc perspective on health problems. Running the mfc bulletin is our chief common activity.

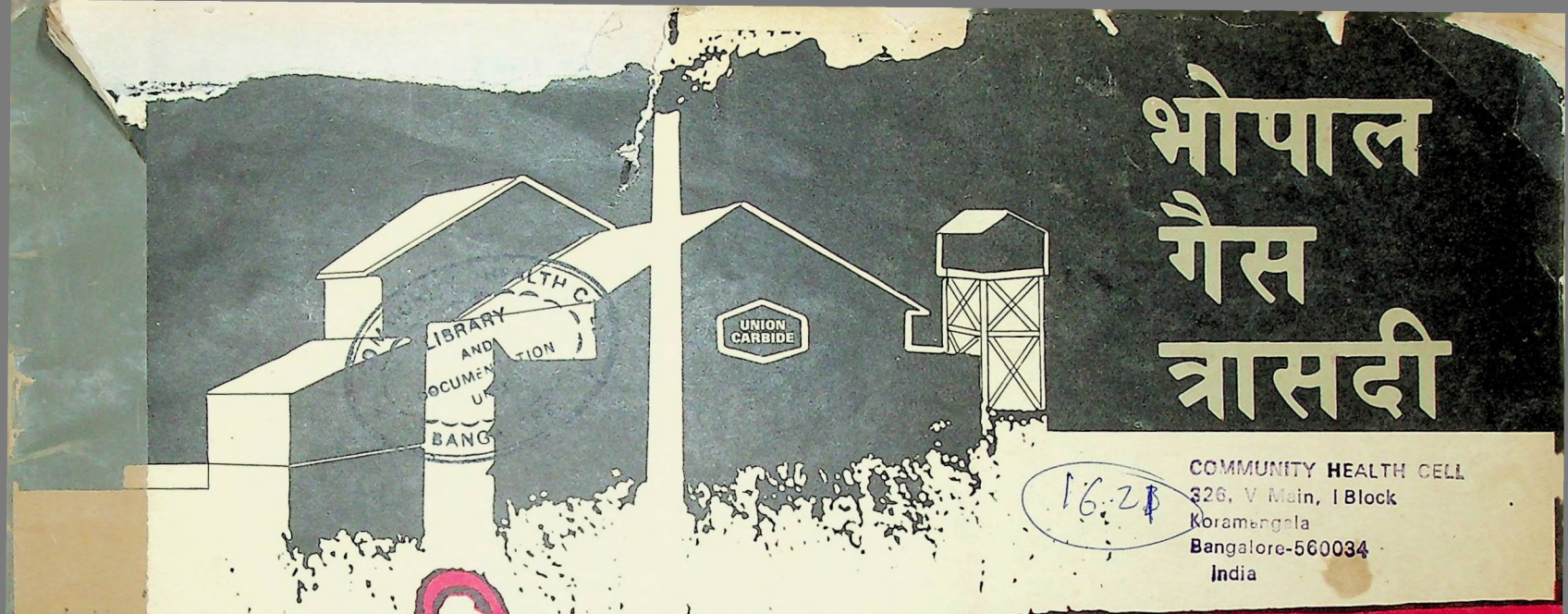
Anthology

Publication of the Anthology of selected articles published in the bulletin has been a milestone in the development of mfc. The first anthology — In Search of Diagnosis — was very well received and was rapidly sold out. KSSP translated it in Malayalam (two editions). The second anthology — Health Care which way to go — is almost sold out. Reprints of the first and second anthologies and the third anthology — Under the Lens Health and Medicine — are due shortly.

Annual Meet

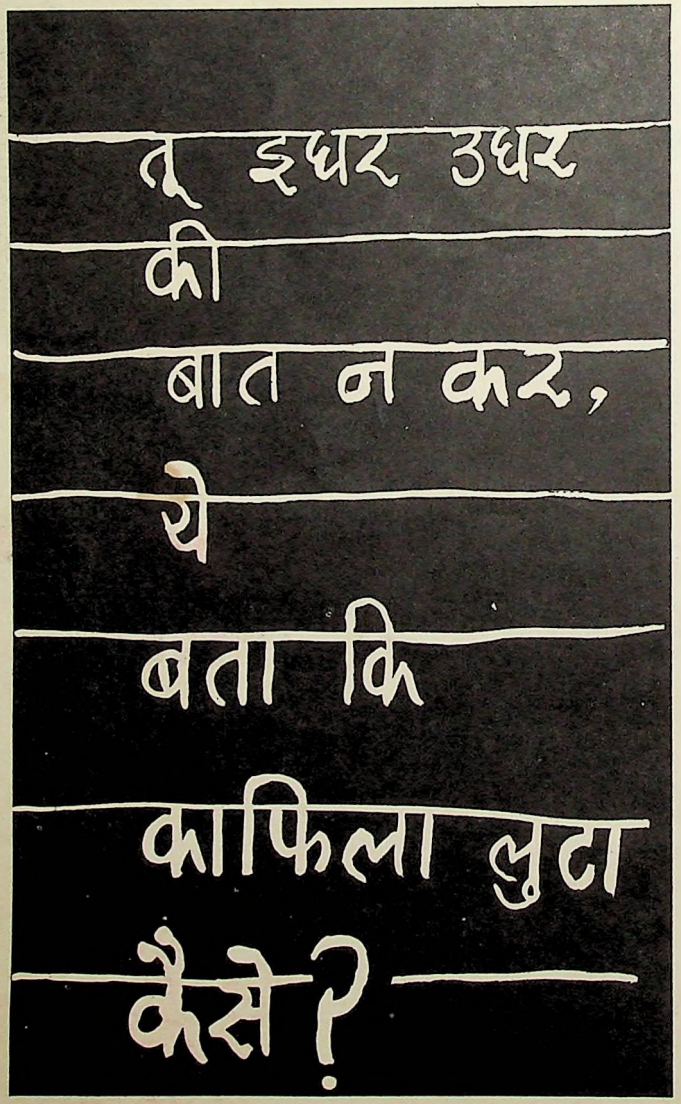
• Once a year mfc members gather at an All India Annual Meet to explore a relevant topic through discussion or to understand the functioning of a particular health care project in terms of a chosen topic. Since 1974, annual meets have been held at Ujjain (relevance of the present health services), Sevagram (present health problems), Hoshangabad (Indian nutritional problem), Calicut (community health approach, role of doctor in society), Varanasi (unemployment among doctors), Jamkhed (community health worker), RUHSA Project (community paediatrics), Tara (misuse of drugs by doctors), Anand (prejudice against women in medical care), CINI, Calcutta (alternative medical education).

The Annual Meet provides an opportunity for far-flung medico friends from different parts of the



भोपाल गैस त्रासदी

जनविज्ञान का सवाल



यह त्रासदी बीती हुई घटना मात्र नहीं है,
बल्कि एक जिन्दा सवाल है।

सवाल क्या है?

आइए, मिलकर समझने की कोशिश करें.....

अध्ययन केन्द्र
एकलव्य शैक्षिक शोध एवं नवाचार संस्थान,
होम गार्ड आफिस के पास, कोठी बाजार,
होशंगाबाद (म. प्र.) द्वारा बनाई गई पोस्टर
प्रदर्शनी पर आधारित

भोपाल की मासूम जनता को शायद किसी रात सोते समय यह पता भी नहीं चलेगा कि कल की सुबह उनके भाग्य में नहीं है. शहर के समीप यूनियन कार्बाइड से विषैली मौत के रूप में न जाने कब रंग हीन गैस फॉसजीन, ऑक्सीजन के साथ उनके भीतर जाकर रक्त को दूषित कर दे और वे निद्रा की मीठी गोद में लेटे-लेटे ही चिरनिद्रा की गोद में स्थानांतरित हो जाएं.

■ प्रचंड साप्ताहिक, 30 दिसंबर 82

जब हवा जहरीली हो जाए तो मौत का हिसाब रखना शायद यमदूत के लिए भी मुश्किल होगा। ऐसे में भोपाल में जहरीली गैस के हादसे में कितने मरे इसका सही आँकड़ा कौन बता सकता है। सरकार कह रही है ५४६ मौतें हुई हैं। विभिन्न सूत्र इस गिनती को एक हजार से पाँच हजार तक बता रहे है। लाशों को समेटने के लिए श्मशान के घेरे छोटे पड़ गए। जो मौत से बच गए, और जिंदगी से लड़ रहे हैं उन्हें बड़े-बड़े अस्पतालों में जगह दे पाना मुश्किल हो रहा है। केवल भोपाल ही नहीं, इटारसी, सीहोर, आष्टा, राजगढ़, पिपरिया, सागर, विदिशा, जबलपुर, सोहागपुर, इंदौर, उज्जैन, देवास सभी जगह अस्पताल जहरीली हवा फेफडे में भर लेने वालों से भर गए हैं। जिसे जो दिशा मिली वह उस तरफ भाग गया। और यह तो मनुष्य की बात पशुओं-पक्षियों में भी जैसे महामारी फैल गई हो। करीब तीन हजार पशुओं के मरने का अनुमान है। भोपाल में जनजीवन अभी भी घटना की दहशत से मुक्त नहीं हुआ है। घटना की विकरालता के संदर्भ में प्रधानमंत्री श्री राजीव गाँधी आज अचानक भोपाल आए। उधर अमेरिका में यूनियन कार्बाइड कंपनी के संचालकों ने दुनिया में उनके ऐसे चारों कारखाने बंद करने का निर्णय लिया है। शासन, डॉक्टर, दवाई, सभी कुछ अस्पतालों में भेज रहा है। शासन विभिन्न क्षेत्रों और नगरों में पीड़ितों के लिए हर संभव सहायता की कोशिश कर रहा है।

भागो-भागो मौत आ रही है

पाँच सौ से अधिक मरे, दो लाख लोग प्रभावित, चारों तरफ भगदड़

चालीस वर्ग किलोमीटर क्षेत्र में जहर ही जहर, राहतें घोषित

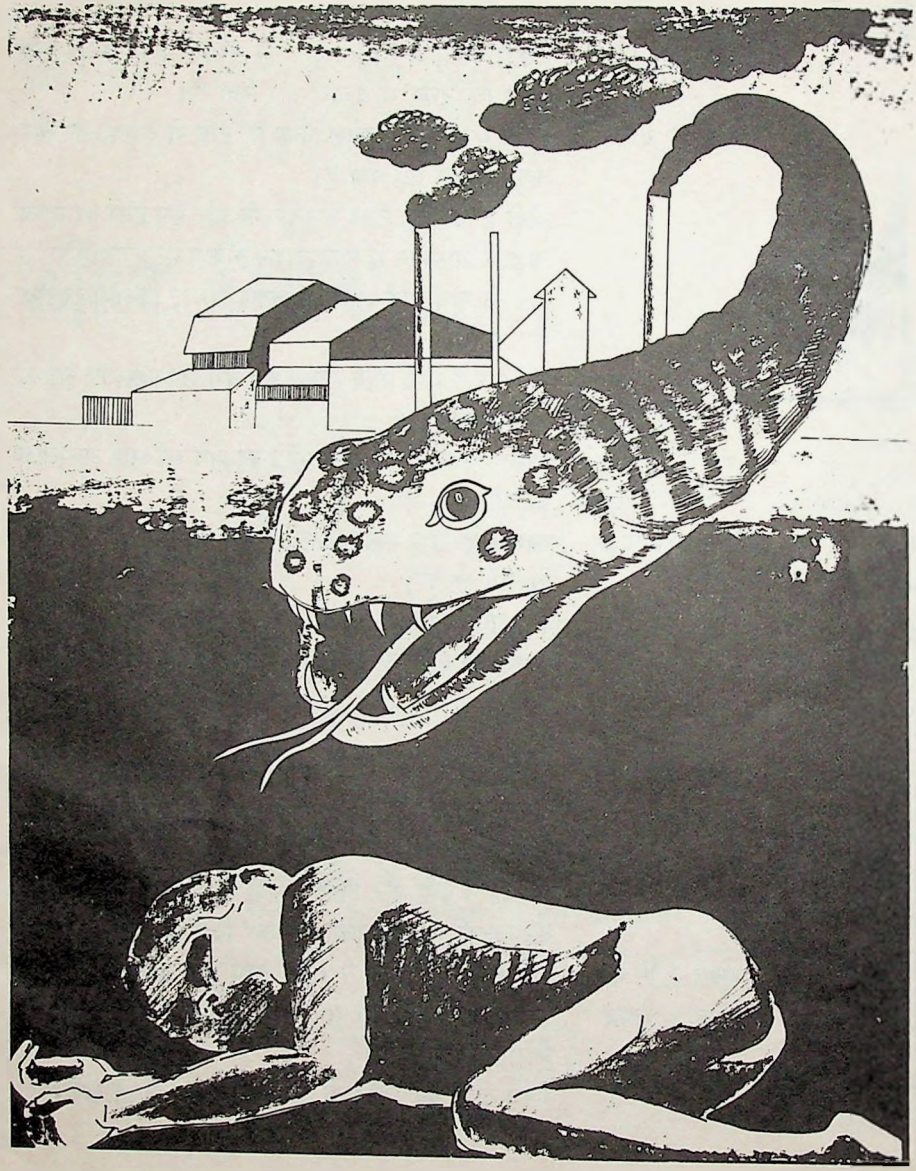
हवा में जहर, मौत का कहर

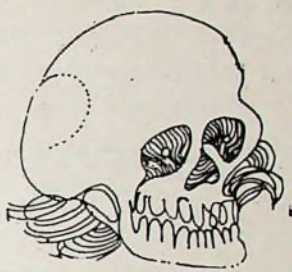
मदन मोहन जोशी द्वारा

भोपाल ३ दिसंबर। यूनियन कार्बाइड के बैरसिया रोड स्थित कारखाने में फासजीन गैस की जोखिम का मामला पुराना है और छिटपुट घटनाएँ होती रही थीं, लेकिन किसी को अंदाजा नहीं था कि किसी दिन सारा शहर गैस चेंबर में बदल जाएगा, सैकड़ों बेकसूरों को लेने कोई कालरात्रि आएगी। कैसी दिखती थी वह जहरीली गैस और कैसी थी उसकी बू-पूछो तो लोग बता नहीं कर पाते। वह सब कल्पनातीत और वर्णनातीत था।

रविवार की रात खासी ठंड थी और राजधानी भोपाल के लोग रजाइयों में दुबके थे। आधी रात के एक घंटे बाद जो जागे, उन्होंने घुटन सी महसूस की। आँखों में चुभन सी हो रही थी। सोमवार की सुबह मनहूस दिन लेकर आई। यूनियन कार्बाइड के कीटनाशक कारखाने के एक टैंक में रिसन होने से मिथाइल साइनाइड नामक जहरीली गैस शहर के वायुमंडल में व्याप गई थी और नींद से जागा शहर यातनाओं के दहखाने में था। सैकड़ों लोग बिस्तर में ही समाधिस्थ हो गए थे। शहर की अनेक बस्तियाँ चीखों से गूँज उठीं, लोग घरों से सुरक्षित स्थानों की ओर बेतहाशा भाग रहे थे। अस्पतालों में मरीजों की भर्ती चल रही थी। उनकी आँखें लाल थीं। उन्हें कै हो रही थी। जो शहर छोड़कर भाग सकते थे, वे शहर छोड़कर भागे—बसों से या रेलों से, या जो भी वाहन मिला। सोलह लोगों के मरने से खबर शुरू हुई थी। शाम तक मृतक संख्या का आँकड़ा पाँच सौ को पार कर गया। कोई नहीं जानता कि यह कहाँ जाकर थमेगा, प्रभावित तो हजारों हैं। अस्पतालों में दस हजार से भी ज्यादा लोगों का इलाज चल रहा है। इनमें से चार-पाँच सौ जिंदगी और मौत के बीच झूल रहे हैं। जब आदमी कीड़ों की तरह मरे हों तो मवेशियों की कौन कहे। पालतू पशु और सुबह-शाम गाने वाले रंग-बिरंगे पक्षी भी असंख्य मरे हैं। भोपाल की झील स्तब्ध हो गई है, और सड़कों गलियों में मौत के साए मँडरा रहे हैं, मातम है, रुदन है। किसी के सिर से माँ-बाप का साया उठ गया, कोई जीवन-संघर्ष के लिए अकेला रह गया। मानवीय त्रासदी की ऐसी कहानियाँ आने वाले कई दिनों तक सुनने को मिलेंगी। इस देश में शायद ऐसा पहले कभी नहीं और कहीं नहीं हुआ। विश्व के लिए भी यह एक अद्भुत हादसा है, एक मानवीय त्रासदी।

2/3 दिसम्बर की रात- अखबारों में





यह
हाहाकार
यूनियन कार्बाइड के
भोपाल स्थित
कीटनाशक कारखाने
से जहरीली गैस
रिसने से
मचा!

उस काली रात को..

2/3 दिसम्बर 1984

रात 10.30 बजे : दूसरी पाली में मिक प्लांट पर तैनात मजदूरों को पता चला कि टंकी में दबाव बढ़ रहा है।

रात 12.30 बजे : तैनात मजदूरों ने महसूस किया कि टंकी में दबाव और ताप बहुत अधिक बढ़ गया है।
थोड़ी ही देर बाद टंकी हिलने लगी और गैस टंकी का वाल्व तोड़कर आसमान में सफेद बादल के रूप में छा गई। यह गैस हवा के साथ साथ शहर की तरफ 10-12 किलोमीटर तक फैल गई।
चंद मिनटों में ही लोग खांसते हुए घरों से निकलकर सड़कों भागने लगे।

रात 1.15 बजे : खांसते, उल्टी करते और आँखों पर हाथ रखे लोग अस्पताल पहुंचने लगे।

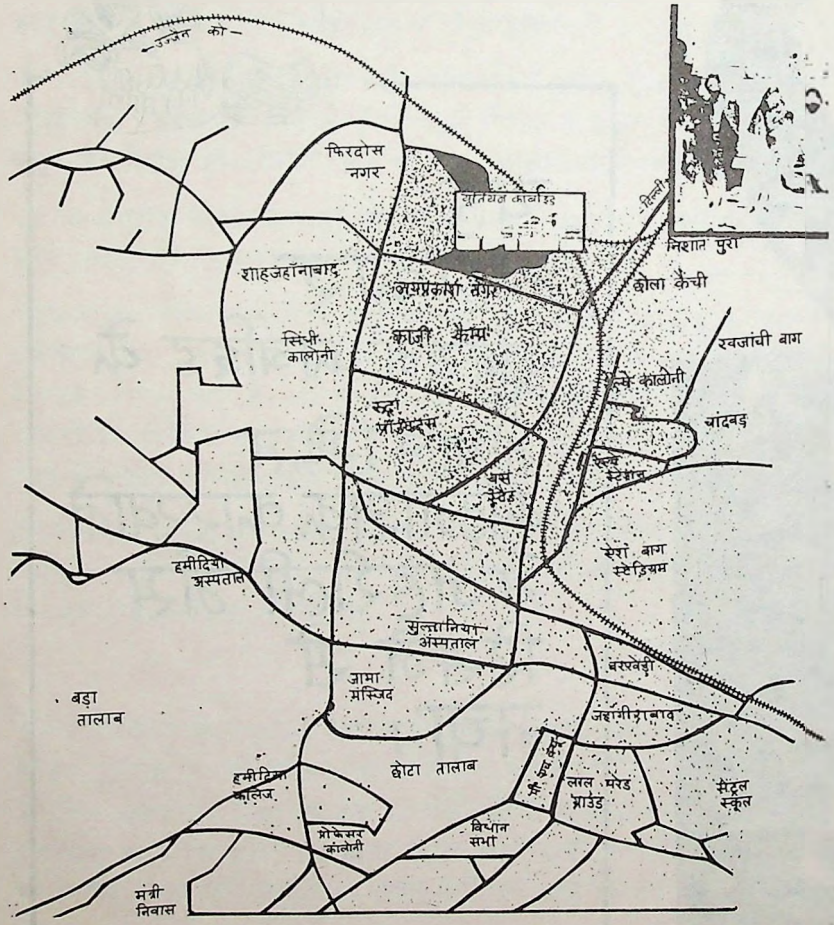
रात 2.00 बजे : लोग गाड़ियों में भागते भागते सीहोर तक पहुंचने लगे—40 किलोमीटर दूर!

रात 2.30 बजे : अब तक 4000 से ज्यादा लोग अस्पताल में पहुंच चुके थे। अस्पतालों के डाक्टर भी गैस से प्रभावित होकर बीमार होने लगे।

सुबह 4.00 बजे : 10 000 से ज्यादा लोग भोपाल से भागकर सीहोर, ओबैदुल्लागंज, होशंगाबाद तथा अन्य शहरों और गाँवों में पहुंच चुके थे।
सैनिकों ने इसी बीच पीड़ित लोगों को ट्रकों में भर भर कर अस्पतालों तक पहुंचाना शुरू कर दिया था।

सुबह 7.30 बजे : पुलिस और प्रशासन ने राहत कार्य शुरू किया।

सुबह 8.00बजे : आकाशवाणी समाचार से देश के लोगों को, सारी दुनिया के लोगों को पता चला।
मरने वालों की संख्या के बारे में अटकलें लगने लगीं।



दोपहर 12 बजे : एक बार फिर से भोपाल की सड़कों पर भगदड़ मच गई। अफवाह फैली कि गैस का रिसन फिर से होने लगा है।

शाम 5.00 बजे : अस्पतालों में लगभग 20,000 लोग इलाज के लिए पहुंच चुके थे। 500 से ज्यादा लोग कब्र के गाल में समा चुके थे। अनगिनत पशु और पक्षी भी मर चुके थे।

और फिर.....

4 दिसंबर1984 : यूनियन कार्बाइड के 5 प्रबन्धकों को गिरफ्तार किया गया तथा कारखाने में ही नजरबंद रखा गया। सी.बी. आई. द्वारा जाँच शुरू हुई। यूनियन कार्बाइड संबंधित दस्तावेज जब्त कर लिए गए। फैक्टरी पर सील लगा दी गई।

5 दिसंबर : मृतकों की संख्या एक हजार से अधिक।

7 दिसम्बर : यूनियन कार्बाइड (अमेरीका) के अध्यक्ष और यूनियन कार्बाइड (इंडिया) लिमिटेड के अध्यक्ष तथा प्रबंध संचालक गिरफ्तार किए गए तथा यूनियन कार्बाइड के अतिथि गृह में रखे गए। मगर इन्हें गिरफ्तारी के कुछ ही समय बाद रिहा कर दिया गया।
यूनियन कार्बाइड के खिलाफ मुआवजे के लिए मुकदमा अमेरीका में दायर। इसके पश्चात अनेक अमेरिकी वकील भोपाल के गैस पीड़ितों की तरफ से मुकदमा दायर कर रहे हैं।

10 दिसम्बर : मृतकों की संख्या दो हजार से अधिक।

12 दिसम्बर : सरकार ने बची हुई मिक को निष्प्रभावी करने की योजना घोषित की। उसमें कहा गया कि बची हुई मिक से सेविन कीटनाशक बनाई जाएगी। फैक्टरी में पहले से ही सेविन का निर्माण होता रहता था। शासकीय घोषणा में ऐसी किसी नई बात का उल्लेख नहीं था जो सामान्य विधि से अलग हो। लोगों को कहा गया कि इसमें कोई खतरा नहीं है, फिर भी यदि लोग चाहें तो वे भोपाल छोड़कर जा सकते हैं। उनके लिए बसों व रेलगाड़ियों का इन्तजाम था। इस घोषणा से एक भारी पलायन शुरू हुआ और अगले 2-3 दिन में भोपाल शहर खाली हो गया। लगभग 2 लाख लोगों ने शहर छोड़ा।

14 दिसम्बर : मृतकों की संख्या तीन हजार से अधिक।

16 दिसम्बर : यूनियन कार्बाइड में सेविन बनाना शुरू हुआ और 23 दिसम्बर तक बनता रहा।

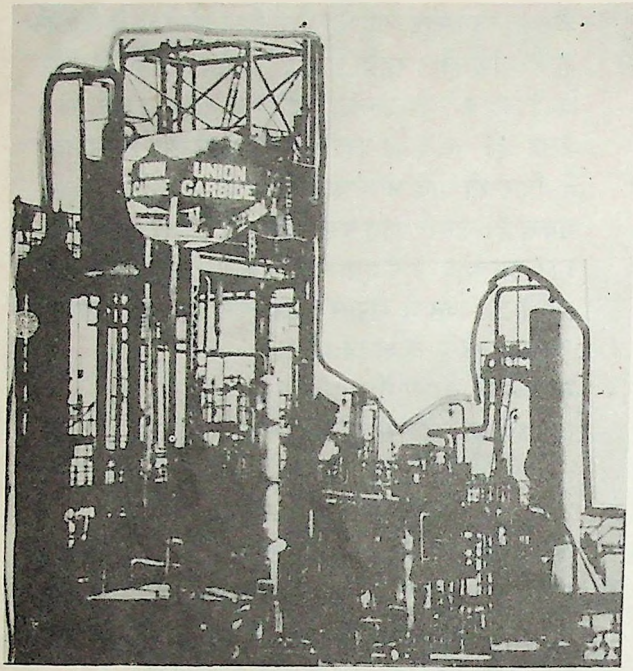
30 दिसम्बर : श्रम मंत्री ने मंत्रिमंडल से इस्तीफा दिया।

1 जनवरी85 : **जैसे–जैसे लोग वापस आने लगे इलाज, राहत व पुनर्वास की समस्या लोगों के सामने आने लगी। पीड़ित लोग संघर्ष का रास्ता अपनाने पर मजबूर हुए। 1 जनवरी को जुलूस निकला और चक्का जाम हुआ।**

3 जनवरी : एक विशाल जुलूस निकाला और उसके पश्चात जहरीली गैस कांड संघर्ष मोर्चा की तरफ से धरना शुरू हुआ।

12 जनवरी : रेल रोको आंदोलन जिसमें कई लोग गिरफ्तार हुए। इसके साथ–साथ सरकार की तरफ से राहत कार्य भी तेज हुआ। गैस पीड़ितों को राशन देने व उनके इलाज निगरानी के लिए व्यवस्था की घोषणाएं भी हुई।

दो माह, तीन माह, 100 दिन! फिर केवल यादें? एक धरना, एक जुलूस, या शायद एक स्मारक!! लेकिन भोपाल की त्रासदी तो जीवित है। लोग अभी भी मर रहे हैं, गर्भवती महिलाओं को आने वाले कल का भय सता रहा है, आँसू अभी भी बह रहे हैं। भोपाल को एक धुंधली यादगार समझ कर नहीं छोड़ा जा सकता। यूनियन कार्बाइड को अंतिम हंसी हंसने नहीं दिया जा सकता.....



क्या इस कारखाने में दुर्घटना पहली बार हुई?

नहीं! ! !

मिथाइल आइसो साइनेट प्लांट का निर्माण 1977 में शुरू हुआ और 1980 में यह प्लांट काम करने लगा। इस प्लांट के चालू होते ही आए दिन दुर्घटनाएं होने लगी। अनगिनत ऐसी दुर्घटनाएं हुई जिनको दबा दिया गया।

'रपट' – अक्टूबर1982

"मगलवार का वह दिन जब रात के अंधेरों में घिरकर बुधवार की शक्ल में तब्दील हो रहा था तभी अचानक बेर्सासिया रोड स्थित यूनियन कार्बाइड के एम.आइ.सी. प्लांट में कार्यरत ट्रेनी ऑपरेटर वाडेकर द्वारा वाल्व खोलते ही पाइप लाइनों को जोड़ने वाला फ्लेज एक धमाके के साथ फूट पड़ा और वह जहरीली मिथाइल आइसों साइनेट, फ्लेंज से लावे की तरह उबल पड़ी। प्लांट पर काम कर रहे मजदूर अपनी–अपनी जान बचाने की बदहवासी में बाहर की तरफ भागने लगे और खतरे की सूचना देने के लिए कांच फोड़ दिया। इस अंधेरे में खामोशी से अपना वक्त काटती रात इस अपशगुनी सायरन की मनहूस आवाज से अचानक कत्ल की रात में बदल गई।

सायरन के बजते ही सारी फैक्टरी के मजदूर अपने अपने काम छोड़कर फैक्टरी से दूर निकल जाने को भागने लगे। एक तरफ तो कार्बाइड के अन्दर यह सब हो रहा था और दूसरी तरफ हवा का तेज बहाव न होने के बावजूद मिथाइल ने माहौल में घुलकर अपना रंग दिखाना शुरू कर दिया। जिसके नतीजे में आस पास के इलाके, ग्रीन पार्क कालोनी तथा छोला रोड व पास ही बनी झुग्गियों के लोगों को,जो गहरी नींद सो रहे थे, गैस के प्रभाव से सांस लेने में तकलीफ सी होने लगी और सायरन की आवाज से वे घबराकर उठ बैठे। वातावरण में फैले इस जहर के खतरे से वाकिफ हो चुके लोग उस वक्त शहर की तरफ भागने लगे जब उनकी आँखों से आंसू निकलने लगे और सांस लेना दूभर हो गया। रात का वह सन्नाटा आहो–जार और चीखो पुकार में बदल गया, सर पर खड़ी मौत को भांपकर लोग अपने अपने बच्चों को गोद में ले–ले कर अपनी पूरी ताकत से शहर की तरफ बचाव की उम्मीद में दौड़ पड़े।

यह सब उस समय हुआ जबकि उक्त प्लांट का वाल्व पाँच–दस मिनट में ही वहाँ के एक सुपरवाइजर श्री वी.एन. अग्रवाल ने आवश्यक मास्क धारण कर बन्द कर दिया था, हालांकि इस काम में वे खुद भी बुरी तरह घायल हो गए। उसके गालों की चमड़ी बुरी तरह जल गई तथा शरीर के अनेक हिस्से भी मिक से झुलस गये। रात के 1 बजकर 10 मिनट पर हुई इस दुर्घटना का असर सारे इलाके पर सुबह साढ़े छः बजे तक रहा। आसपास के इलाकों से भागे हुए लोग सुबह ही वापस लौट पाए। लगभग चार बजे पुलिस भी घटना स्थल पर पहुंच गई और दुर्घटनाग्रस्त लोगों के बयान दर्ज करने चाहे लेकिन प्लांट सुपरिंटेंडेंट गोपालन ने बयान देकर तथ्य छिपा लिए। सबसे बड़ी बात तो यह है कि मिथाइल एक्सपोजर हो जाने की हालत में दुर्घटनाग्रस्त लोगों को 48 घंटे तक मेडिकल आब्जर्वेशन में रखा जाना आवश्यक है लेकिन 'रपट' में पर्दाफाश होने के बाद कम्पनी के डरे हुए अधिकारियों ने घटना को दबाए रखने के लिए न तो उन्हें चिकित्सा के लिए हमीदिया अस्पताल में भेजा न कहीं और, बल्कि वहीं उन्हें सुबह तक बिठाए रखा, और बिना किसी चिकित्सा के घर भेज दिया। और आज रोटी की मजबूरी में फंसे चारों लोग चुप हैं।"

□ 26 दिसम्बर 1981 को प्लांट पर काम करते समय मोहम्मद अशरफ फॉसजीन गैस लीक हो जाने के कारण मारा गया।

□ 15 दिन बाद, जब अमेरिका से आए विशेषज्ञ भी मौजूद थे, अचानक एक बार फिर फॉसजीन लीक हो जाने के कारण मौत के झूले में झूलते 24 लोगों को अस्पताल पहुंचाया गया और कई माह तक आशा–निराशा के बीच तड़पते मजदूर तरसती निगाहों से जिन्दगी की ओर देखते रहे।

□ अप्रैल 1982 में जी. डब्लू. ए. खान और एम. एस. खान को गम्भीर चोट लगी तथा इसी दिनांक को फॉसजीन दुर्घटना में एक कर्मचारी एस. ए. वाडेकर गम्भीर रूप से घायल हो गया।

□ फरवरी 1982 में 18 श्रमिक फॉसजीन गैस के कारण गम्भीर रूप से घायल हुए थे और उन्हें हमीदिया अस्पताल में भरती किया गया।

पत्रकार की चेतावनी

"यह MIC प्लांट वस्तुत: अमेरीका के एक निर्जन इलाके में स्थापित किया गया था, लेकिन वक्त के साथ बढ़ती आबादी तथा कारखाने में आए दिन होने वाली मौतों ने अमेरीका सरकार को मजबूर कर दिया कि उसे वहाँ से निष्कासित करे। ऐसे समय में जब तलाश की गई तो इस प्लांट की अनुमति किसी भी देश ने देने से इनकार कर दिया, लेकिन अपनी शानदार परम्पराओं के अनुसार भारत सरकार ने इनकार नहीं किया और अचानक काल का यह क्रूर पंजा भोपाल के गले पड़ गया।" 17 सितम्बर 1982

"इस कारखाने के आस पास कई गाँव हैं, कई कालोनियाँ हैं। जिनमें रहने वाले लोग आए दिन अनजानी बीमारियों के शिकार होकर डाक्टरों की चौखटों पे दम तोड़ रहे हैं, खेतों में खड़ी लहलहाती फसलें भी अचानक पता नहीं क्यों कभी–कभी मुरझा जाती है, शायद उनमें महसूस करने की ताकत ज्यादा है।" –17 सितम्बर1982

"मानवीयता के विरुद्ध एक घृणित षडयंत्र चल रहा है। अपनी अपनी धुन में डूबे लोग बेखबर से हैं। जिनको खबर है वह चुप हैं। मौत दबे पाँव आगे बढ़ती आ रही है। भोपाल सो रहा है फिलहाल अगली सुबह तक के लिए और किसी दिन शायद बिना अगली सुबह को जागने के लिए।" –1 अक्टूबर 1982

"इस घृणित अमानवीय षडयंत्र का नतीजा आखिर एक दिन अवश्य सामने आएगा, लेकिन तब तक शायद बहुत देर हो चुकी होगी। शायद कई हजार लोग अशरफ की तरह मारे जाएं कई हजार बाबूलाल चकोले की तरह अपने सीनों पर यूनियन कार्बाइड के जख्म ढोते हुए जिन्दा रहें, क्योंकि अमेरीकी जाल में फंसे हुए लोग इसके विरुद्ध कोई कदम उठाने को तैयार नहीं है।" –8 अक्टूबर 1982

"यह शिकायतें मेरी निजी नहीं हैं, बल्कि सामाजिक पीड़ा से उपजी शिकायतें हैं।"

राजकुमार केसवानी

एक पत्र: मुख्यमंत्री को.....

आदरणीय महोदय,

यह खत मेरी बहुत सारी शिकायतों को ढोकर आप तक पहुंच रहा है। यह शिकायतें मेरी निजी नहीं, बल्कि सामाजिक पीड़ा से उपजी शिकायते हैं।

इस पत्र के साथ में अखबार 'रपट' साप्ताहिक के तीन अंकों की प्रतियां भेज रहा हूं। इन अंकों में मुख्य मुद्दे हैं—यूनियन कारबाइड की इस शहर को मौत की धमकी और गवर्नमेण्ट प्रेस के मशीनों और फाइलों के बीच दबी 'मोनो कास्टर' सेक्शन के मजदूरों की सिसकियां। बाकी खबरें भ्रष्टाचार से सम्बन्धित हैं, जिनको मैं दूसरा स्थान देता हूं।

यह पत्र लिखने का कारण मात्र इतना है कि जब आप नामदेव टसाल की सामाजिक पीड़ा से उपजे क्रोध को सन्दर्भों में देखते हैं और जायज मानते हैं तो मेरे आक्रोश को भी आप यकीनन सन्दर्भों से परे हटाकर नहीं देखेंगे। मेरी गुजारिश है आपसे, यकीन जानिये यह शहर भोपाल खतरे में है, इसे बचा लीजिये। इस दीवाने की बात मानकर तहकीकात तो करवाइये, आपको भी यकीन हो जाएगा।

मैं अपने लिखे और अपने अखबार की वकत बहुत अच्छी तरह जानता हूं। कोई क्रांति नहीं आ जाएगी, किसी का तख्ता नहीं पलट जाएगा, लेकिन क्या महज इसी वजह से मैं चुप रहूं? क्या यह सोचकर कि मेरी इस कोशिश को पीत पत्रकारिता का नाम दिया जा सकता है, मैं अन्धा बन जाऊं? नहीं, मैं हिम्मत नहीं हारूंगा, लड़ूंगा और इस दृढ़ निश्चय के साथ कि इस शहर को हिटलर का गैस चेम्बर नहीं बनने दूंगा।

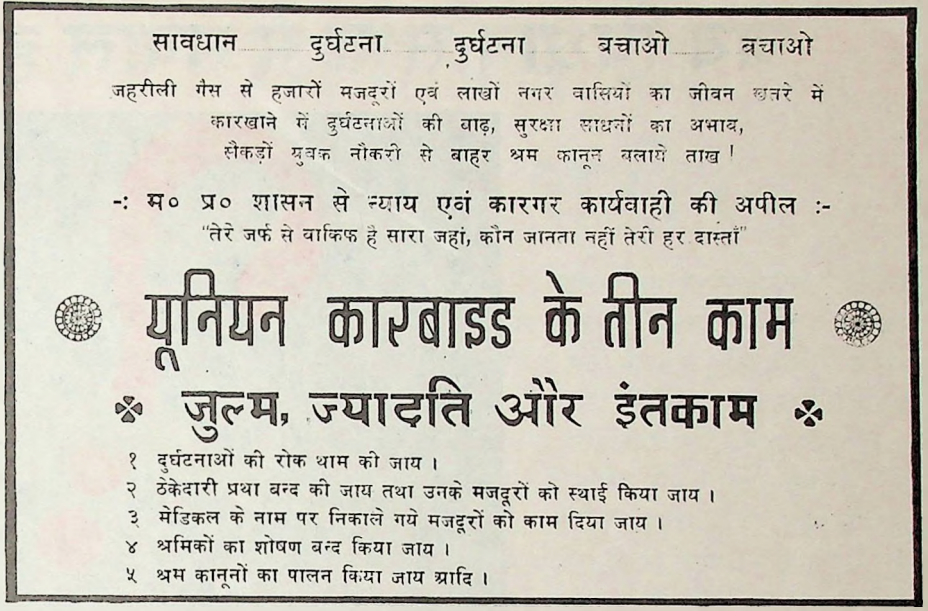
बहुत सारी बातें, बहुत सारी, लेकिन मन में इस वक्त एक ही बात है कि एक बार आप सचमुच यह झांककर ही, देख तो लें, इस शहर भोपाल के चलते-फिरते इन्सानों के खिलाफ मौत क्या मंसूबे बांध रही है?

मैं जानता हूं, जवाब आएगा।

अपनी धुन में

भोपाल राजकुमार केसवानी

कार्बाइड की प्रबल भाग्य रेखा.....



1967-68 में जब यूनियन कार्बाइड की स्थापना की गई, तब यह स्थान नगर निगम क्षेत्र के बाहर था। धीरे–धीरे यह इलाका नगर निगम सीमा क्षेत्र में आ गया और सन् 1975 में तत्कालीन नगर निगम प्रशासक श्री महेश नीलकण्ठ बुच द्वारा कार्बाइड को नोटिस दिया गया कि यह क्षेत्र अब निगम सीमा क्षेत्र में आ चुका है, अतः कारखाने को शीघ्र ही सीमा से बाहर ले जाया जाए। कार्बाइड की प्रबल भाग्य रेखा के कारण इससे पहले कि बुच साहब कुछ कर पाते वेयहाँ से स्थानांतरित हो गए और यह प्रकरण दब सा गया। और साथ ही एक सौदेबाजी के तहत कार्बाइड के तत्कालीन महा प्रबन्धक श्री सी. एस. राम. द्वारा नगर निगम को वर्द्धमान पार्क के निर्माण हेतु 25 हजार रुपये का चंदा दिया गया। इस तरह वह नोटिस पूरी तरह ठण्डे बस्ते में चला गया।

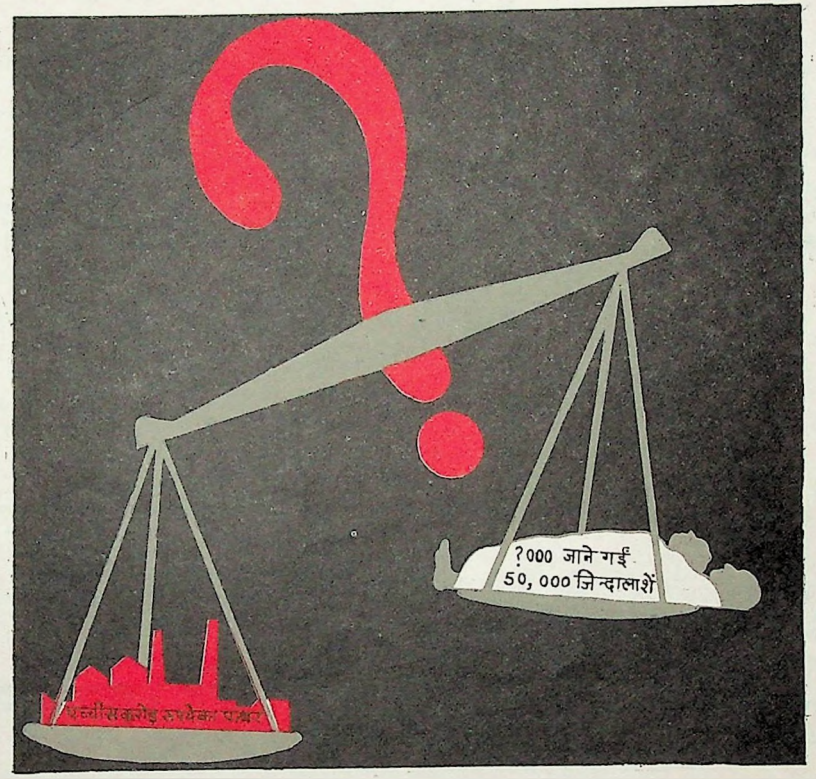
('रपट' से)

मजदूर संघ ने भी आंदोलन छेड़ा....

1982 में हुई दुर्घटना के बाद कारखाने के मजदूर संघ ने सुरक्षा समस्याओं को लेकर आंदोलन छेड़ा। उन्होंने आसपास बसे लोगों और सरकार तक को कारखाने के खतरों के बारे में सूचित किया।

इस आन्दोलन के कारण कई मजदूरों को नौकरी से निकाल दिया गया। मजदूर संघ से प्राप्त तथ्यों के आधार पर ही बाद में स्थानीय पत्रकार श्री राजकुमार केसवानी ने 'रपट' (साप्ताहिक), 'प्रचंड' (साप्ताहिक) एवं 'जनसत्ता' (दैनिक) में इस सम्बन्ध में लगातार चेतावनी भरे लेख लिखे।

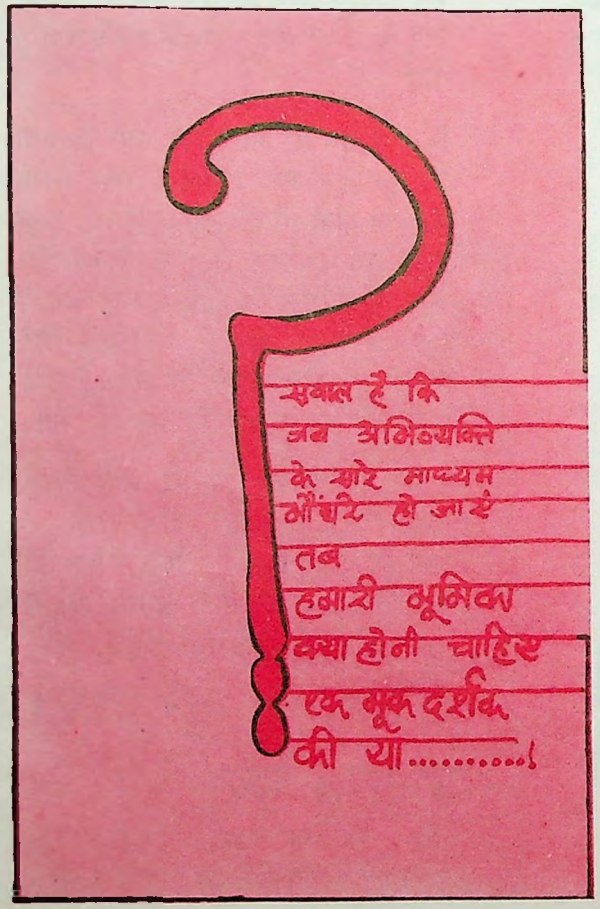
जब विधान सभा में सवाल हुआ.....



श्री महेन्द्र वर्मा : अध्यक्ष महोदय, इस कारखाने के कारण जहरीली गैस वहाँ के आसपास के एरिए को प्रभावित कर रही है, तो क्या माननीय मंत्री जी उसके कुप्रभाव को देखते हुए उस कारखाने को कहीं अन्यत्र ले जाकर स्थापित करने की कार्यवाही करेंगे?

श्री तारासिंह वियोगी श्रममंत्री अध्यक्ष महोदय, यह कारखाना सन् 1969 में स्थापित हुआ है और 25 करोड़ की लागत लगी है, यह कोई छोटा सा पत्थर नहीं है कि इस को उठाकर किसी दूसरी जगह रख दूँ। इसका पूरे देश से सम्बन्ध है। ऐसा भी नहीं है कि भोपाल को इससे कोई बहुत बड़ा खतरा पैदा हो गया है और ऐसी कोई संभावना नहीं है।

मिक गैस की चपेट में शरीर



□ शरीर में मिक तीन तरीकों से पहुंचती है—साँस द्वारा, मुँह से या त्वचा को भेद कर। इसलिए अन्य गैसों की अपेक्षा मिक अधिक घातक है।

□ मिक का शरीर पर असर इस बात पर निर्भर करता है कि हवा में उसकी मात्रा क्या है। जब भोपाल की हवा में 40 टन मिक घुलकर फैला तब लोगों पर जो असर हुआ वह कुछ इस प्रकार से था:

□ **आँखों में:** असहनीय जलन मानो किसी ने उनमें मिर्ची झोंक दी हो। साथ ही खूब आँसू बहने लगे और सब कुछ धुंधला —सा दिखाई देने लगा। मिक आँखों की पतली त्वचा को जला देती है और यही इन सब का कारण है। आँखों के घाव अब धीरे धीरे भर गए हैं। पर कुछ लोग अंधे भी हो गए हैं। लंबे इलाज के बाद भी लोगों की आँखे पूर्णतः ठीक नहीं हुई हैं। धुंधला दिखने व टकटकी लगा कर देखने पर आँसू आ जाने की शिकायतें अभी भी हैं।

□ **श्वास नली और फेफड़ों में:** अधिक मिक सूँघने पर जलन और दम घुटना। साथ ही सीने में दर्द व खाँसी भी होने लगी। घुटन के कारण लोग मरने लगे या फिर बेहोश होकर गिर गए। गैस पीड़ितों को अभी भी खाँसी, दमा, साँस फूलना, छाती में दर्द, आदि की शिकायतें हैं। साँस लेने की क्षमता में कमी आ जाने से वे काम करने में असमर्थ हो गए हैं। थोड़ा काम करने से ही थक जाते हैं और साँस फूल जाती है।

□ **पाचन तंत्र:** घुटन महसूस होने पर लोग मुँह से साँस लेने लगे। इससे गैस पेट में पहुंची और उससे जलन, दर्द व उल्टी होने लगी। साथ ही मूत्राशय व बड़ी आंत पर असर होने से मूत्र और मल पर नियंत्रण नहीं रहा। दस्त व पेट की अन्य तकलीफों से लोग अभी भी परेशान हैं।

□ **त्वचा:** गैस या द्रव जब त्वचा के सम्पर्क में आती है तो उसको जला देती है। त्वचा को भेद कर गैस खून तक पहुंच जाती है और असर करती है।

- **गैस प्रभावितों की आधुनिक वैज्ञानिक जाँच और उसके अनुसार प्रभावी इलाज ढूँढना**
- **लोगों को सही एवं सम्पूर्ण इलाज दिलाने के लिए उचित चिकित्सा व्यवस्था करना।**

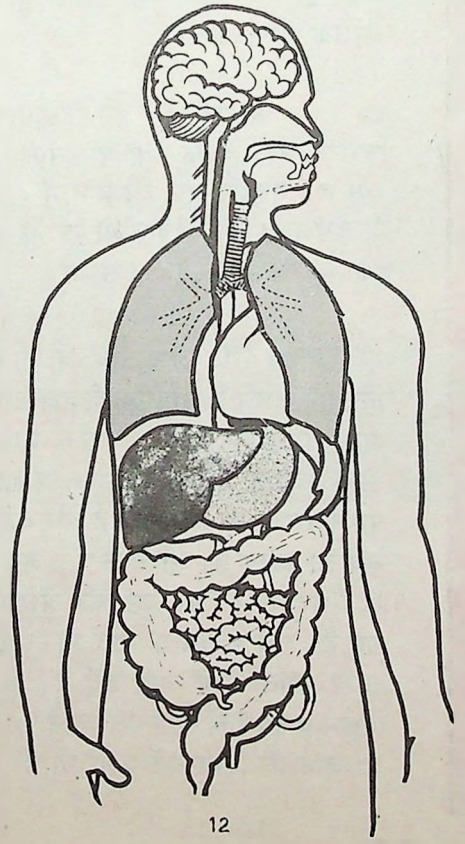
इसके लिए क्या अध्ययन और प्रयास किए जा रहे हैं?

है और असर करती है।

मिक सूँघने से ऐसा क्यों हुआ?

मिक की विशेषता यह है कि वह हमारे शरीर के प्रोटीन के साथ क्रिया करती है, कोशिकाओं की दीवारों को नष्ट कर देती है तथा कोशिका द्रव को बाहर खींच लाती है। इस क्रिया से फेफड़ों और श्वास नली की अन्दर की सतह गल जाती है। श्वास नली में अधिक कफ पैदा हो जाती है। फेफड़ों में द्रव भर जाता है और वे काम नहीं कर पाते। इसे पल्मोनरी इडीमा कहते हैं और इससे मौत भी हो सकती है। इस कारण शरीर को प्राणवायु (ऑक्सीजन) कम मात्रा में प्राप्त होती है। अपर्याप्त ऑक्सीजन होने से शरीर के विभिन्न अंगों पर असर होता है। केन्द्रीय तंत्रिका तंत्र (जिससे पूरे शरीर का संचालन होता है) शिथिल हो सकता है और हृदय धड़कना बन्द कर सकता है।

मिक की रासायनिक क्रिया से शरीर के कई आवश्यक रसायन एवं जीवाणु प्रभावित होते हैं। एसीटाइल कोलीन एस्ट्रेस एक विशेष एनजाइम है जिसका मस्तिष्क से शरीर के विभिन्न अंगों को संदेश भेज कर सक्रीय करने में विशेष योगदान है। मिक



के असर से यह एन्जाइम निष्प्रभावी हो जाता है। इससे शरीर के कई अंग विकृत रूप से काम करने लगते हैं और पेट, आँख, गले आदि की कई तकलीफें इस कारण से होती हैं।

मिक ने खून पर भी अपना असर दिखाया है। खून में साइनाइड होने की खबरें मिली हैं। कुछ शवों की जाँच से यह भी पता लगा है कि खून में यूरिया की मात्रा बढ़ गई और कुछ ऐसे मामले भी सामने आए जिन में खून धमनियों और हृदय में जम गया जिससे खून का दौरा बंद हो गया। कई शवों में हृदय में खून का नामोनिशान ही न रहा।

शरीर में पैदा हुए जहरीले रसायनों की सफाई जिगर (यकृत) व गुर्दों के माध्यम से होती है। परन्तु मिक की क्रिया से पैदा हुए जहरीले पदार्थों की मात्रा अधिक होने से जिगर और गुर्दे भी खराब हो सकते हैं।

खतरा दूरगामी प्रभावों का

मिक की क्रियाओं से शरीर में छूटे रसायनों के भी बुरे प्रभाव होने का अंदेशा है। कुछ

रसायन ऐसे हैं जिनसे कैन्सर होने की आशंका है।कुछ रसायनों से अनुवांशिकीय प्रभाव का डर है जिससे अगली पीढी के बच्चों पर कुप्रभाव हो सकते हैं।

गैस के कुछ असर तो शायद गैस पीड़ितों को जिन्दगी भर सहन करने पड़ेंगे। उनके शरीर इतने कमजोर पड़ गए हें कि अब निमोनिया, दमा, टी.बी. आदि बीमारियाँ उनको आसानी से घेर सकती हैं।

एक अहम सवाल...

2-3 दिसंबर की रात पहले मरीजों के गिरते-पड़ते हमीदिया अस्पताल पहुंचने पर वहां के डाक्टरों ने जब यूनियन कार्बाइड के डाक्टर से फोन पर गैस के बारे में पूछा तो वे बोले-"गैस जहरीली नहीं है!" अगले दिन सुबह भी वे बोले कि मिक से थोड़ी परेशानी होगी पर वह घातक नहीं है!! और उस समय भी कई लोग दम तोड़ रहे थे। पर क्या आप जानते हैं कि यूनियन कार्बाइड की अपनी ही सुरक्षा पुस्तिका में स्पष्ट लिखा है कि मिक एक ऐसा घातक रसायन है कि तुरंत इलाज के बावजूद भी उससे हुए नुकसान से बचा नहीं जा सकता?

वैज्ञानिक जाँच और इलाज.....

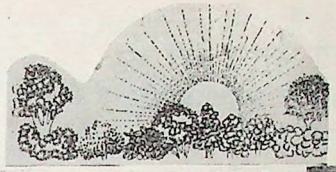
इसलिए जरूरत है सम्पूर्ण वैज्ञानिक जाँच की और उसके अनुसार कारगर इलाज की। इस जहर का असर जड़ से काटने की दवा दुनिया भर में पता नहीं है। आश्चर्य की बात यह है कि यूनियन कार्बाइड ऐसा रसायन इतनी बड़ी मात्रा में बनाता रहा परन्तु उनकी करोड़ो रुपए की प्रयोगशाला में उसकी दवा ढूँढने के कोई प्रयास नहीं हुए।

इस स्थिति में डाक्टर क्या इलाज कर रहे हैं? मरीजों की तकलीफों के लक्षण जैसे खाँसी, आँखों में जलन, उल्टी..... का इलाज उनकी आम दवाएं देकर किया जा रहा है। पर क्या यह काफी है?

महिलाओं पर विशेष असर....

गैस प्रभावित महिलाओं की माहवारी में खून का बहाव सामान्य से अधिक हो गया है और पीठ में दर्द की भी शिकायत है। कई गर्भवती महिलाओं के गर्भ गैस के असर में गिर गए। शिशु के गर्भ में ही शिथिल हो जाने और मृत पैदा होने के मामले भी सामने आए हैं। आशंका यह भी है कि गर्भ में शिशु के दिमाग या अन्य अंगों पर असर हो सकता है।

मिक से घिरे.....
हवा पानी पेड़ पौधे



■ पत्तियाँ झड़ी, झुलसी, पर पेड़ नहीं मरे नए अंकुर फूटे हैं पर मिक की इतनी भारी चपेट अन्दर तक असर कर नस्ल भी बिगाड़ सकती है। यानी आनुवांशिक असर—म्यूटाजेनेसिस।

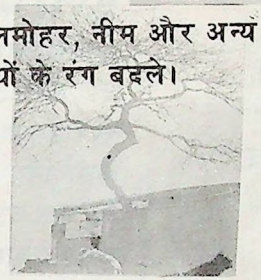
■ कैंसर फैलाने वाले रसायन पानी और पौधों में पाए जा सकते हैं- कार्सिनोजेनेसिस।

घबराई हुई जनता को वैज्ञानिकों से सही जानकारी की अपेक्षा थी पर वैज्ञानिकों के कथन भ्रम में डालने वाले थे।

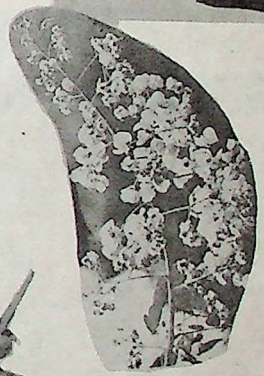
■ पानी साफ है पर उबाल कर पियो।
■ सब्जी ठीक है मगर धो कर पकाओ
■ मिक का पर्यावरण पर दूरगामी असर नहीं होगा

इन कथनों के आधार क्या थे?
क्या वैज्ञानिकों के पास भी सही जानकारी नहीं थी?
अगर नहीं थी, तो उन्होंने इस बात को कबूल क्यों नहीं किया?

■ गुलमोहर, नीम और अन्य पेड़ों की पत्तियां झड़ी।
पत्तियों के रंग बदले।

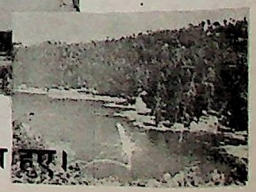


■ तुलसी और गुलाब काले पड़े।
■ सब्जियों पर असर हुआ।



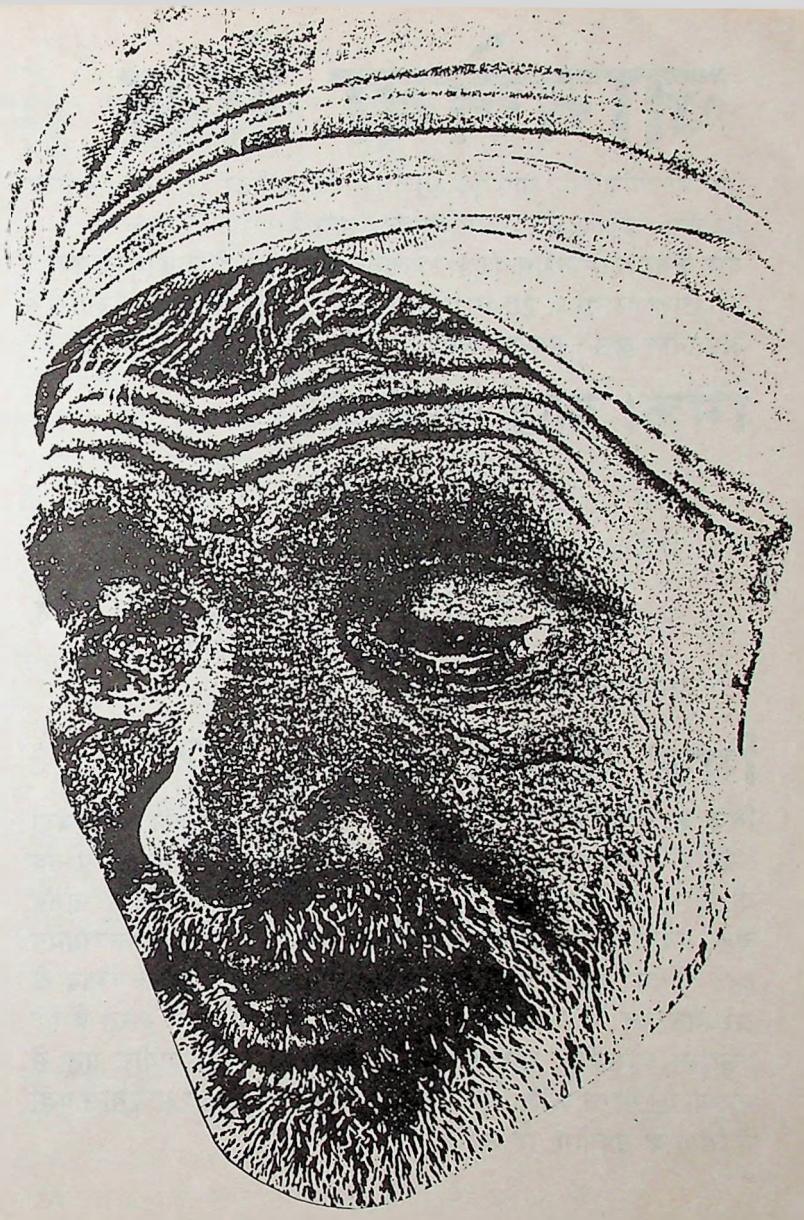
■ मधुमक्खियाँ और तिलचट्टे मरे।

■ यहाँ तक कि मच्छर भी साफ हो गए।
■ गाय, भैंस, बकरी, कुत्ते, मुर्गे—मुर्गियाँ खत्म हुए।



और पीछे रह गए हैं....

यूनियन कार्बाइड के आसपास की बस्तियों में रहने वाले अधिकांश मजदूर, हम्माल ठेलेवाले जैसे गरीब मेहनतकश परिवार हैं। सैकड़ों परिवारों के कमाने वाले सदस्य गैस का शिकार हो गए। बहुत से ऐसे परिवार हैं जिनमें केवल विधवा, बूढे,या छोटे बच्चे ही बचे हैं। इन बेसहारा विधवाओं, बूढ़ों व अनाथ बच्चों की समस्या एक प्रचंड सामाजिक समस्या के रूप में उभर आई है। यही नहीं, गैस से पीड़ित अधिकांश व्यक्ति कोई काम नहीं कर पाते हैं। थोड़ी सी मेहनत करने पर सांस फूलने और सीने में दर्द आदि होने लगता है। मांस पेशियों के विकार के कारण लोग काम करने पर कमजोरी बहुत ही जल्दी महसूस करने लगते हैं। अब वे रोजी रोटी के लिए क्या करेंगे? देखा गया है कि वे धीरे धीरे साहूकारों के शिकंजों में फंसते जा रहे हैं। सवाल यह उठता है कि इन्हें किस प्रकार की राहत दी जाना चाहिए तथा उनके लिए किस प्रकार की पुनर्वास योजनाओं को लागू किया जाना चहिए। इसमें दो मत नहीं हैं कि यूनियन कार्बाइड से उन्हें मुआवजा मिलना चाहिए। मगर यह पता नहीं है कि वह कब मिलेगा। तब तक वे क्या करेंगे? सरकार की तरफ से राशन आदि दिया जा रहा है.....यह भी सब पीड़ितों तक नहीं पहुंच रहा है——मगर यह भी कब तक? अभी तक सरकार के तरफ से कोई पुनर्वास योजना घोषित नहीं की गई है। और साथ साथ यूनियन कार्बाइड अपनी जिम्मेदारी को नहीं निभा रहा है।



जानलेवा गैस

कल्पना कीजिए कि आप एक 60 घन मीटर (4 मीटर x5 मीटर x3 मीटर) कमरे में बंद हैं और उसमें सामान्य हवा है।
यदि कमरे में मिक गैस की 1.25 लीटर मात्रा छोड़ दी जाए (यानी हवा के 10 लाख भागों में 20 भाग मिक) तो आप आँख, नाक और गले में असहनीय जलन महसूस करेंगे

मिकः कुछ जानकारी

नाम : मिथाइल आइसो साइनेट (MIC- मिक)
रंग : रंगहीन
गंध : असहनीय मीठी तीखी
उबलांक : द्रव 39.1° सेंटीग्रेड पर उबलकर गैस बन जाती है
घनत्व : हवा से भारी (20° सेंटीग्रेड पर 0.96)
रासायनिक सूत्र : CH_3 NCO

मिकः तीसरे महायुद्ध में?

मिक का प्रभाव मनुष्यों पर क्या होता है, दुनिया में इसका सबसे बड़ा "प्रयोग" भोपाल में हुआ है। अभी तक प्रयोगशालाओं में मिक के प्रभाव के प्रयोग चूहों पर ही होते थे। भोपाल ने तो जानवरों की जगह "मानव चूहे" प्रयोग के लिए उपलब्ध करा दिए। यह कहा जा रहा है कि रसायन और जैविक युद्ध के बहुत से विशेषज्ञ मनुष्य पर मिक के प्रभाव के अध्ययन हेतु भोपाल आए। ये महानुभाव यह अध्ययन करते हैं कि क्लोरीन, फॉसजीन, साइनो गैस....इत्यादि गैसों का उपयोग युद्ध में मनुष्यों को मारने के लिए कैसे किया जा सकता है। शायद आने वाले युद्धों में मिक के उपयोग पर उनकी आँख है।

□ मिक प्लांट में प्रतिदिन आठ घंटे काम करने वाले मजदूर सारे समय रिसती हुई गैस सूँघते रहते हैं। मिक इतनी घातक गैस है कि अगर हवा के 10 लाख भागों में 0.02 भाग (वैज्ञानिक इसे 0.02 ppm अर्थात पार्ट्स प्रति मिलियन कहते हैं) से ज्यादा मिक हो तो इन मजदूरों के स्वास्थ्य पर दूरगामी बुरा असर पड़ सकता है। अन्तर्राष्ट्रीय स्तर पर मान्य सुरक्षा मानकों के अनुसार इस हवा को प्रदूषित माना जाएगा और फैक्टरी में ऐसी स्थिति कभी पैदा नहीं होनी चाहिए। इस सुरक्षा मानक को वैज्ञानिक TLV– थ्रेशहोल्ड लिमिट वेल्यू–अर्थात् सुरक्षा की अधिकतम सीमा मान कहते हैं।

□ मिक अन्य रसायनों की अपेक्षा अधिक क्रियाशील है। यह अम्लीय और क्षारीय दोनों तरह के रसायनों से तीव्रता से क्रिया करती है। पानी के साथ भी क्रिया करके मिथाइल अमीन और कार्बन डाइऑक्साइड बनाती है। इस क्रिया में ऊष्मा उत्पन्न होती है।

मिक कितनी घातक?

हवा के 10लाख भागों में जब केवल 5भाग मिक मिलाकर चूहों पर प्रयोग किया गया तो 4 घंटे के भीतर ही लगभग आधे चूहे मर गए।
चार आदमियों को जब 5 मिनट तक हवा में अलग अलग मात्रा में मिक मिलाकर सुंघाई गई तो निम्न परिणाम आए:

हवा के 10 लाख भागो में	0.4	भाग मिक	कोई प्रभाव नहीं
"	2.0	"	:आँसू बहने लगे। नाक और गले में जलन होने लगी
"	4.0	"	:अधिक जलन
"	21.0	"	:आँख नाक व गले में असहनीय जलन। (मृत्यु की संभावना)

भोपाल में जहर ऐसे बनता है.....

1. कार्बन मोनो ऑक्साइड प्लांट

एक विशेष प्रकार के कोयले को ऑक्सीजन की उपस्थिति में जलाया जाता है। इससे कार्बन मोनो ऑक्साइड और थोड़ी सी कार्बन डाइऑक्साइड बनती है। कार्बन डाइऑक्साइड को पानी में घोलकर अलग किया जाता है।

2. फॉसजीन प्लांट

इस कार्बन मोनो ऑक्साइड की क्लोरीन के साथ क्रिया करवाई जाती है। इस क्रिया में गैसें एक्टीवेटिड कार्बन पर से गुजरती हैं। इस क्रिया से फॉस्जीन का उत्पादन होता है।

3. मिथाइल आइसो साइनेट प्लांट

फॉसजीन की मोनो मिथाइल अमीन के क्रिया करवा कर मिथाइल आइसो साइनेट का उत्पादन होता है। इन दोनो को घोलने के लिए क्लोरोफॉर्म का उपयोग किया जाता है। इस प्रक्रिया में हाइड्रोक्लोरिक अम्ल भी बनता है जिसे रिफाइनरी में अलग करना पड़ता है। कुछ फॉसजीन भी बिना रासायनिक क्रिया में भाग लिए, बच जाती है। इसको भी निकाला जाता है और मिथाइल आइसो साइनेट में केवल 0.02 प्रतिशत फॉसजीन रहने दिया जाता है।

4. सेविन प्लांट

मिथाइल आइसो साइनेट को अल्फा नैफ्थॉल के साथ रासायनिक क्रिया करवाकर कार्बराइल बनाया जाता है। अल्फा नैफ्थॉल को पहले कार्बन टेट्राक्लोराइड (CCl_4) में घोला जाता है और इस घोल में धीरे धीरे मिथाइल आइसो साइनेट डाला जाता है। इस रासायनिक क्रिया में ट्राइमिथाइल अमीन उत्प्रेरक के रूप में उपयोग किया जाता है।

इस क्रिया में ताप उत्पन्न होता है और ताप का नियंत्रण करना जरूरी है क्योंकि अधिक ताप से कार्बराइल के बजाए कुछ और बन सकता है। ताप नियंत्रण हीट एक्सचेन्जर नामक यंत्र से किया जाता है। कार्बराइल बनने के बाद भी उसमें कुछ मिथाइल आइसो साइनेट रह जाता है। इसको निकाला जाता है। इस क्रिया में एक गूदानुमा मिश्रण (कार्बराइल और कार्बन टेट्राक्लोराइड) भी बचता है। इस 'स्लरी' को सर्ज टैंक में एकत्रित किया जाता है और वहाँ से फिल्टर में भेजा जाता है। यहाँ कार्बराइल और कार्बन टेट्राक्लोराइड अलग किए जाते हैं। कार्बराइल को ड्रायर द्वारा सुखाकर उसको डस्ट कलेक्टर में भेजा जाता है जहाँ वह बोरों में भरा जाता है।

इन सब रासायनिक क्रियाओं में कुछ गैस और रसायन बच जाते हैं। इनको या तो सीधे ज्वलन टावर में भेज दिया जाता है जहां इनको जलाकर हवा में छोड़ दिया जाता है या इस प्रक्रिया के पहले उनको कॉस्टिक सोडा स्क्रबर में भेजा जाता है। जहां उनको उदासीन किया जाता है।

कार्बराइल को अलग अलग ताकत की कीटनाशकों में पैक किया जाता है। विभिन्न फॉर्मूलेशन इस प्रकार हैं: सेविन 85 एस (स्प्रेयबल), 50 डब्ल्यू.पी. (वेटबल पाउडर).,10 डी (डस्ट), 5 डी, 4 जी (ग्रेन्यूल), सेविडोल 4-4जी, सेविमोल 40 एल.वी.,टेमिक 10 डी।

जहर ही जहर...

कार्बन मोनो ऑक्साइड

जहरीली गैस है। यह यूनियन कार्बाइड में ही बनती है।

रासायनिक सूत्र	: CO
रंग/गंध	: रंगहीन/गंधहीन
सुरक्षा की अधिकतम सीमा (TLV)	: हवा के 10 लाख भागों में 50 भाग
असर	: सूंघने पर घातक। सर दर्द और उल्टी। अधिक सूंघने पर खून पर असर और मृत्यु।

क्लोरीन:

जहरीली गैस है। यह ग्वालियर रेयॉन (नागदा) से आती है। प्रथम विश्व युद्ध में इसे एक रासायनिक अस्त्र के रूप में इस्तेमाल किया गया था।

रासायनिक सूत्र	: Cl_2
रंग/गंध	: हरा–पीला/जलन पैदा करने वाली
सुरक्षा की अधिकतम सीमा (TLV)	: हवा के 10 लाख भागों में 1 भाग
असर	: आँख, त्वचा और फेफड़ों में असहनीय जलन

फॉसजीन

जहरीली गैस है। यह यूनियन कार्बाइड में ही बनती है। इसका संग्रह नहीं किया जाता है बल्कि इसको मिथाइल आइसो साइनेट के उत्पादन के दौरान बनाया जाता है।

रासायनिक सूत्र	$COCl_2$
रंग/गंध	: रंगहीन/घास या भूसा जैसी गंध
सुरक्षा की अधिकतम सीमा (TLV)	: हवा के 10 लाख भागों में 0.1 भाग
असर	: सूंघने पर अति घातक। फेफड़े द्रव से भर जाते हैं जिससे मृत्यु हो जाती है

मोनोमिथाइल अमीन

जहरीली गैस/द्रव है। यूनियन कार्बाइड इसे राष्ट्रीय केमिकल्स एण्ड फर्टीलाइसर्स –बंबई से खरीदती है। इसको टंकियों में रखा जाता है।

रासायनिक सूत्र	: $CH_3 NH_2$
रंग/गंध	: रंगहीन/तेज, मछली जैसी गंध
सुरक्षा की अधिकतम सीमा (TLV)	: हवा के 10 लाख भागों में 10 भाग
असर	: आँख व श्वसन तंत्र में जलन पैदा करती है। त्वचा को जला सकती है।

सेविन बनाने की दो विधियाँ

1. बिना मिक के उपयोग से

सोडियम अल्फा नेफ्था ऑक्साइड और फॉसजीन की क्रिया से क्लोरोफार्मेट और सोडियम क्लोराइड बनते हैं। क्लोरोफार्मेट और मिथाइल अमीन की क्रिया से कार्बराइल (सेविन) और हाइड्रोक्लोरिक अम्ल बनते हैं।

2. मिक के उपयोग से

मिथाइल अमीन और फॉसजीन की क्रिया से मिथाइल आइसो साइनेट और हाइड्रोक्लोरिक अम्ल बनते हैं। मिथाइल आइसो साइनेट और अल्फा नेफ्थॉल की क्रिया से कार्बराइल (सेविन) बनता है।

यूनियन कार्बाइड मिक रहित तरीके से सेविन बनाती थी। पर अब वे यही सेविन उस विधि से बनाते हैं जिसमें मिक का इस्तेमाल होता है। इस तरीके को अपनाने का क्या कारण हो सकता है? क्या यह कारण पैसों की बचत हो सकता है? अगर ऐसा है, तो क्या लोगों की जानों के साथ इसलिए खिलवाड़ किया गया ताकि यूनियन कार्बाइड का थोड़ा पैसा बच जाए?

कीटनाशक संयंत्र के सुरक्षा साधन?

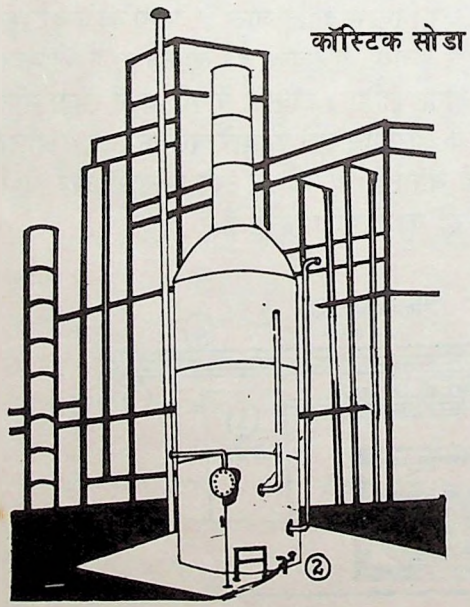
1. स्टोर टंकी

मिथाइल आइसो साइनेट को तीन टंकियों में रखा जाता है। इनके नम्बर 610, 611, व 619 हैं। 60 टन की क्षमता वाली एक टंकी में लगभग 40 टन मिक द्रव रखा जाता है। ये टंकियाँ स्टेनलैस स्टील की बनी हैं क्योंकि अन्य धातुओं से मिक क्रिया करता है। टंकियों का बेलनाकार आकार 40 फुट लंबा और 8 फुट व्यास का है और वे सीमेंट काँक्रीट के एक चबूतरे में धँसी है। टंकियाँ पाइप से एक दूसरे से जुड़ी हैं और पाइपों में गैस या द्रव का बहाव रोकने वाले वाल्व लगे हैं। जरूरत पड़ने पर एक टंकी का द्रव दूसरी टंकी में भेजा जा सकता है। हर टंकी के मुंह पर एक सेफ्टी डिस्क और एक सेफ्टी वाल्व लगा है जो दबाव के 40 पौंड प्रति वर्ग इंच से ऊपर बढ़ने पर स्वतः ही खुल जाते हैं। चूंकि मिक 39.1° सेन्टीग्रेड तापमान पर गैस में बदल जाती है और भोपाल में तापमान लगभग इतना ही रहता है, इसलिए टंकियों को ठंडा रखने के लिए शीतकारक व्यवस्था है। सामान्य तौर पर तापमान 0° सेन्टीग्रेड रखा जाता है। चूँकि मिक बहुत क्रियाशील है इसलिए टंकी के खाली हिस्से में नाइट्रोजन गैस हल्के दबाव से भर कर रखी जाती है। टैंक में नाईट्रोजन गैस भरने और निकालने की अलग से व्यवस्था रहती है।

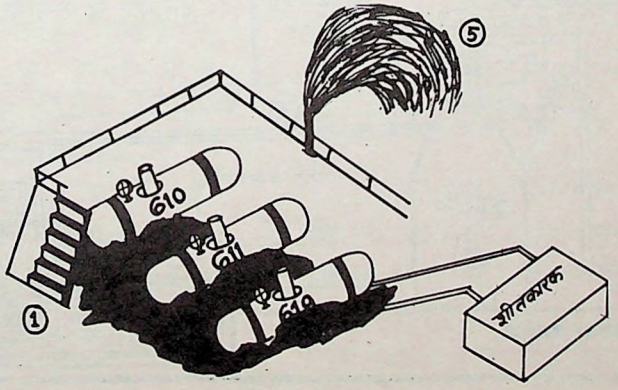
2. कॉस्टिक सोडा स्क्रबर

50 फुट ऊँचे बोतल के आकार के इस संयंत्र में सेविन बनाने के बाद शेष बची मिक तथा अन्य गैसों को कॉस्टिक सोडा की फुहार छोड़कर बेअसर (उदासीन) किया जाता है। एक पाइप मिक की टंकियों से भी सीधा स्क्रबर में आता है। इस पाइप में सुरक्षा वाल्व लगे हैं जो टंकी में 40 पौंड

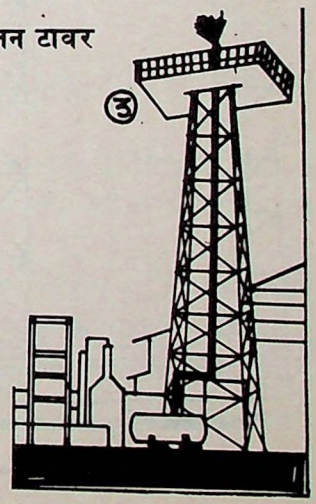
कॉस्टिक सोडा स्क्रबर



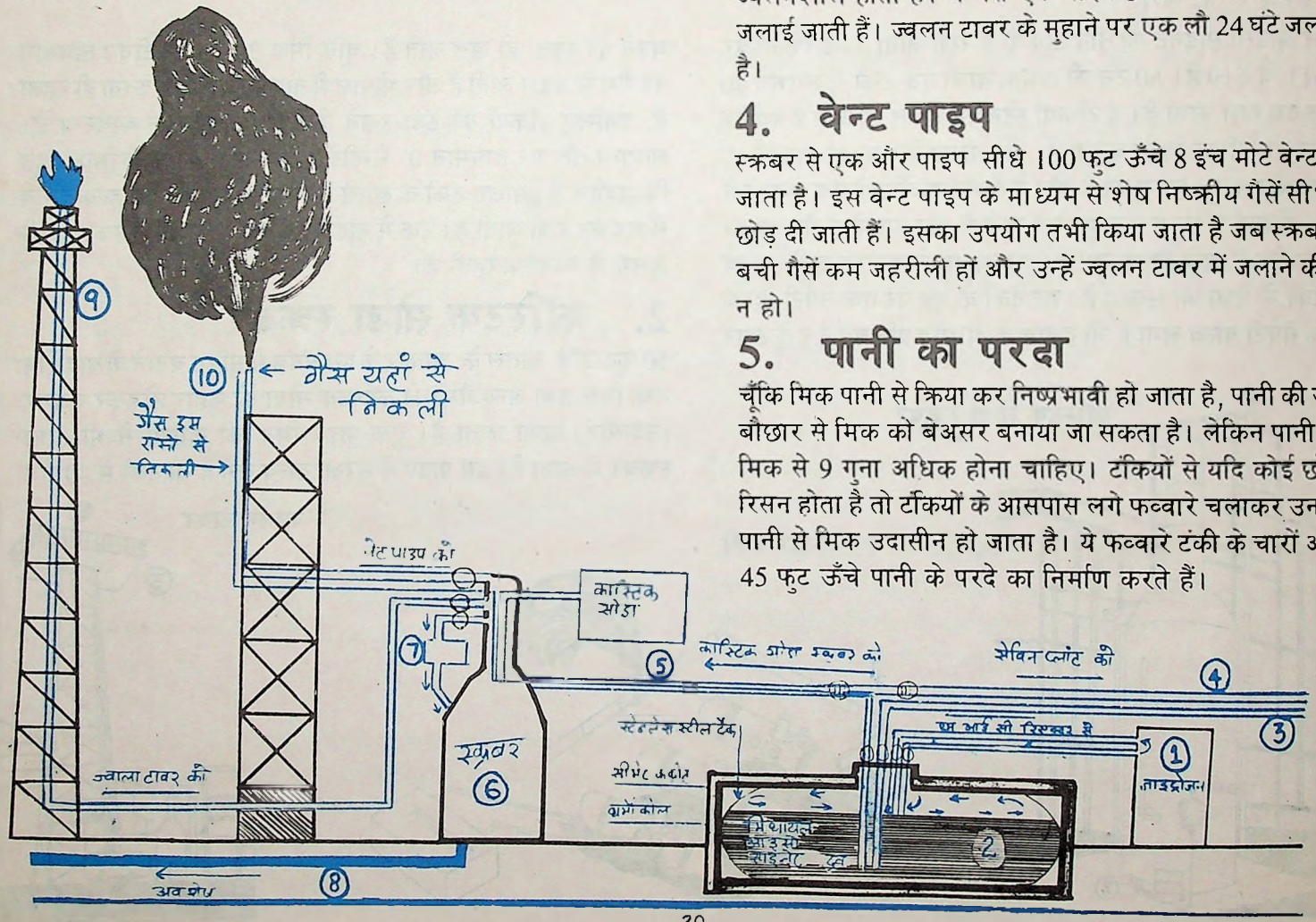
स्टोर टंकी



ज्वलन टावर



स्क्रबर में गैस नीचे से ऊपर की तरफ छोड़ी जाती है और कॉस्टिक सोडा का 10 प्रतिशत घोल ऊपर से नीचे की ओर। एक बार में गैस बेअसर न होने पर उसे दोबारा स्क्रबर में से गुजारने की भी व्यवस्था है। निष्क्रीय अवशेष स्क्रबर के नीचे से पाइप द्वारा निकाले जाते हैं।



प्रति वर्ग इंच से अधिक दबाव होने पर सुरक्षा के लिए स्वतः खुल जाते हैं।

3. ज्वलन टावर

स्क्रबर की क्रिया के बाद भी मिक सहित कुछ गैसें बची रह सकती हैं जो ज्वलनशील होती है। ये गैसें एक पाइप द्वारा ज्वलन टावर पर लाकर जलाई जाती हैं। ज्वलन टावर के मुहाने पर एक लौ 24 घंटे जलती रहती है।

4. वेन्ट पाइप

स्क्रबर से एक और पाइप सीधे 100 फुट ऊँचे 8 इंच मोटे वेन्ट पाइप में जाता है। इस वेन्ट पाइप के माध्यम से शेष निष्क्रीय गैसें सीधे हवा में छोड़ दी जाती हैं। इसका उपयोग तभी किया जाता है जब स्क्रबर से शेष बची गैसें कम जहरीली हों और उन्हें ज्वलन टावर में जलाने की जरूरत न हो।

5. पानी का परदा

चूँकि मिक पानी से क्रिया कर निष्प्रभावी हो जाता है, पानी की जबरदस्त बौछार से मिक को बेअसर बनाया जा सकता है। लेकिन पानी की मात्रा मिक से 9 गुना अधिक होना चाहिए। टंकियों से यदि कोई छोटा मोटा रिसन होता है तो टंकियों के आसपास लगे फव्वारे चलाकर उनसे आ रहे पानी से मिक उदासीन हो जाता है। ये फव्वारे टंकी के चारों ओर 30 से 45 फुट ऊँचे पानी के परदे का निर्माण करते हैं।

भोपाल गैस चेम्बर कैसे बना?

दुर्घटना क्यों हुई, इसके कारणों की ठीक जानकारी किसी को नहीं है।

दुर्घटना के सम्भावित कारण

शुद्ध मिथाइल आइसो साइनेट को यदि अधिक दिनों तक जमा करके रखा जाता है तो उसमें पॉलीमराइजेशन की क्रिया होने की सम्भावना रहती है। पॉलीमराइजेशन एक विशेष क्रिया है जिसमें पदार्थ के अणु एक दूसरे से जुड़ जाते हैं– जैसे जंजीर में कड़ियाँ–और एक ज्यादा बड़ा अणु बना लेते हैं। मिथाइल आइसो साइनेट के पॉलीमराइजेशन से ऊष्मा उत्पन्न होती है। पॉलीमराइजेशन की क्रिया न हो इसके लिए मिथाइल आइसो साइनेट में थोड़ी (0.02 प्रतिशत) फॉसजीन मिला कर रखा जाता है। इससे अधिक फॉसजीन होने पर एक नया खतरा पैदा होता है। टंकी में रखी मिक में 2 प्रतिशत फॉसजीन बताई जाती है। यानी 40 टन मिक में लगभग 800 किलो ग्राम फॉसजीन थी।

ऐसा कहा जाता है कि टंकी न. 610 में आधा किलो ग्राम पानी चला गया था। पानी टंकी में कैसे पहुंचा, यह किसी को मालूम नहीं है। शायद वाल्व साफ करते समय गलती से पानी टंकी में घुस गया। इस पानी ने मिथाइल आइसो साइनेट में उपस्थित फॉसजीन के साथ क्रिया कर ली। इस क्रिया से हाईड्रोक्लोरिक अम्ल और कार्बन डाइ ऑक्साइड बना। (हाइड्रोक्लोरिक अम्ल की टंकी की स्टेनलैस स्टील की चादरों से क्रिया होने पर लोहे का तत्व भी मिक में घुल गया।) इस क्रिया में ऊष्मा उत्पन्न हुई और गैस बनने से टंकी में दबाव भी बढ़ा। ताप बढ़ने से, और उपस्थित अशुद्धियों से, द्रव मिथाइल आइसो साइनेट में पॉलीमराइजेशन शुरू हो गया। इस क्रिया में और ऊष्मा उत्पन्न हुई। इससे पॉलीमराइजेशन तेज हो गया और द्रव मिथाइल आइसो साइनेट, अधिक ताप के कारण, गैस में परिवर्तित हो गया। पॉलीमराइजेशन शुरू में धीरे धीरे होता है, बाद में यह क्रिया तेज हो जाती है।

पॉलीमराइजेशन से तापमान बढ़कर 100° से200° सेन्टीग्रेड के बीच हो गयाक्रिया इतनी तेज थी कि टंकी हिलने लगी और उसके चारों तरफ बने सीमेन्ट कॉंक्रीट के चबूतरे में दरार पड़ गई। द्रव गैस में बदलने से टंकी के अन्दर दबाव और बढ़ गया। और यह इतना बढ़ा कि गैस ने सेफ्टी डिस्क को तोड़कर सेफ्टी वाल्व खोल लिया। यह वाल्व 40 पौंड प्रति वर्ग इंच दबाव ही सह पाता है। वाल्व खोलकर गैस सीधी स्क्रबर में चली गई।

कहा जाता है कि....

☐ स्क्रबर चालू नहीं किया गया क्योंकि उसको चालू करने वाली दोनों मोटर खराब थीं।

☐ स्क्रबर चालू किया था, पर कॉस्टिक सोड़े का घोल नहीं था।

☐ स्क्रबर चालू किया था, पर कॉस्टिक सोड़े का घोल ज्यादा हल्का था।

☐ रिसन इतनी अधिक मात्रा और दबाव में हो रहा था कि रिस रही गैस की पूरी मात्रा को उदासीन कर पाना संभव नहीं था।

स्क्रबर से एक पाइप ज्वलन टावर में जाती है, जहाँ पूरी फैक्टरी की बेकार बची ज्वलनशील गैसों को जलाया जाता है। यह ज्वलन टावर पिछले कुछ दिनों से मरम्मत के लिए बन्द था।

आठ इंच व्यास वाला एक वेन्ट पाइप स्क्रबर में से आसमान में जाता है, जहाँ से उत्पादन के बाद बची अवशेष निष्क्रीय गैसें बाहर निकाली जाती हैं। संयोग से यह पाइप दुरुस्त था और काम कर रहा था। गैस इसी रास्ते से बाहर निकल गई और जानलेवा सफेद बादल के रूप में वातावरण में छा गई।

दुर्घटना से उपजे कुछ सवाल...

☐ मिथाइल आइसो साइनेट को इतने लंबे समय तक जमा करके क्यों रखा गया था? जबकि सुरक्षा की दृष्टि से इसे 15 दिन से अधिक दिनों तक जमा नहीं रखा जाना चाहिए। यह मिथाइल आइसो साइनेट 22 अक्टूबर को तैयार की गई थी और 15 नवम्बर को इस्तेमाल की जानी थी।

☐ कहा जाता है कि टंकी वाटर प्रूफ थी, फिर पानी अन्दर कैसे पहुंचा?

☐ खतरे की सूचना देने के लिए टंकियों में ताप और दबाव के सूचक लगे रहते हैं। टंकी नं. 610 के दोनों सूचक खराब थे। इसको क्यों नहीं सुधारा गया था?

☐ मिक में फॉसजीन की मात्रा इतनी अधिक क्यो थी?

☐ टंकियों का तापमान कम रखने वाला शीतकारक यंत्र (रेफ्रिजरेशन सिस्टम) साल भर से बन्द था। क्यों?

☐ मिथाइल आइसो साइनेट द्रव जिन टंकियों में रखा जाता है वे पाइप द्वारा आपस में जुड़ी रहती है। दबाव पड़ने पर पाइपों के बीच लगे वाल्व को खोलकर द्रव को एक टंकी से दूसरी टंकी में भेजा जा सकता है। दुर्घटना के समय टंकी नं. 610 से निकल रही मिक को खाली टंकी नं. 619 में क्यों नहीं भर लिया गया? यह व्यवस्था ऐसी क्यों नहीं थी कि दबाव बढ़ने पर वाल्व अपने आप खुल जाते?

☐ यह स्पष्ट है कि स्क्रबर महत्वपूर्ण सुरक्षा साधन है। यदि मोटर खराब थी तो उसे सुधारा क्यों नहीं गया?

☐ स्क्रबर में सोडा की सांद्रता कम क्यों थी?

☐ स्क्रबर स्वचालित क्यों नहीं था? ताकि खतरा उत्पन्न होने पर अपने आप चालू हो सके?

☐ स्क्रबर की क्षमता तो मात्र पहले आधे घंटे में 5 टन गैस व उसके बाद हर आधे घंटे में एक टन गैस निष्क्रीय करने की है जबकि 40 टन से भी अधिक गैस टंकी में भरी थी जो एक घंटे से कम में ही सारी छूट गई। सुरक्षा साधनों में ऐसी कमी क्यों?

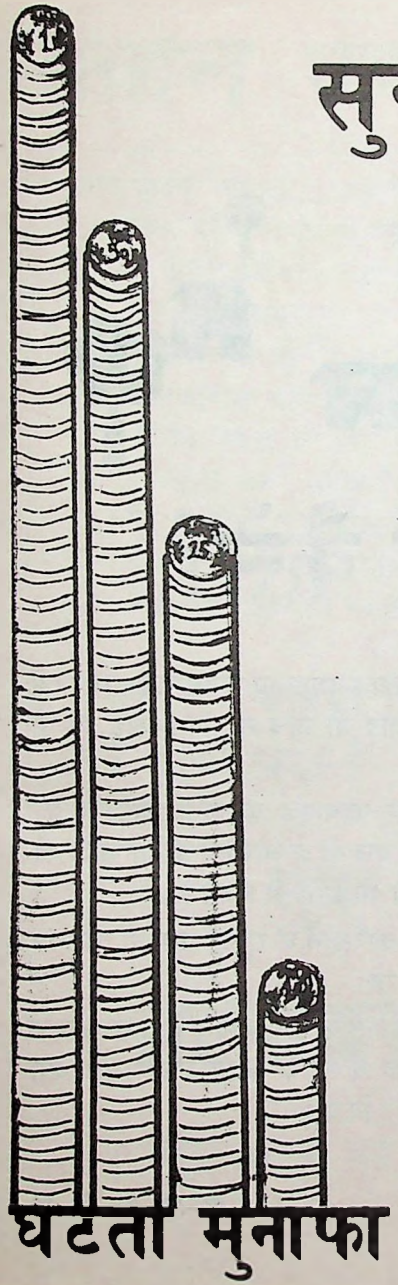
☐ ज्वलन टावर को 24 घंटे जलते रहना आवश्यक है। यदि वह खराब था तो समय रहते ठीक क्यों नहीं किया गया?

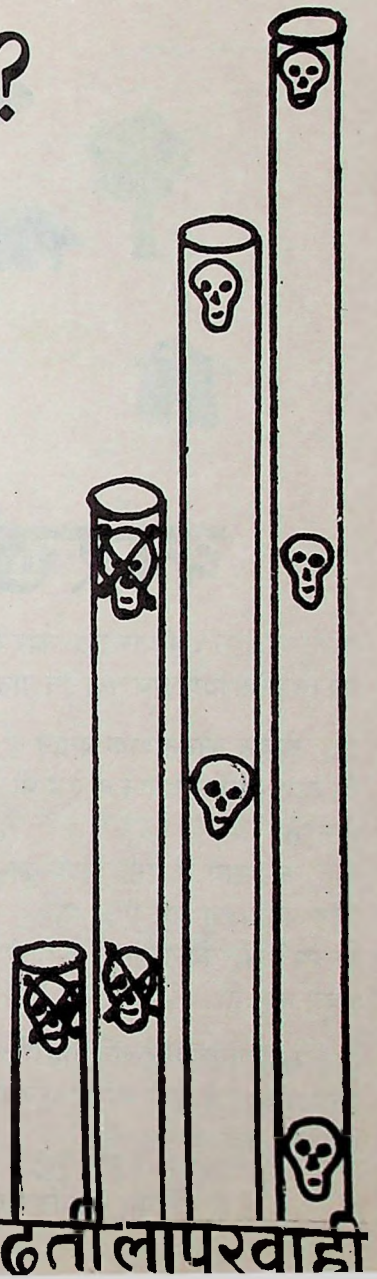
☐ क्या खर्चा बचाने के लिए सुरक्षा संयंत्रों को बन्द किया गया था?

ऐसा क्यों

फैक्टरी में जैसे खतरनाक रसायनों का उपयोग होता था, उसके हिसाब से सुरक्षा व्यवस्था और खतरे की चेतावनी देने वाले सूचक यंत्र पर्याप्त नहीं थे।जो उपलब्ध थे वो काम नहीं कर रहे थे। यह तो सामान्य हालत की बातें ठहरीं। 2 दिसम्बर जैसी असामान्य स्थिति का मुकाबला करने की कोई तैयारी या पूर्व योजना तो थी ही नहीं। जबकि 11 सितम्बर 1984 को लिखे गए यूनियन कार्बाइड के एक मेमोरेन्डम में ऐसी ही स्थिति की चेतावनी अमेरीका स्थित प्लांट के लिए दी गई थी। क्या अमेरीकी प्लांट ने इस तरह की सम्भावना की जानकारी भोपाल प्लांट को पहुंचाई? खतरा टालने की कोई तरकीब सोची? खतरनाक मिक की इतनी अधिक मात्रा का भंडारण करना क्या जरूरी था? मिक का तुरन्त उत्पादन और तुरन्त सेविन में परिवर्तन की प्रणाली क्यों नहीं अपनाई गई? सेविन का उत्पादन बिना मिक का उपयोग किए दूसरे तरीके से भी संभव है। वह तरीका क्यों नहीं अपनाया गया?

सुरक्षा में लापरवाही क्यों?





☐ कम्पनी के अमेरिकी विशेषज्ञों के अनुसार भी सुरक्षा साधन ठीक नहीं थे। अमेरीका में इस तरह कारखाना चलाने ही नहीं दिया जाता।

☐ अमेरीका में यूनियन कार्बाइड के कारखाने में कम्प्यूटर चलित सुरक्षा साधन हैं। भारत में हाथ से चलित सुरक्षा साधन हैं।

☐ पिछड़े देशों की गरीबी और विकास की जरूरतों का फायदा उठाकर बहुराष्ट्रीय कम्पनियाँ खतरनाक से खतरनाक कारखाने, सावधानी बरते बिना यहाँ चला लेती हैं। इन देशों का नियम इन मामलों में बहुत कमजोर और अपर्याप्त है।

☐ उत्पादन न होने वाले महीनों में सुरक्षा व्यवस्था भी बन्द कर दी जाती थी—मिक टंकी में भरी हो या नहीं। कहा जाता है कि सुरक्षा साधनों को चालू रखने पर हर दिन 20000 रुपए का खर्च आता है।

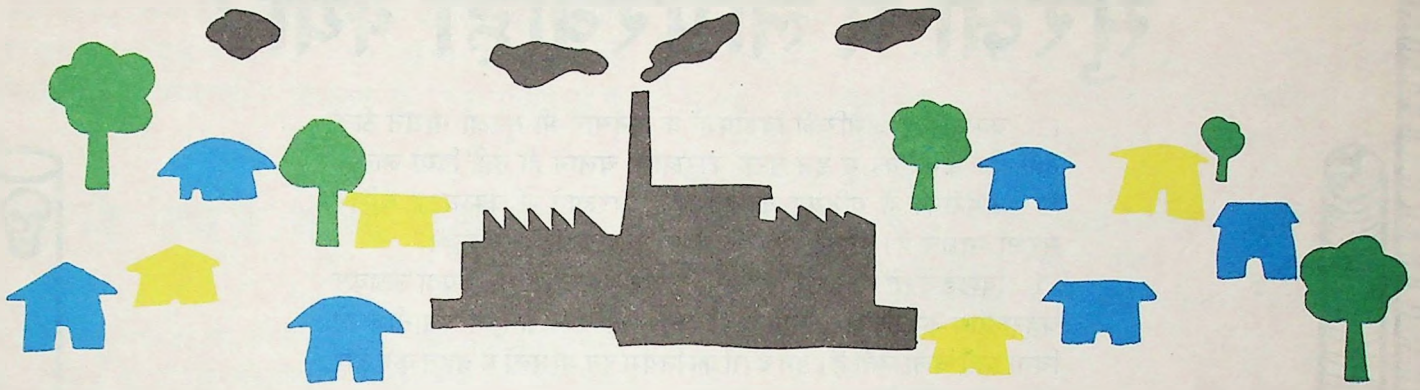
☐ आश्चर्य की बात यह है कि यूनियन कार्बाइड ने सभी सुरक्षा साधनों को एक साथ निष्क्रीय कैसे होने दिया, खासकर जब इतने विषैले पदार्थ उनके भण्डार में थे और कार्बराइल का उत्पादन 26 नवम्बर तक चालू था?

☐ कई सालों से भोपाल के कारखाने में बन रहे सेविन कीटनाशक की मांग घट रही थी। इस लिए कारखाना साल में तीन—चार महीने ही चल रहा था।

☐ पिछले चार सालों में यूनियन कार्बाइड को 5 करोड़ रुपए का घाटा हुआ।

☐ खर्चा बचाने के लिए मजदूरों की छंटनी हुई। प्रशिक्षित मजदूरों को बैटरी कारखाने भेजा जाने लगा। कई नौसिखिए और सस्ते मजदूर खतरनाक मिक प्लांट को सम्भाले थे। काम के घंटों में कटौती की गई।

☐ सेविन बनाने की दो विधियाँ उपलब्ध थीं। तो फिर खतरनाक मिक का उपयोग करने वाली प्रणाली ही क्यों अपनाई गई?



कारखाना चलाने की अनुमति कैसे?

अक्टूबर 1975 में भारत सरकार के उद्योग मंत्रालय ने यूनियन कार्बाइड को लाइसेंस दिया तब क्या इन बातों का ध्यान नहीं रखना चाहिए था कि-

□ सेविन कीटनाशक बनाने के सबसे सुरक्षित तरीके की ही अनुमति दी जाए (सेविन बनाने के ऐसे भी तरीके हैं जिनमें मिक का उपयोग नहीं होता)।

□ कारखाने में ऐसी चीजों का इस्तेमाल न हो जिससे मनुष्य जीवन और पर्यावरण पर ऐसा घातक असर पड़े जिसका इलाज तक नहीं मालूम? और जिन चीजों के असर के बारे में दुनिया भर में जानकारी ही बहुत कम हो।

□ खतरनाक कारखाने शहरी आबादी से सुरक्षित दूरी पर बनाए जाएं। कनाड़ा देश में इसी कारण यूनियन कार्बाइड को कारखाना खोजने की अनुमति नहीं दी गई थी।

□ 1975 में यूनियन कार्बाइड को कीटनाशक एक्ट के तहत विशेष लाइसेंस मिला।

□ हालांकि इस बीच कारखाने में कई दुर्घटनाएं घटती रहीं। 1982 में एक मजदूर की मृत्यु हुई, इसके बाद जो जाँच समिति बिठाई गई थी उसकी रपट का कुछ पता नहीं।

□ 1983 तक सरकार यूनियन कार्बाइड के दोनों लाइसेंस का नवीनीकरण करती गई। सेविन के अलावा दो और नए कीटनाशकों को बनाने के लिए अनुमति दी गई। ये भी मिक से बनते हैं।

□ हर साल फैक्टरी इन्सपेक्टर कारखाने के सुरक्षा प्रबन्धों की नाम मात्र जाँच करके खानापूर्ति करते रहे।

□ दिसम्बर1984 की भीषण दुर्घटना के बाद जाकर कहीं सरकार ने यूनियन कार्बाइड के लाइसेंस रद्द करने के कदम उठाए और श्रम मंत्रालय की जिम्मेदारी को स्वीकार किया।

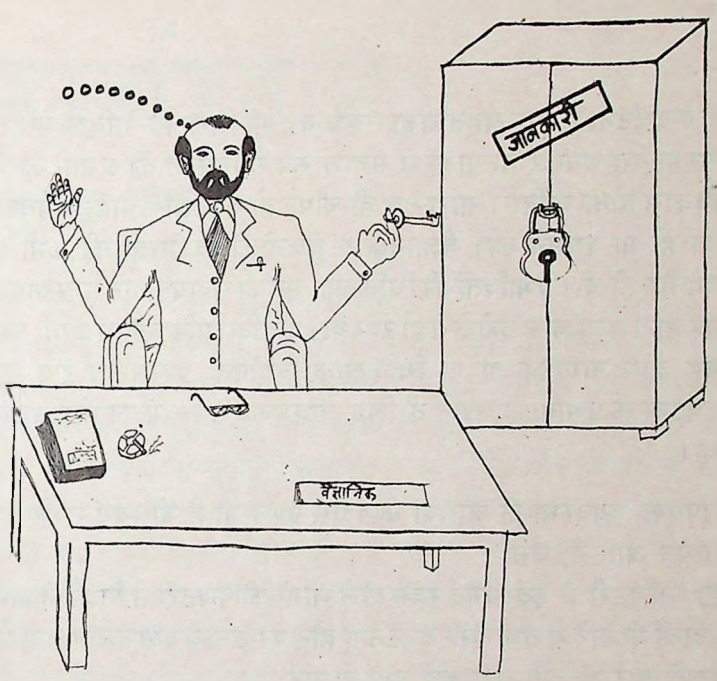
●●●●●

सवाल दर सवाल....

लोग जानना चाहते हैं.....हमारी राय बहुत से सवालों पर....

- ☐ पोस्ट मॉर्टम रिपोर्ट के जाँच के नतीजे
- ☐ पल्मोनरी इडीमा का डर
- ☐ दिमाग पर असर
- ☐ होने वाले बच्चों पर असर
- ☐ आनुवांशिक असर
- ☐ कैन्सर, लकवा का डर
- ☐ क्या हवा, पानी, सब्जियाँ सुरक्षित हैं?
- ☐ पेड़ पौधों पर क्या असर है?
- ☐ फैक्टरी में इस्तेमाल होनेवाले जहरीले पदार्थ?
- ☐ फैक्टरी में तकनीकी गड़बड़ियाँ?

मगर हमें कहना है.....
सब ठीक ठक है



पर यह तालाबंदी क्यों?

यह कहने का आधार क्या है?

जरूरत है.....

- ☐ सही वैज्ञानिक जाँच की
- ☐ नतीजों को विश्लेषण सहित सरल भाषा में जनता के सामने रखने की

ऐसा क्यों नहीं किया जा रहा है?

गैस दुर्घटना से एक बहुत बड़ा सबक यह भी मिला कि भविष्य में ऐसी सम्भावित भयंकर घटनाओं से सुचारू रुप से निपटने की क्षमता का भी विकास होना चाहिए। सारा तंत्र ही चौपट हो गया था—चाहे अस्पतालों का हो या शासन का। वैज्ञानिक व तकनीकी विशेषज्ञों की कमी तो दयनीय ही थी। प्रभावितों की चिकित्सा, उनकी सहायता एवं पुनर्स्थापना का सारा कार्य चालू तरीके से हो रहा था। जबकि व्यक्तियों का कार्य, चाहे वह आम नागरिक हो या चिकित्सक, विशेषतः प्रशंसनीय रहा, पर दुर्घटना के प्रभावों से जूझने के लिए आवश्यक समन्वय का घोर अभाव था।

उपयुक्त व्यवस्था के अलावा कुछ ऐसे प्रश्न भी हैं जो स्वयं उभर कर सामने आते हैं, जैसे:

□ फैक्टरी के इर्द—गिर्द रहने वाले लोगों की फैक्टरी से निकलने वाले पदार्थों के बारे में तथा ऐसी दुर्घटनाएँ होने पर उनको क्या करना चाहिए, इसके बारे में जानकारी क्यों नहीं दी गई?

□ इन लोगों को बचाव प्रशिक्षण या प्रथम चिकित्सा प्रशिक्षण क्यों नहीं दिया गया जो ऐसे मामलों में एक कानूनी आवश्यकता है?

□ अस्पतालों को जहरीले रसायनों के खतरों के बारे में पूर्व सूचना तथा ऐसे समय में चिकित्सा की क्या व्यवस्था हो, इसके बारे में पूरी जानकारी क्यों नहीं दी गई, जब कि मिक जैसे जहर को काटने वाली दवा ही नहीं है–

□ शासन अपने चिकित्सा तथा पर्यावरण विशेषज्ञों को तुरन्त प्रयोग करके दुर्घटना की और उसके कारण होने वाली भीषण क्षति व उसके दूरगामी प्रभाव का पता लगाने हेतु, तुरन्त जुटाने में क्यों असमर्थ रही?

हत्यारी कार्बाइड का बहिष्कार करो

केरल शास्त्र साहित्य परिषद

यह वही यूनियन कार्बाइड है....

यह

वही यूनियन कार्बाइड है जिसके बारे में एक अमेरिकी व्यापारिक पत्रिका 'फॉरचून' ने लिखा था:

"यूनियन कार्बाइड मुनाफाखोरी से ग्रस्त एक ऐसा प्रतिक्रियावादी राक्षस है. जिसे नागरिकों की भलाई से कोई वास्ता नहीं है।"

यह

वही यूनियन कार्बाइड है जिसे अमेरीका की वित्तीय मामलों की प्रसिद्ध पत्रिका 'वॉल स्ट्रीट जर्नल' ने 1979 के प्रारंभ में एक भारी भरकम, भद्दा, जोखिम भरा उद्योग निरूपित किया था।

यह

वही यूनियन कार्बाइड है जिसे 1960 के दशक के अंत में एवं 1970 के दशक के प्रारंभ में पर्यावरण का सबसे बड़ा दुश्मन ठहराया गया था।

यह

वही यूनियन कार्बाइड है जिसे विषैली जानलेवा गैसों के उपयोग के कारण कनाड़ा तथा स्कॉटलैंड से बाहर निकाल दिया गया था।

सेविन का उत्पादन

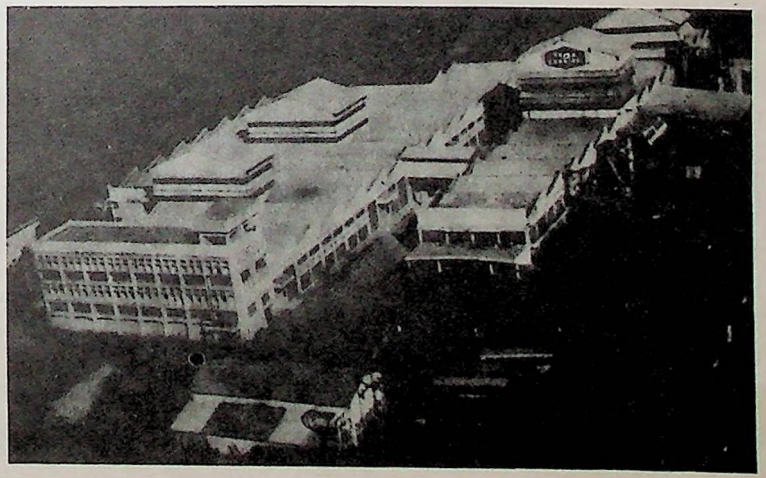
वर्ष	उत्पादन अनुमति (टन)	उत्पादन क्षमता (टन)	उत्पादन (टन)	बिक्री मात्रा (टन)	आय (करोड़ रुपए)
1982	5000	5000	2308	2211	22.47
1983	5250	5000	1657	1500	17.29

कार्बाइड है....

शोध केन्द्र

- □ शोध एवं विकास केन्द्र-कलकत्ता
- □ शोध एवं विकास केन्द्र –भोपाल

भोपाल का शोध केन्द्र सन् 1976 में लगभग 20 करोड़ रुपये की लागत से स्थापित हुआ। इस केन्द्र को आयकर से छूट दी गई है। इस केन्द्र का वार्षिक बजट (1984) 66 लाख रुपये है। कहा जाता है कि इस केन्द्र में ऐसा शोध किया जा रहा था जिसका सम्बन्ध जैविक और रसायनिक युद्ध से भी है। (दुश्मन को सफाया करने की तकनीक एटम बम से आगे बढ़ चुकी है। जहरीली गैसें छोड़कर दबे पाँव मारना रसायनिक युद्ध का तरीका है-और दूसरा, कॉलेरा, टाइफॉइड से भी ज्यादा घातक बीमारियाँ फैलाने वाले जीवाणुओं की नस्ल विकसित करना जैविक युद्ध का तरीका है। दुश्मन के इलाके में ऐसे जीवाणु छोड़कर महामारी फैलाई जा सकती है।)



यूनियन कार्बाइड का इतिहास

□ यूनियन कार्बाइड सन् 1886 से एक कार्बन कम्पनी के रूप में विकसित हुई जिसने सबसे पहले शुष्क सेल बैटरी बनाना प्रारंभ किया।

□ सन् 1917 में चार अन्य कम्पनियों को मिलाकर यूनियन कार्बाइड व कार्बन कॉर्पोरेशन बनाया गया।

□ पहले विश्व युद्ध में अमेरीका की भूमिका को देखकर कम्पनी ने रसायन व गैस निर्माण में भी दिलचस्पी ली।

□ दूसरे विश्वयुद्ध में पहली बार यूनियन कार्बाइड का परमाणु ऊर्जा अभियान उभर कर सामने आया।

□ 1970 के दशक में यूनियन कार्बाइड ने रोजमर्रा के काम आने वाली वस्तुओं के उत्पादन में रुचि लेना प्रारंभ किया।

□ 1980 में यूनियन कार्बाइड ने अमेरिकी सरकार के कई परमाणु ऊर्जा केन्द्र चलाने की जिम्मेदारी उठाई

□ यूनियन कार्बाइड के उत्पादकों की वार्षिक बिक्री 10 अरब डॉलर से अधिक है। (एक डालर—लगभग 14 रुपये)

□ यूनियन कार्बाइड का अमेरीका में तीसरा स्थान तथा विश्व रसायन बाजार में सातवां स्थान रहा है।

□ 1983 में यूनियन कार्बाइड ने 7.9 करोड़ डॉलर का मुनाफा कमाया।

□ यूनियन कार्बाइड के विश्व के 37 देशों में 134 उद्योग कार्यरत हैं। इनमें से 9 दक्षिण अफ्रीका में हैं।

□ यूनियन कार्बाइड की सबसे अधिक बिक्री ऑक्सीजन, क्रोमियम, मैंगनीस व स्टील प्लांट में उपयोग में आने वाली संबंधित धातुओं व रसायनों की है।

भारत में

□ भारत से यूनियन कार्बाइड का रिश्ता बहुत पुराना है

□ यूनियन कार्बाइड सन् 1905 में नेशनल कार्बन कम्पनी (इंडिया) लिमिटेड के नाम से भारत में आई।

□ **यूनियन कार्बाइड ने बैटरी के क्षेत्र में कारोबार शुरू किया।**

□ यूनियन कार्बाइड कॉर्पोरेशन (अमेरीका) भारत में यूनियन कार्बाइड (इंडिया) लिमिटेड के नाम से सन् 1934 में स्थापित हुई।

□ भारत में यूनियन कार्बाइड के 13 कारखाने हैं। पहला कारखाना कलकत्ता में 1934 में लगाया गया।

□ सन् 1983 में यूनियन कार्बाइड (इंडिया) लिमिटेड की कुल बिक्री 210 करोड़ रुपए थी। इसमें मुनाफा 14.77 करोड़ रुपए था। टैक्स चुकाने के बाद कम्पनी को 9.32 करोड़ रुपए का मुनाफा हुआ।

□ यूनियन कार्बाइड (इंडिया) लिमिटेड का पंजीकृत कार्यालय कलकत्ता में है।

भोपाल में

□ सन् 1961 में एग्रो केमिकल्स (कृषि रसायन) बनाने का कारखाना भोपाल में शुरू हुआ। इस कारखाने में सेविन से फार्मूलेशन किया जाता था। यानी अमेरीका से बना बनाया पाउडर मंगवाकर उसमें कुछ पदार्थ मिलाए जाते थे। इससे उसकी सांध्रता (कॉन्सेन्ट्रेशन) आवश्यकतानुसार बनाई जाती थी।

□ सन् 1970 में यूनियन कार्बाइड ने भारत में सेविन बनाने के लिए लाइसेंस मांगा।

कारखाने

कलकत्ता	1934	बैटरी सेल का सामान बाहर से मद्रास	1952	हैदराबाद 1967	शुष्क सेल का उत्पादन विशाखापटनम
		मंगवाकर सेल बनायाजाता था लखनऊ	1958	टॉर्च का उत्पादन भोपाल 1968	कीटनाशक का उत्पादन
	1940	सेल पूरी तरह यहीं बनने लगा कलकत्ता	1965	सिनेमा आर्क कार्बन बंबई 1971	मैंगनीज डाइ ऑक्साइड का उत्पादन

□ सन् 1973 में यूनियन कार्बाइड (इंडिया) लिमिटेड और यूनियन कार्बाइड कॉर्पोरेशन (अमेरीका) के बीच एक समझौता हुआ। इस समझौते के अंतर्गत यह तय हुआ कि सेविन और कुछ अन्य कीटनाशक भारत में ही बनाए जाएंगे। इसके लिए मिथाइल आइसो साइनेट अमेरीका से आयात किया जाएगा। साथ साथ सेविन बनाने के लिए आवश्यक मशीनरी का भी आयात किया जाएगा।

□ सन् 1975 में यूनियन कार्बाइड को सरकार से सेविन बनाने का लाइसेंस मिला।

□ सन् 1977 में भारत में पहली बार आयातित मिथाइल आइसो साइनेट से सेविन बनाया गया।

□ सन् 1979 में मिथाइल आइसो साइनेट का उत्पादन भोपाल कारखाने में शुरू हुआ।

□ सन् 1983 में नए प्रकार के कीटनाशक बनाने के लिए यूनियन कार्बाइड को दो और लाइसेंस मिले।

उत्पादन

1.	एवरेडी बैटरी	109.74
2.	टॉर्च	13.85
3.	सिनेमा आर्क कार्बन	4.38
4.	औद्योगिक कार्बन	13.43
5.	कार्बन इलेक्ट्रोड	
6.	फोटो एन्ग्रेविंग प्लेट	1.30
7.	कार्बनिक रसायन	11.63
8.	पॉलीएथिलीन	35.85
9.	स्टेलाइट कास्टिंग	0.97
10.	ट्यूब रॉड	
11.	इलेक्ट्रोलिटिक मैंगनीस डाइ ऑक्साइड	1.22
12.	कीटनाशक	17.29
13.	मछली तथा अन्य समुंद्री वस्तुएं	4.23
14.	ओलीफिन	8.97

1983 बिक्री (करोड़ रुपये)

बिक्री केन्द्र

नई दिल्ली		आंध्र प्रदेश	: सिकंदराबाद
गुजरात	: बड़ौदा		गुंटूर
	अहमदाबाद	तमिल नाडू	: मद्रास
महाराष्ट्र	: बंबई	केरल	: कोचीन
	पुणे	बिहार	: पटना
मध्यप्रदेश	: इंदौर	पं. बंगाल	: कलकत्ता
	जबलपुर	राजस्थान	: जयपुर
उत्तर प्रदेश	: लखनऊ	असम	: गुवाहाटी
	कानपुर	कर्नाटक	: बैंगलूर

सांस रोकिए ....और भी है भोपाल

- ☐ जहाँ पेड़, पौधे, खेत मुरझाते हैं
- ☐ जहाँ मछलियाँ और मवेशी मरते हैं
- ☐ जहाँ जानलेवा बीमारियों का फंदा कसता है आदमी पर
- ☐ पर धीरे...धीरे हर दिन।

यहाँ फेफड़े खराब किए जाते हैं

एसबेस्टॉस खदानों और कारखानों में काम करने वालों को फेफड़ों की बीमारी एसबेस्टॉसिस हो जाती है।

मध्य प्रदेश में एसबेस्टॉस खदानें मैहर, सतना, कटनी, जबलपुर क्षेत्र में हैभारत में एकबेस्टॉस के करीब 20 कारखाने आन्ध्र प्रदेश, गुजरात, महाराष्ट्र तमिलनाडू और हरियाणा में है

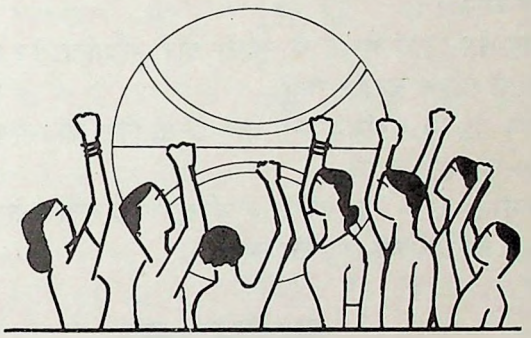
एसबेस्टॉस के रेशे इतने छोटे होते हैं कि आँख से दिखते नहीं हैं। ये फेफड़े की दीवार पर जमकर उसको कड़ा कर देते हैं। फेफड़े में हवा आने और बाहर निकलने में रुकावट पैदा हो जाती है। खाँसने में दर्द, सीने में आवाज; सांस लेने में घुटन और परेशानी, सूखा कफ निकलना, वजन घटना, नाखूनों में दाग पड़ना।

एसबेस्टॉस के रेशों से फेफड़े, पेट, बड़ी आंत और भोजन नली का कैंसर भी हो सकता है। कई लोगों को ऐसे कैन्सर की शिकायत दस वर्षों बाद जाकर हुई। एसबेस्टॉस के रेशों से टी.बी. भी हो सकती है।

रुई कहे जुलाहे से, तू क्या धुनके मोय.....

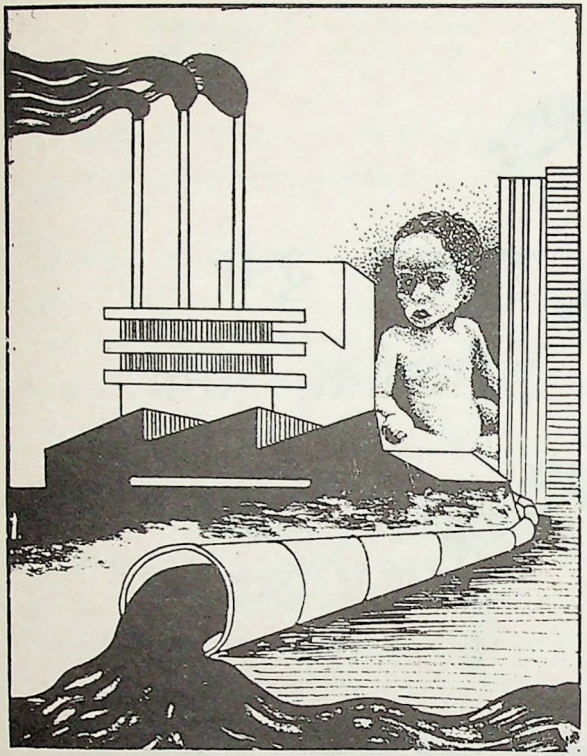
कपड़ा कारखानों में रुई के रेशों के सांस के साथ अन्दर जाने से हर छः में से एक मजदूर को फेफड़े की बिसिनोसिस बीमारी हो जाती है। इससे काम के समय हाँफना, छाती में कड़ापन, खाँसी और फेफड़े की सांस लेने की क्षमता घट जाती है। बीमारी अगर बढ़ जाए तो लाइलाज है। इसके मरीज को आगे चलकर दमा, टी.बी. हो सकती है।

हमें भी रहना है इस पृथ्वी पर



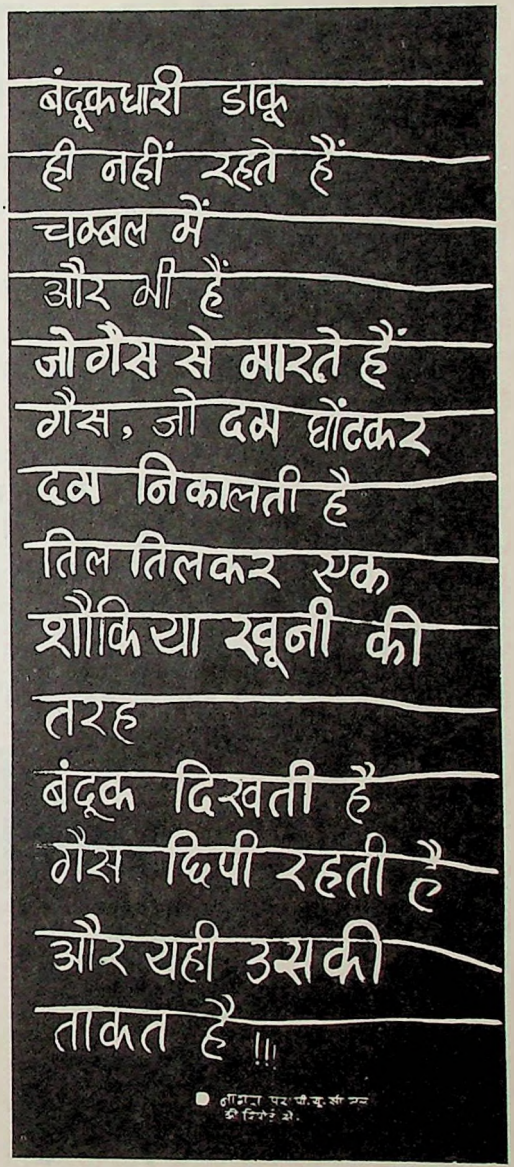
डाक्टरों की भूमिका

बिसिनोसिस, सिलिकोसिस, एसबेस्टॉसिस के लक्षण दमा और ब्रॉंकाइटिस से मिलते जुलते हैं। कम्पनी मालिक और कम्पनी डॉक्टर इसका फायदा उठाकर बीमारी को ब्रॉंकाइटिस या दमा बताते हैं। इससे यह साबित नहीं किया जा सकता है कि बीमारी कारखाने में काम करने से हुई है। इस तरह कम्पनी मालिक मजदूर के इलाज का खर्चा, मुआवजा, और अन्य खर्चों से बच जाता है। साथ ही बाकी मजदूरों को बीमारी से बचाने के लिए सुरक्षा साधन उपलब्ध कराने की जिम्मेदारी से भी बचा जाता है।



डरमेटाइटिस

कपड़ा, रसायन, रंगाई, छपाई, इंजिनियरिंग आदि उद्योगों में रसायनिक पदार्थों का इस्तेमाल करते रहने से डरमेटाइटिस नामक चमड़ी का रोग हो जाता है। चमड़ी सूजकर लाल हो जाती है। उसमें खुजली होने लगती है। चमड़ी में से पानी जैसा द्रव बहने लगता है। चमड़ी धीरे धीरे सूख कर सिकुड़ जाती है।



मंदसौर में मंद मौत....

मध्यप्रदेश में स्लेट पेन्सिल निर्माण की 500 इकाईयाँ है। इनमें से 150 केवल मंदसौर में हैं। स्लेट पत्थर काटते वक्त उसकी धूल में सांस लेते रहने से फेफड़े की सिलिकोसिस बीमारी हो जाती है। इसमें स्लेट पत्थर की धूल फेफड़ों में जमकर उन्हें खराब कर देती है। इससे सांस लेने में तकलीफ, बीमारी बढ़ने पर खून की उल्टी और 15-20 दिन बाद मृत्यु हो जाती है। धूल फांकता हुआ मजदूर स्लेंट पेन्सिल काटने की मशीन 2-3 साल से अधिक नहीं चला सकता। हर वर्ष 150 से 200 मजदूर इस बीमारी के शिकार होते हैं। पिछले 10 साल में 2000 से अधिक मजदूर सिलिकोसिस के कारण असमय ही मौत के शिकार हो गए। मजदूरों के अलावा बस्ती वाले लोग भी इस जहरीली धूल में सांस ले रहे हैं।

ग्वालियर रेयॉन, नागदा

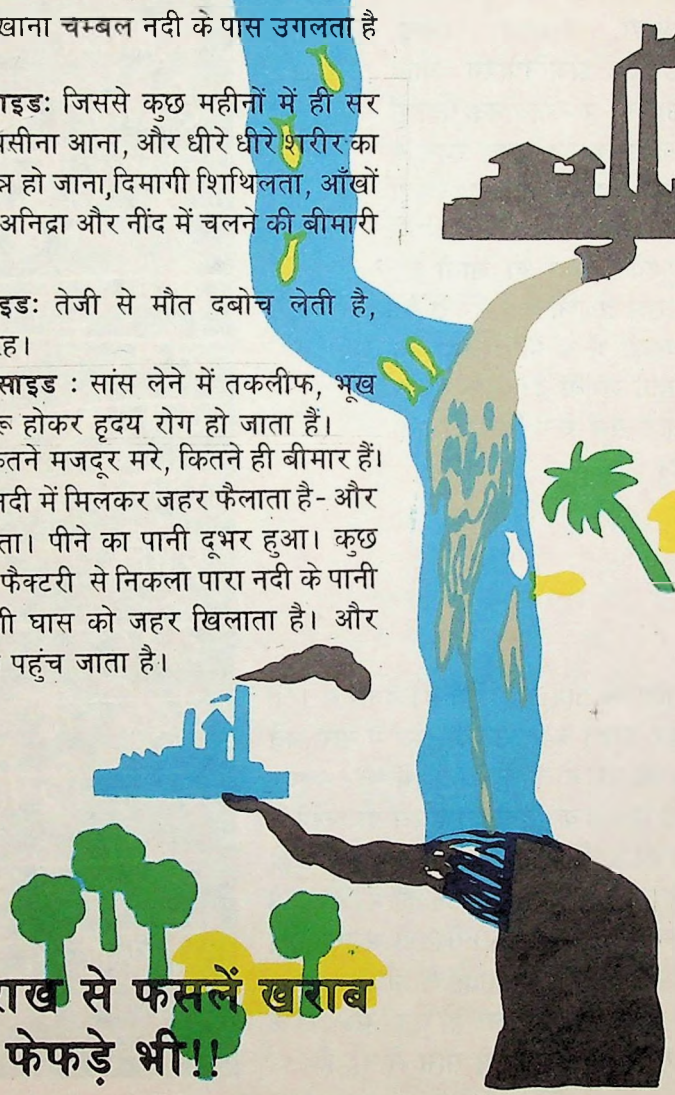
बिड़ला का कपड़ा कारखाना चम्बल नदी के पास उगलता है जहरीली गैसें.....

☐ **कार्बन डाइ सल्फाइड:** जिससे कुछ महीनों में ही सर चकराना, हाथ पाँव में पसीना आना, और धीरे धीरे शरीर का एक तरफ का हिस्सा सुन्न हो जाना,दिमागी शिथिलता, आँखों और अंतड़ियों के रोग, अनिद्रा और नींद में चलने की बीमारी होने लगती है।

☐ **हाइड्रोजन सल्फाइड:** तेजी से मौत दबोच लेती है, साइनाइड जहर की तरह।

☐ **सल्फर डाइ ऑक्साइड :** सांस लेने में तकलीफ, भूख मारती है, खाँसी से शुरू होकर हृदय रोग हो जाता हैं।

इन गैसों की चपेट में कितने मजदूर मरे, कितने ही बीमार हैं। फैक्टरी का गन्दा पानी नदी में मिलकर जहर फैलाता है- और कुँओं को भी नहीं छोड़ता। पीने का पानी दूभर हुआ। कुछ लोगों की जाने भी गईं। फैक्टरी से निकला पारा नदी के पानी में मिलकर किनारे लगी घास को जहर खिलाता है। और चरती गाय के दूध तक पहुंच जाता है।



जुआरी एग्रो केमिकल्स, गोवा

☐ 1973 में शुरू।
☐ तीन माह के अन्दर नदी में मछलियों ने दम तोड़ा।
☐ एक साल में मवेशी मरने लगे।
☐ दो साल में नारियल के पेड़ मुरझाने लगे।

लकवे की नदी–कालू

बंबई की कालू नदी में कारखानों का कचरा फिकता है। नदी बहा ले जाती है जहर–गांव गांव। अम्बीवली गाँव के पास कालू नदी के पानी में जहरीले पारे का असर पाया गया है। पारे का असर नदी के आसपास की घास में, और घास से गाय के दूध में और दूध के जरिए मनुष्य के शरीर में पहुंच रहा है। पारे के जहर से होता है लकवा, लंगड़ापन, गूंगापन, पागलपन, अंधापन, बहरापन। और दौरे भी पड़ते हैं। कमजोरी आने लगती है।

जापान के निवासी जहरीले पारे का यह असर भुगत चुके हैं।

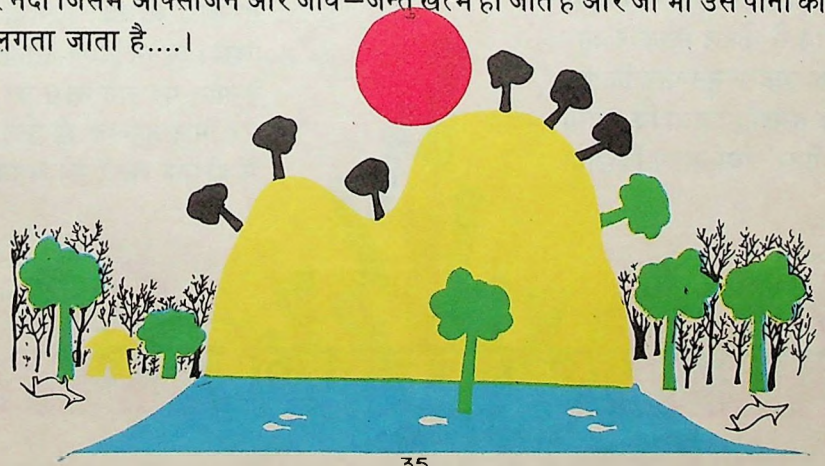
फैक्टरी की राख से फसलें खराब होती हैं और फेफड़े भी!!

नदी कैसे मरती है?...धीरे धीरे...

आप जानते हैं कि तालाब और नदी के पानी में ऑक्सीजन घुली रहती है जिसे पानी में रहने वाले जीव–जन्तु सांस द्वारा ग्रहण करते हैं। प्रकाश संश्लेषण (फोटोसिन्थेसिस) की क्रिया से पानी में उगने वाले पेड़–पौधे ऑक्सीजन छोड़ते हैं। इससे पानी में ऑक्सीजन की मात्रा बनी रहती है।

कारखाने जब मलवा कचरा नदियों में बहा देते हैं तो क्या होता है? जब मलवा पानी में उतर जाता है तब कुछ नीचे चला जाता है और कुछ पानी में तैरता रहता है। पानी में कई तरह के जीवाणु रहते हैं जो इस कचरे को खा लेते हैं। कुछ जीवाणु पानी की ऊपरी सतह पर रहते हैं तथा कुछ निचली। ऊपरी सतह वाले जीवाणु भी ऑक्सीजन लेते हैं और इनको एरोबिक बैक्टीरिया कहते हैं। कचरा खाने के बाद यह जीवाणु कचरे को अहानिकारक पदार्थों में बदल देते हैं। इस क्रिया में पानी की ऑक्सीजन खर्च होती है।फिर ये पदार्थ पेड़-पौधे तथा एलगे प्रकाश संश्लेषण द्वारा ग्रहण करते हैं। इस प्रक्रिया में वह आक्सीजन छोड़ते हैं। इस तरह पानी में ऑक्सीजन की मात्रा बनी रहती है।

पर एक समय आता है जब पानी में कचरा हद से ज्यादा हो जाता है। कचरे को बदलने में बहुत अधिक ऑक्सीजन खर्च होने लगती है। पानी में ऑक्सीजन की कमी होने लगती है। पानी में रहने वाले लाभदायक जीवाणु मरने लगते हैं। अब पानी की निचली सतह में रहने वाले जीवाणु कचरे पर वार करने लगते हैं। ये जीवाणु पानी से ऑक्सीजन ग्रहण नहीं करते हैं, इसलिए इनको एनॉरोबिक बैक्टीरिया कहते हैं। ये जीवाणु कचरे में हाइड्रोजन छोड़ते हैं। यह हाइड्रोजन कचरे से उपलब्ध सल्फर के साथ मिलकर हाइड्रोजन सल्फाइड गैस पैदा करता है। और यह गैस बहुत बदबूदार है। धीरे धीरे पानी काला और गन्दला होने लगता है। सूरज की रोशनी इस कीचड़ से पानी को भेद नहीं पाती। रोशनी की कमी में पेड़–पौधों की प्रकाश संश्लेषण क्रिया बन्द हो जाती है। इससे ऑक्सीजन की मात्रा और कम हो जाती है। ऑक्सीजन की कमी से पेड़–पौधे, जीवाणु, मछलियाँ मरने लगते हैं। अन्त में बच जाती है एक गन्दी, बदबूदार नदी जिसमें ऑक्सीजन और जीव–जन्तु खत्म हो जाते हैं और जो भी उस पानी को हाथ लगाता है वह एक धीमी गति से दबोचने वाली मौत के हाथ लगता जाता है....।



ग्वालियर रेयॉन (केरल)

1958 में स्थापित। कारखाने से प्रतिवर्ष 680 लाख लीटर गन्दा पानी निकलकर चालियार नदी में मिलता था। इससे नदी का पानी काला पड गया। मवेशी मरने लगे। फसलें मुरझाने लगीं। पानी से लोगों को चमड़ी की और हवा से फेफड़ों की बीमारी होने लगी।

1963 के बाद लोग और सहन नहीं कर पाए। उन्होंने कारखाने पर धावा बोल दिया। मालिकों ने वादा किया कि कारखाने की गंदगी को 20 मिलोमीटर लंबा पाइप बिछाकर समुद्र में छोड़ा जाएगा। यह व्यवस्था तीन साल में हो जाएगी।

मालिक वादा करके भूल गए। लोग फिर जुटे और लड़े। 1965 में...1967 में...1968 में...

1968 में सरकार ने एक आयोग बिठाया। जिसने 1972 में अपनी रिर्पोट दी। आयोग ने कारखाने की गंदगी को साफ करने के लिए संयंत्र लगाने की सिफारिश की। पर संयंत्र लगा नहीं।

1973 में लोगों ने फिर से आवाज उठाई। सरकार ने अब की बार एक जाँच कमेटी बैठाई। 1974 में केरल सरकार और जल प्रदूषण निगम ने जल प्रदूषण का एक कानून पास किया। सरकार और प्रबन्धकों के बीच एक समझौता हुआ कि गंदगी को दूर छोड़ने के लिए 1.6 किलोमीटर लंबा पाइप बिछाया जाएगा पर पाइप बिछा नहीं।

ओरियन्ट पेपर मिल (शहडोल)

1965 में स्थापित। कारखाने से निकलने वाला मलवा सोन नदी में मिलता है। इससे नदी का 40 किलो मीटर दूर तक पानी गन्दा होता है। इस गन्दे पानी को 30 से ज्यादा गाँवों में उपयोग किया जाता है।

गन्दे पानी के उपयोग से सोन के किनारे पर होने वाली तरबूज की फसल लगना बन्द हो गई। मछलियाँ आधी रह गईं। इससे बहुत से लोग बेरोजगार हो गए। हर साल हजार में से सत्तर मवेशी मरने लगे। पैदा होने वाली दूध की मात्रा भी 80 प्रतिशत तक घट गई। गायों की गर्भधारण करने की क्षमता पर भी प्रभाव पड़ा।

गन्दे पानी से गाँवों के लोगों को पैर फटना, नाखून टूटना और मुड़ना, पैरों में खुजली, चमड़ी में दाग, फोड़े-फुन्सी और दर्द की शिकायत रहने लगी। सोन नदी का पानी पीना तो दूर, नहाने धोने लायक नहीं रहा।

तंग आकर सन् 1970 में 26 गाँवों के कोई 300 लोगों ने मिलकर इसके खिलाफ आवाज उठाई। उन्होंने मिल मालिक, सरकारी अधिकारी, मंत्री तथा अन्य जिम्मेदार लोगों को पत्र लिखे। ज्ञापन दिए। नतीजा कुछ नहीं हुआ। आखिरकार लोगों ने सोन पर बने बांध को तोड़ने का निर्णय लिया।

पर मिल मालिक भी कम चालाक नहीं हैं। उन्होंने आन्दोलन में शरीक लोगों को बहकाना शुरू किया।

1977 में केरल विधान सभा की एक कमेटी ने मामले की जाँच की। कमेटी के निष्कर्ष आश्चर्यजनक थे। पर मालिकों की मोटी खाल पर इन सबका कोई असर नहीं हुआ।

1978 की गर्मियों में कारखाना बंद रहा। क्यों कि कुछ अन्य कारणों से मजदूर हड़ताल पर थे।

कारखाना दोबारा चालू हुआ और फिर से कचरा नदी में फेंका जाने लगा। गुस्से में खौलते हजारों लोग जुटे और तोड़ आए वो बांध जो कम्पनी ने नदी पर बनाया था अपने लिए। अब कम्पनी को सबक मिला और पलक झपकते बिछ गया वह पाइप जो 15 साल से नहीं बिछ रहा था।

पर बात बनी नहीं। नया पाइप बिछ तो गया, पर लीक करने लगा। खतरा अब भी टला नहीं था। लोग भभक उठे। कम्पनी वालों ने फिर वादे किए, तर्क किए। पर लोग इस बार चक्कर में नहीं आए। कम्पनी के हर तर्क का वैज्ञानिक जवाब उनके पास था। पिछले चार सालों में कुछ वैज्ञानिकों की मदद से उन्होंने कारखाने का सारा विज्ञान समझ लिया था।

आखिरकार 1981 में प्रदूषण बोर्ड ने ग्वालियर रेयॉन के खिलाफ हाइकोर्ट में मुकदमा दायर कर दिया। हाईकोर्ट ने कम्पनी के खिलाफ कड़ी हिदायतें जारी कीं। कम्पनी को झुकना पड़ा।

कुछ गाँवों के मुखिया प्रलोभन में आ गए। कुछ लोगों को कीर्तन का शौक था उन्हें कीर्तन का सामान मंजीरा, ढोलक, भजन की किताब आदि बाँट दी गई। हनुमान मंदिर बनवाया गया।

कुछ गाँवों में कुंए खुदवा दिए, किसी तालाब की सफाई करवा दी, कहीं नाले पर छोटा बांध बंधवा दिया।

धीरे धीरे लोग टूट गये। आन्दोलन ठंडा पड़ गया। और ओरियन्ट पेपर मिल चल रही है, लगातार धुंआ और जहर उगल रही है। सोन लगातार जहरीली हो रही है। लोग बीमार हो रहे हैं। उपजाऊ जमीन बंजर हो रही है। पशु मर रहे हैं। लोग पानी के लिए तरस रहे हैं।

जरूरत है कि
लोग तिल तिलकर मरने के खिलाफ
फिर से जुटें,
पग–पग पर लड़ें–जूझें!!

मौत से जूझती एक नदी...

धीमी मौत

कीटनाशक

हम जहर खाते हैं

आंध्र प्रदेश में धान के खेतों में काम करने वाले मजदूर केंकड़े खाते हैं। यह केंकड़े धान के खेतों में होते हैं। अचानक मजदूर बीमार पड़ने लगे। खोजबीन से पता चला कि केंकड़े के माँस में कीटनाशक उपलब्ध था। यह वही कीटनाशक था जो किसानों ने अपने धान के खेतों में छिड़क दिया था।

केरल में करीब सौ लोग चावल खाने के बाद मर गए। उन्होंने चावल बाजार से खरीदा था। खोजबीन से पता चला कि भंडारण के समय, चावल को सुरक्षित रखने के लिए, उसपर पेराथियॉन कीटनाशक छिड़का गया था।

यह केवल दो उदाहरण है। ऐसे दुनिया में सैकड़ों उदाहरण है। कीटनाशकों से हर साल पाँच लाख से अधिक लोग प्रभावित होते हैं। जिनमें से कम से कम 10-12 हजार मर जाते हैं।

ऐसा क्यों होता है? कारण यह है कि डी.डी.टी. जैसे अनेक कीटनाशक अपने जहरीले रूप में वर्षों तक बने रहते हैं और बदलते नहीं। एक अच्छा कीटनाशक तो वह है जो कीटों को खत्म करने के साथ साथ जल्दी ही अहानिकारक पदार्थों में परिवर्तित हो जाता है।जो जल्दी नहीं बदलता, वह मिट्टी से पानी के साथ पौधों में पहुंच जाता है। जब गाय–भैंस इन पौधों को खाते हैं तो इसका जहर दूध में चला जाता है। यह दूध पीने से जहर मनुष्य के शरीर में धीरे धीरे जमा होता रहता है। मात्रा अधिक होने पर गम्भीर बीमारियाँ दबोच लेती है, जैसे सर चकराना, घबराहट, उल्टी, सरदर्द, दौरे पड़ना आदि।

और भी कई तरीके हैं जिनसे कीटनाशक मनुष्य के शरीर में पहुंचते हैं। केरल के उदाहरण के अनुसार सीधा अनाज, या सब्जी आदि खाने से जहर शरीर को नुकसान पहुंचाता है। कभी कभी कीटनाशक सिंचाई के पानी में बहकर नदियों में पहुंचते हैं जिससे पानी में रहने वाले जीव–जन्तु पेड़–पौधे प्रभावित होते हैं। जैसे मछली के शरीर में ये कीटनाशक पहुंचकर जमा हो जाते हैं। जो बाद में मछली खाने वाले मनुष्य के शरीर में पहुंचते हैं। इसके अलावा कीटनाशक छिड़कते समय सांस के साथ मनुष्य के शरीर में पहुंचते हैं। कभी कभी कीटनाशकों को गलत ढंग से इस्तेमाल करने से हाथ–पैरों पर भी असर होता है।

जहर का चक्र

किसी भी कीटनाशक के प्रति कीड़े कुछ ही समय में प्रतिरोधक क्षमता प्राप्त कर लेते हैं, यानी उनपर जहर का असर होना बन्द हो जाता है। उनको मारने के लिए अधिक मात्रा और सांध्रता में कीटनाशक छिड़कना पड़ता है। पर जब उसका भी असर नहीं होता तो अधिक जहरीली दवाइयाँ काम में लाते हैं। कुछ समय में कीड़े उनके भी आदी हो जाते है और तब ज्यादा जहरीले पदार्थ बनाए जाते हैं। यह चक्कर चलता ही रहता है।

पिछड़े देशों में

विकसित देशों में इन कुप्रभावों के कारण कई कीटनाशक दवाइयों के उत्पादन पर प्रतिबंध लगाया गया है। जैसे डी.डी.टी, बी.एच.सी., डाइएल्ड्रिन, एन्ड्रिन, हेप्ताक्लॉर, 2,4,5,1 आदि। उत्पादन बन्द होने से उद्योगपतियों को आर्थिक नुकसान होता है। इससे बचने के लिए कारखाने दूसरे देशों में बेच दिए जाते हैं जहाँ उन पर कानूनी बंदिश नहीं होती। अक्सर गरीब, पिछड़े देश ही इस कार्यवाही का शिकार होते हैं। विकास के नाम पर गरीब देश इनको अपनाते जाते हैं। और अन्ततः नुकसान उठाते हैं। क्या आप जानते हैं कि हमारे देश के निवासियों के शरीर में डी.डी.टी की मात्रा दुनिया में सबसे अधिक है?

मौत का व्यापार

विदेशों में जानलेवा एसबेस्टॉस का उत्पादन लगातार कम किया जा रहा है। लेकिन भारतीय कम्पनियों में उत्पादन तेजी से बढ़ रहा है। भारत में एसबेस्टॉस बनाने वाली बीसों कम्पनियाँ किसी न किसी विदेशी कम्पनी से जुड़ी हुई हैं। भारतीय कम्पनियाँ विदेश से तकनीकी जानकारी तथा मशीनें मंगवा कर यहाँ के सस्ते और गरीब मजदूरों की मेहनत से एसबेस्टॉस का सामान बनवाती है।यह माल वापस विदेशों में भेज दिया जाता है। इस तरह वहाँ माल भी मिल जाता है और बीमारी भी नहीं फैलती।

क्या आप जानते हैं?

हमारे देश का 70 प्रतिशत पानी प्रदूषित है!!!

प्रदूषित बारिश

कारखाने चलाने के लिए तेल और कोयला जलता है। इससे निकली सल्फर डाइ ऑक्साइड गैस हवा की नमी से मिलकर सल्फ्यूरिक अम्ल बनाती है। यह अम्ल बादलों के साथ दूर दूर उड़कर बारिश में पृथ्वी पर पहुंचता है। और फसलें बर्बाद करता है। पैदावार घटने लग जाती है। लोगों में बीमारियाँ भी फैलने लगती है। इसके कई उदाहरण है। अमेरीका के शिकागो शहर में बहुत सारे कारखाने हैं। इन कारखानों से निकली सल्फर डाइ ऑक्साइड दूर कैनाडा के खेतों में सल्फ्यूरिक अम्ल बारिश के रूप में गिरता है। वैसे ही पश्चिम यूरोप की फैक्ट्रियों से यह धुंआ समुद्र पार करके नॉर्वे और फिनलैन्ड तक पहुंचता है। अब सोचिए, बंबई के चेम्बर इलाके की फैक्ट्रियों का धुंआ कहां कहां तक पहुंचता होगा?

हिसाब–किताब

उद्योगपति कहते हैं– "बहुत ज्यादा खर्चा पड़ता है।" क्या वाकई में?

□ गोवा की जुआरी एग्रोकेमिकल्स को 27 लाख रुपये की लागत का मलवा सफाई संयंत्र लगाना पड़ा। 56 करोड़ रुपये की लागत के इस कारखाने के लिए क्या यह बहुत ज्यादा है?

□ ओरियन्ट पेपर मिल (अमलाई) को संयंत्र 12 लाख रुपये का पड़ेगा। हर साल 6 करोड़ रुपये मुनाफा कमाने वाले कारखाने के लिए क्या यह बहुत ज्यादा है?

जनविज्ञान प्रदर्शनी

18 जनवरी से 25 जनवरी तक, होशंगाबाद में भोपाल गैस कांड पर आधारित जन विज्ञान प्रदर्शनी लगाई गई। इसी प्रदेर्शनी पर यह पुस्तिका आधारित है। इस प्रदेर्शनी को करीब 4000 लोगों ने देखा और कोई 125 लोगों ने रजिस्टर में अपने विचार दर्ज किए।

लोगों द्वारा लिखी गई कुछ टिप्पणियों के अंश हम यहाँ दे रहे हैं।भोपाल त्रासदी और औद्योगिक प्रदूषण को लेकर लोगों का दुख, चिन्ता और आक्रोश झलक पड़ता है। लोगों ने बहुत गम्भीरता और गहरी रूचि के साथ प्रदेर्शनी देखी–पढ़ी।

आप से अनुरोध है कि आप चाहें तो इस पुस्तिका के आधार पर प्रदर्शनी हेतु पोस्टर बनवाएं और अपने गाँव–शहर व उसके आस पास दिखाएं।

"1984 की अंतिम घड़ी में भोपाल वासियों पर गैस की मार सिद्ध कर गई है कि हम अपने अस्तीनों में सांप पालते रहे हैं। निश्चय ही यह पूंजीपतियों की साजिश रही है जिसे हम लोग अनदेखा करते आए हैं। बहुराष्ट्रीय कम्पनियों के ठेकेदारों ने मौत का तान्डव रचा–हो सकता है यह केवल पूर्व अभ्यास हो मानव जीवन को कुछ ही क्षणों में किस प्रकार मौत की खाई में ढकेला जा सकता है इसका पूर्व परीक्षण किया गया हो।

हमारे कानून में जब एक आदमी का खून और उसकी मौत के लिए फाँसी का प्रावधान हो, तब जनता एवं कानून स्वयं फैसला कर सकते हैं कि हजारों लोगों की मौत के जिम्मेदार व्यक्तियों के लिए क्या सजा हो सकती है?"

-एक भुक्तभोगी भोपालवासी

"खूनी हिटलर के पश्चात निरीह एवं निर्दोष मनुष्य, पशु एवं प्रकृति की हत्या यूनियन कार्बाइड के द्वारा हुई। इसको जितने सटीक रूप से जनसाधारण को बताया एवं देश में प्रतिदिन पर्यावरण को दूषित कर रहे पूंजीपतियों के कल कारखानों को बेनकाब किया यह एकलव्य का अनूठा प्रयास है। आशा है अब सभी सचेत हो जावेंगे एवं किसी भी रूप में कोई भी निर्दोष मानव एवं प्रकृति की हत्या नहीं कर पाए तो यह प्रयास सफल होगा।"

-ए.जी.कुशवाहा (होशंगाबाद)

सुरेश (13)
मैं दूसरे लड़कों की तरह ज्यादा देर तक नहीं खेल सकता। बहुत जल्दी ही मेरा सांस चढ़ जाता है।

सुखराम (50)
मैं 50 किलो ग्राम का वजन उठा सकता था। परन्तु ऐसा कौन मुसाफिर होगा जो इससे आधा वजन उठाने के लिए कुली की तलाश करें?

रमेश कुमार
मैं और मेरी पत्नी बड़ी दुविधा में है। हमें अपने पहले बच्चे की बड़ी इच्छा है। (उसकी पत्नी गर्भवती है) परन्तु हमें शंका है कि हमारा होने वाला बालक सही सलामत होगा।

आदिल (4)
मुझे हौआ (भूत) दिखता है। मेरा दोस्त गब्बूस भी रात को हौआ देखता है। (आदिल को रात के समय दौरा सा पड़ता है और वह चीखने लगता है, "प्यारी बहन मुझे बचा लो, पापा मुझे बचा लो।"

"आज भोपाल ने हमारे भाईयों की जान ली प[illegible]र[illegible]हाँ का उद्योग प्रत्यक्ष या अप्रत्यक्ष रूप से हमारी न लें! .....हम भविष्य को देखते हुए यह न सोचें कि यह घटना भोपाल की है हमें क्या लेना देना....उद्योगों से पैदा होने वाले दोषों को दूर करने हेतु सरकार पर और उद्योग प्रबन्ध पर दबाव दें।"

-विनोद तिवारी (सतना)

"साम्राज्यवादी देश भारत जैसे गरीब मुल्क में घिनौने उद्योग खोल कर किस प्रकार आदमी की जिन्दगी के साथ मजाक कर रहे हैं। यह बात इस प्रदेर्शनी के द्वारा सहज ही समझ में आ जाती है। मध्यप्रदेश शासन द्वारा भी अपनी भूमिका सही ढंग से नहीं निबाही———

-एम.ए. लतीफ (म. प्र. तृतीय वर्ग शासकीय कर्मचारी संघ)

"इस तरह की भयंकर त्रासदियाँ जिसमें अधिकतर समाज का निम्न मध्य व निम्न वर्ग हर स्तर पर खत्म हो जाता है और सरकारी तंत्र उसके वर्गहित एवं साम्राज्यवादी एजेन्सियाँ अपने ग्लैमर प्रचार तंत्र एवं भ्रम जालों से पीड़ित जनता का ध्यान त्रासदी की ओर से हटाने में जुट जाते हैं तब इस तरह की प्रदर्शनियाँ लोगों के दिलों दिमांग में इस तरह की लादी हुई अमानवीय मौतों की याद जिन्दा रखती हैं.....।

-अखिल पगारे (होशंगाबाद)

"देश में जहाँ भी इस तरह के कारखाने हैं वहाँ के स्थानीय निवासियों को उसमें प्रयुक्त होने वाले रसायनों व उनसे होने वाले सम्भावित खतरों की जानकारी होना चाहिए। (मतलब सरकार को देनी चाहिए).....सरकार चेत जाय तो ठीक है अन्यथा कोई और तरीका अपनाएं (नागरिक लोग)"

-संजय दुबे (होशंगाबाद)

"आओ बन्धुओं अब हम सब इस प्रकार के जानलेवा कारखानों का बहिष्कार करने की आवाज उठाएं।"

-दीपक (होशंगाबाद)

"यदि सरकार मुझे किसी प्रकार की सजा न दे तो भोपाल में स्थित यूनियन कार्बाइड कारखाने में आग लगा दूँ।"

-सुन्दरनारायण शर्मा (होशंगाबाद)

"इस कारखाने को किसी जगह एक बड़ा गड्ढा खोद कर दफन कर देना चाहिए। इससे अच्छा और कोई रास्ता नहीं है।"

-नरेन्द्र सिंह (होशंगाबाद)

"जहाँ तक भोपाल गैस त्रासदी का प्रश्न है निश्चय ही यह एक अमानवीय दुर्घटना है जिसकी जितनी अधिक निंदा की जावे उतनी ही कम है। परन्तु इसके साथ साथ प्रश्न यह है कि क्या विज्ञान के इस युग में जबकि हमें हमारे जीवन की सुविधाओं को प्राप्त करने में विज्ञान एवं उद्योगों का महत्वपूर्ण योगदान है, तब हमें कारखानों और उद्योगों की स्थापना से मुंह नहीं मोड़ना चाहिए। परन्तु इसके साथ हमें यह भी देखना होगा कि हमारी उन्नति हेतु इस प्रकार कारखाने स्थापित किए जाएं कि कल को ये हमारी अवनति न करें और हमारे लिए प्राणलेवा न सिद्ध हों।"

-टी.एस. चौहान (होशंगाबाद)

"जरूरत इस बात पर सख्त ध्यान देने की है कि कई उद्योग जो अभी भी धीरे धीरे जहर को मनुष्य के शरीर में पहुंचाते रहते हैं उस समय तक तत्काल बन्द कर दिए जाएं जब तक कि सुरक्षा के प्रति पूर्ण आश्वस्त न हो जावें। समय समय पर कड़ी जांच की जावे और फिर भी अव्यवस्था मिलने पर जांचकर्ता के खिलाफ कड़ी कार्यवाही की जावे।"

-राजकुमार गुप्ता (होशंगाबाद)

"इस प्रदर्शनी से यह निश्चित संकेत मिलता है कि यह दुर्घटना किंकर्त्तव्य विमूढ़ता का द्योतक है। जनता को राहत पहुंचाने हेतु उद्योगों के परिणाम से पूर्व परिचय और लक्षणों का पूर्वज्ञान आवश्यक है। यदि ऐसा नहीं तो इस प्रकार के घातक कारखानों को तुरन्त बंद कर देना अनिवार्य है।

-एस.ए.अली (होशंगाबाद)

"इस प्रकार के मुनाफा कमाने वाले औद्योगिक संस्थान जन जाति समाज से दूर बहुत दूर नितांत वीरान जंगलों में ही लगाना चाहिए।"

-अखिलेश गुप्ता (होशंगाबाद)

"अगर स्वतन्त्र होने पर भी हम विकसित देशों के दबाव में आकर इस तरह की तबाही मोल ले सकते हैं तो इस स्वतंत्रता से बुरी और कोई चीज नहीं है।"

-के.के.बी. (होशंगाबाद)

"भोपाल के गैस दुर्घटना से हम लोगों को भी भारी दुख है। ऐसा गैस किसी जंगल में ही बनवाया जावे जहाँ कि पचास किलोमीटर तक आबास न हो।"

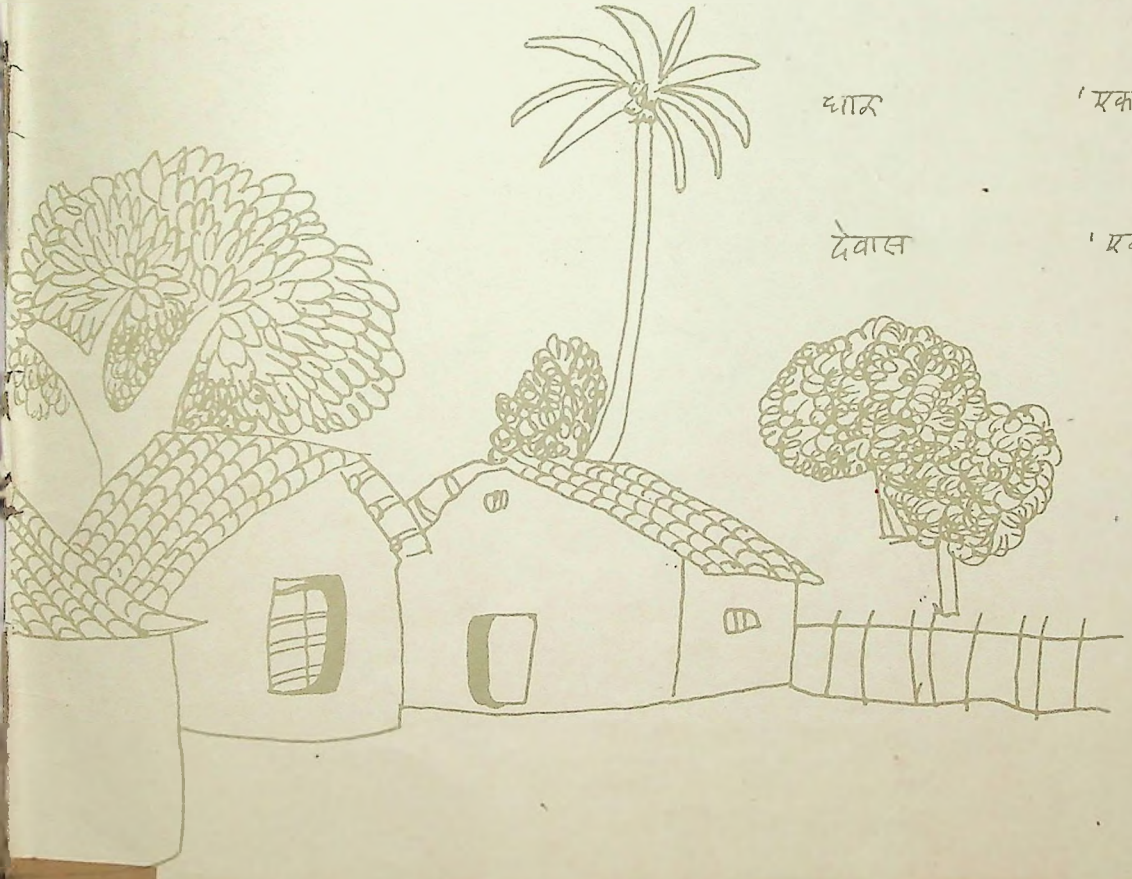
-मोहरबान सिंह यादव (गुना)

मेबाबाई
नहीं, नहीं, तुम मुझे अस्पताल मत ले जाओ। मृतकों के भूत चारों तरफ घूम रहे हैं।

सुनील (16)
लोग मेरे बड़े भाई को ढूंढ रहे हैं इस उम्मीद पर कि वे उसे एक दिन पा लेंगे। लेकिन यह आशा दिन–ब–दिन मरती जा रही है।

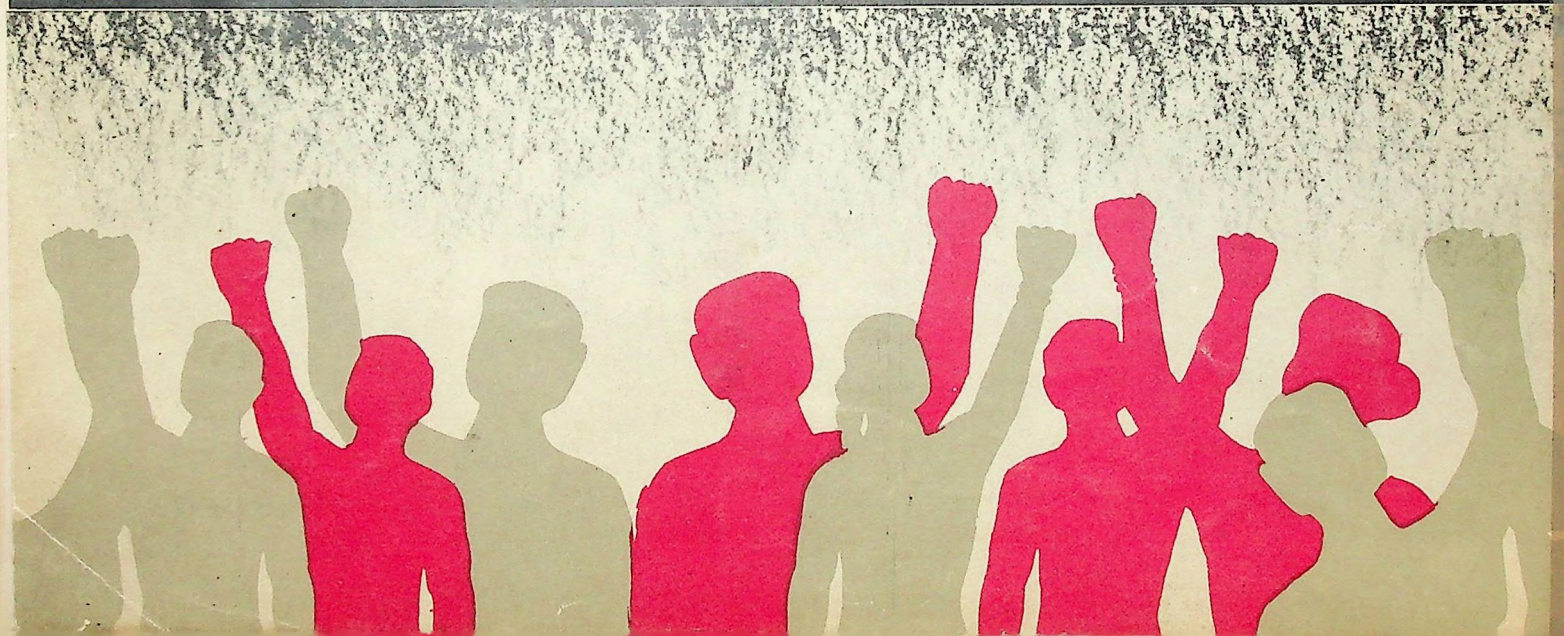
एकलव्य के क्षेत्रीय केन्द्रों के संपर्क पते :

होशंगाबाद	'एकलव्य', कोठीबाजार, होमगार्ड आफिस के पास, पिपरियारोड, होशंगाबाद (म०प्र०) 461001.
हरदा	'एकलव्य', नेहरू कॉलोनी, हरदा (म०प्र०)
पिपरिया	'एकलव्य', पचमढ़ी रोड, पिपरिया (म०प्र०)
उज्जैन	'एकलव्य', 293 विवेकानंद नगर कॉलोनी उज्जैन (म०प्र०)
धार	'एकलव्य', 17 एस.आई.जी. कॉलोनी माण्डू रोड, धार (म०प्र०) 454001.
देवास	'एकलव्य', माधव आश्रम, राधागंज, देवास (म०प्र०) 455001.



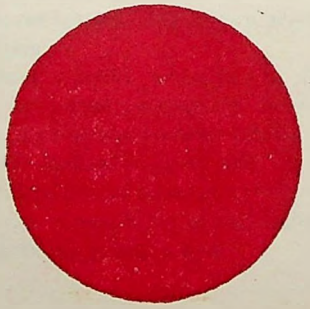
जो इनका भेद खोल दे
हर एक बात बोल दे
हमारे हाथ में वही
खुली किताब चाहिए
घिरे हैं हम सवाल से
हमें जवाब चाहिए

एकलव्य, ई 1/208 अरेरा कालोनी, भोपाल462 016



MEDICAL RELIEF
and
RESEARCH IN BHOPAL

The Realities and Recommendations



medico friend circle

A summary report of a medical fact finding team's investigation two months after the gas accident at Bhopal, presented at the All India Convention of People's Science, Democratic Rights and Environmental Protection Groups called by the Zahreeli Gas Kand Sangarsh Morcha, Bhopal, 17–18 Feb 1985

medico friend circle
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326, V Main, I Block
Koramangala
Bangalore - 560 034

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MEDICAL RELIEF AND RESEARCH IN BHOPAL

The Realities and Recommendations

INTRODUCTION

This report has been written by a group of doctors from the medico friend circle (mfc) after collecting medical information from gas affected persons, interviewing doctors working in Government hospitals, private practitioners and relief workers, and by sifting through various available toxicological literature and press reports.

The **objectives** of our investigation were as follows :

a) to understand the health situation of the victims;
b) to obtain information about the medical relief being provided to them:
c) to get to know about the medical research being conducted in the wake of the Bhopal tragedy, and
d) to offer necessary recommendations to Government and Voluntary bodies.

During the investigation, the group worked under the following **limitations** :

1) The Government's policy and effort to deny information, having instructed government as well as private doctors not to divulge any medical details:
2) A lack of proper medical records; and
3) Given the constraints of time and resources available to the group, the impossibility of conducting a systematic survey to generate primary data

FINDINGS

On the basis of the evidence gathered, the group concluded that –

a) in spite of the great confusion prevalent during the first

few days after the accident, the general public, voluntary agencies and the medical staff of government hospital worked ceaselessly with whatever facilities were at hand in attempting to save as many lives as possible;

b) in spite of clear evidence of cyanide poisoning from 3rd December 1984 the administration of the known specific antidote sodium thiosulfate was banned. Only after a fatal lapse of two months has this decision been officially reversed, and even today clear guidelines for its administration to patients have not been issued, nor is the injection yet being made available in the quantity required for massive detoxification of the affected population;

c) the crucial information about the nature of the gas as well as the findings of autopsy was with-held from the medical community as well as the public by both the Union Carbide and the Government, incapacitating the treating doctors and creating unnecessary fear amongst the people. In its place, misinformation was fed by the medical officers of Union Carbide, Dr. Jaeger of the World Health Organisation and the Ishwardas committee of the Government of Madhya Pradesh in the form of statements to the press, like 'there is no evidence of cyanide poisoning' and 'only lungs and eyes have been affected' :

d) In the absence of uniform guidelines from responsible senior government doctors, the treatment was symptomatic and consisted mainly of atropine (or homatropine) and antibiotic medications for the eyes, oxygen and bronchodilators for severe respiratory complaints, antacid-antispasmodics for gastritis and paracetamol for fever. Corticosteroids were also given in large quantities, at first to save life and later in an attempt to prevent lung fibrosis. Antibiotics were given freely and in anticipation of a heavy wave of secondary infection in mid-December, which, however, curiously did not

occur to the extent expected. Outside the Government system, private treatment and sale of proprietary medicines, including expensive iron tonics and cough syrups flourished without affording much relief.

e) regarding the people's state of health, various complaints persist which we concluded are due only to the effects of the poisonous gas exposure.

— There has been remarkable improvement in the condition of the eyes, and the group has not found any case of total blindness which can be attributed to the gas However, a large number of people continue to suffer from blurring of vision and intolerance to bright light, preventing them from pursuing their prior occupations.

— Thousands of people have developed chronic lung disease as a sequel to the gas exposure, and it seems that this will be a permanent handicap. Records of selected patients subjected to sensitive lung function tests show definite abnormalities suggesting both 'obstructive' (where air passages are obstructed) and 'restrictive' (where the lungs are unable to expand due to fibrosis) lesions. X—ray evidence of fibrosis is also now becoming apparent.

— People also suffer on a large scale from gastritis, fever and psychological stress of varying severity.

— Women have suffered from abortions, stillbirths, diminished foetal movements, suppression of lactation, abnormal vaginal discharge and menstrual disturbances.

f) a large number of pregnant women were exposed to the toxic gas, hypoxia, infection, stress and drugs, each of which can cause damage to the foetus and result in birth of deformed children No information has been provided to women about this considerable risk to enable them to exercise their choice of terminating pregnancy within the period when abortion is safe.

g) due to the unprecedented nature of this tragedy, a vast array of medical research studies have been launched. Even though research is essential in the present situation, certain undesirable and even dangerous trends are emerging. The choice of research projects is being made solely by government agencies without any consultation with the medical community or the people. The people are not being informed and their consent is not being taken for inclusion into the studies and for the procedures to which many of them will be subjected. This is a minimum medical ethic. The research interests of the doctors are tending to take priority over the need to provide service to the people.

RECOMMENDATIONS

On the basis of these findings, we are able to make the following recommendations which we consider necessary. The first five recommendations should be taken up on a priority basis

1) That medical and pathological information be made available to the public and to the medical community, including clinical findings, laboratory investigations, treatment records, autopsy reports and any further clues as to the nature of the toxic substances involved in the tragedy.

2) That, in the wake of ICMR's acknowledgement that cyanide poisoning has occurred, the much delayed treatment by sodium thiosulfate be administered to the affected population in the recommended dosage In order for this measure to reach all persons who were in Bhopal at the time of the gas leakage, the government of Madhya Pradesh must give wide publicity to the arrangements made for total detoxification.

3) That the Government immediately publicise the potential dangers involved to all pregnant women who were exposed to the gas in the first trimester of pregnancy so that these women can still take a timely decision to terminate pregnancy

To facilitate such a decision, adequate facilities for ultrasonography and amniocentesis must be provided without delay. This measure is particularly urgent as many pregnant women are now crossing the safe period for termination of pregnancy.

4) That all exposed couples of reproductive age be advised to avoid conception until they are totally detoxified. To facilitate this, immediate information about and supply of various contraceptive methods must be arranged through all available public and private channels.

5) That complete and unambiguous guidelines be provided to medical and para-medical staff of government and non-government agencies concerned with the treatment and follow up of gas victims.

6) That the government of Madhya Pradesh set up decision making and review committees concerned with health services to the gas victims and medical research on the effects of exposure, and that the members of such committees be drawn not only from Government agencies but also include representatives of the affected people and members of professional associations and voluntary bodies.

7) That the Government set up a health care system to reach the door step of all gas victims. A cadre of paramedical workers and medical social workers must be created to undertake the following tasks:

a) to provide on the spot treatment for acute symptoms
b) to identify chronic and serious cases;
c) to identify fresh cases;
d) to maintain comprehensive and regular health records for the entire affected population; and
e) to give mass education to gas victims to understand and tackle the problems of breathlessness and other chronic symptoms.

In the formation of this cadre, the resources of voluntary agencies must be utilised.

8) That duplicate health records be maintained for all gas

affected patients with one copy to be given to the patient.

9) That close monitoring of vital statistics in the affected localities be carried out on a long term basis for detecting trends of mortality and morbidity in the exposed population for at least two generations.

10) That all research projects concerning the after effects of the gas leakage on human beings be made public from the outset and public debate be allowed and encouraged to consider the propriety and relevance of the research.

11) That all researchers be required to gain the informed consent of every individual (or guardian of that individual) who is included in a research study or procedure of any sort.

12) That the results of all medical research be communicated in understandable language to the people who have been studied. Such communication must be offered as a rule prior to or simultaneous to, but not later than, submission of these researches for publication in scientific journals. The people's review committees may assist the medical scientists in conveying the research results back to the people of Bhopal.

13) The occupational health records of Union Carbide should be made available to all those persons who are interested in them.

Bhopal
17 Feb 1985

Abhay Bang, Wardha
Ramana Dhara Hyderabad
Shyama Narang, Hyderabad
Mira Sadgopal, Bankheri

medico friend circle
organizational office
326, V Main, I Block
Koramangala, Bangalore 560034

An Appeal

Dear Friends,

This report written by a fact finding team from our circle is being sent to you all for your support and action We invite you to join us in our efforts to express solidarity with the Bhopal disaster victims and their urgent need for effective medical attention and justice. There is an immediate need -

1) To support the local medical profession and health workers with authentic technical information and management guidelines to help their efforts in patient care
2) To disseminate meaningful and demystified medical information so that affected victims and their families are reassured and helped through the crisis
3) To ensure that the efforts of governmental and non- governmental agencies become an expression of humane welfare and not exploitation.

You can help us by doing one or more of the following:

(a) Disseminate this information to citizens groups, media representatives, voluntary agencies, health and development activists to generate pressure on the governmental machinery and the ICMR for more effective action.

(b) Show this report to medical experts and scientists who can give their opinion on the problems mentioned in this report. Send us point by point reactions/responses. Any technical information, research findings and reports of their investigations carried out which will help patient management are most welcome.

(c) Any other forms of support including contribution to support studies/investigations by our team and publication of findings for professional and public awareness. (Contributions by cheque/DD may be made in favour of 'medico friend circle—Bhopal Fund'.

Looking forward to your active involvement.

Yours sincerely,
Ravi Narayan
Convenor : medico friend circle

- medico friend circle is a circle of friends with medical/ non-medical background who share the common conviction -

— that the present health services and medical education system is lopsided in the interest of the privileged few and must change to serve the interests of the large majority, the poor

We are committed to :

— people oriented medical care
— community oriented medical education
— demystification of medical science
— preventive and social measures in health care
— human value oriented medical practice
— equality, team work and democratic functioning
— medical interventions guided by people's needs and not commercial interests
— open minded, scientific attitude to non – allopathic systems

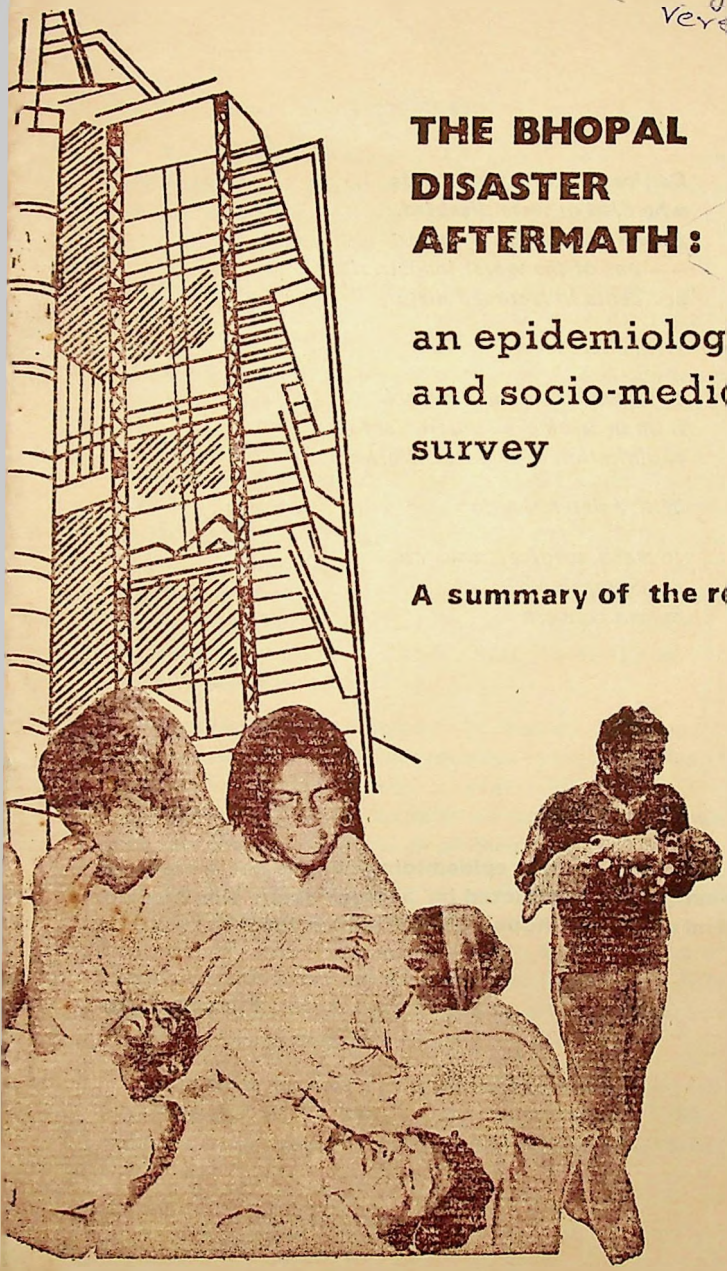
- mfc tries to foster among medicos and others a current upholding human values and aims at restructuring the medical profession to enable it to realize the potential created by modern scientific medicine.

- mfc offers a forum for dialogue/debate, sharing of experience and experiments with the aim of realizing the goal outlined above; and for taking up issues of common concern for action.

Concern for man himself and his safety must always form the chief interest of all technical endeavours. Never forget this in the midst of your diagrams and equations.

—Albert Einstein

(English Version)



THE BHOPAL DISASTER AFTERMATH:

an epidemiological and socio-medical survey

A summary of the report

medico friend circle

Dedicated to the thousands
who died or were disabled
by the Bhopal Gas Disaster
——one of the worst industrial
accidents in recorded history.

With a resolve

to prevent medical research
from becoming an instrument of
exploitation of human suffering

With a determination

to make medical research
an expression of
human concern

A summary of the epidemiological and socio-medical investigation conducted by a team from the medico friend circle, in Bhopal, 18—25 March 1985

Price Rs. 2. 00

PREFACE

The Bhopal disaster has been an unprecedented occupational and environmental accident. Equally unprecedented have been the imperatives for relief, rehabilitation and research in the aftermath of the disaster.

The local situation has been extremely complicated and dynamic. While health service providers and researchers have had to face many medical challenges; government and voluntary agencies involved in relief and rehabilitation have had to face many logistical and organizational challenges.

For the medico friend circle too, in its intervention in research and continuing education strategies in support primarily of voluntary agencies, it has been both a challenge and a thought provoking learning experience. The experience of planning, organising, analysing and communicating our research findings based on a modest study has brought us further in touch with the apathy, vested interests and status quo factors which obstruct action in favour of the disadvantaged in society.

Having seen the intensity of health problems of the disaster victims and the inadequacies in the strategies employed to ameliorate them we cannot but help raise critical comments on all components of the social medical system who are there to handle such problems.

Our objective, however, is more than critical analysis. Through this epidemiological study we have tried to make our own small contribution to a better understanding of the health problems that prevail in the aftermath of the disaster. We have also made suggestions for a more comprehensive relief and rehabilitation strategy.

A word of caution here-most of our observations are of the situation as it existed at the end of March 1985. Six months have passed in the process of analysis, consensus

seeking and understanding our findings. During these six months, many further developments—both positive and negative—have taken place in Bhopal at the governmental and the non governmental initiative.

We hope that this report will atleast help to highlight to our readers among other matters that—

(i) what people say and feel is as important evidence as what we can discover through our over-mystified medical technological approach;

(ii) in the absence of a community oriented epidemiological perspective, decision making about relief efforts following a disaster can be adhoc and often irrelevant; and

(iii) for research to be relevant to the lives of the people, the findings and inferences drawn must be communicated to the health service providers and the patients themselves through an effective communication strategy.

Finally we hope that through this report, we shall stimulate debate, dialogue and a commitment to a deeper understanding of the problem leading to more relevant and meaningful interventions.

Bangalore
2 Oct. 1985

Ravi Narayan
Convenor

THE BHOPAL DISASTER: ITS AFTERMATH

Introduction

The disaster that took place on the dark, wintry night of 2/3 December 1984 in Bhopal is the worst man made environmental accident in recorded history. The shocking, official estimates of 1754 human deaths, an equal number of dead cattle and the physical and mental disablement of over two lakhs people, by a mixture of toxic gases including Methyl Isocyanate (MIC), do not adequately express the tragedy that has occurred.

The relief efforts, initiated immediately, were handicapped and hampered by the lack of authentic information on the nature of the gases released, by the unwillingness of the Union Carbide to release information and by lack of relevant information among the State and Central authorities.

The doctors at the Hamidia Hospital, Bhopal, where hundreds of the victims rushed, were faced with an acute emergency which they never anticipated, of whose exact nature they had no inkling, and for the treatment of which they had no ready sources of information.

Since the nature of the toxic gases released into the atmosphere had not been made public either by the Union Carbide or by the Centre (which sent high level technical experts to Bhopal), this had to be a conjecture based on reason and visible evidence.

Soon, two theories emerged to account for the varied symptomatology and stunning mortality of the victims. The development and testing of these theories, had they been done properly, would undoubtedly have added immensely to scientific knowledge. What is more important is that it would have relieved the sufferings of thousands of people. The local realities have, however, revealed the power stru-

ggles in the medical community and how it ignores in the process, the victims; the lack of human concern leading to withholding of probable proper treatment; the indifference of our medical and scientific community to communicate with our largely illiterate but not unintelligent masses.

The Two Theories

The protagonists of the first theory, the *'Pulmonary theory'* believe that isocyanates of which MIC is one, damages only those tissues with which they come into direct contact and cannot be carried by the blood to internal tissues and organs. Thus MIC can damage only the lungs, eyes and skin and this according to them explains the predominant involvement of the eyes and lungs in the Bhopal victims. They also believe that symptoms, if any, related to other systems must be due to hypoxia caused as a result of lung damage. This theory is strongly supported by a dominant section in the Gandhi Medical College and the medical community in Bhopal. They believe that early deaths were due to carbon monoxide poisoning - one of the constituents of the released gases. They refuse to accept any alternative theory.

This theory cannot fully explain the varied symptoms of the victims: nor the fact of multi-systemic involvement without lung involvement seen in many patients. While another isocyanate, toulene diisocyanate (TDI) has been shown to cause brain damage, the protagonists of the present theory are silent as to why MIC cannot do so, too. Public Health specialists in the U. S. say that this exposure can lead to permanent lung involvement and blindness. This is in contrast to the Union Carbide which maintains that MIC can have no lasting damaging effects.

The main protagonist of the second theory, the *'Enlarged Cyanogen Pool theory'*, is the Indian Council of Medical Research (ICMR). In fairness to this body, it must be stated at the very outset that it does not reject the first theory

but believes that both have important roles to play in explaining the varied symptomatology.

This theory stemmed from the observation that the tissues and blood of the dead victims were bright red in colour. This occurs both in cyanide and carbon monoxide poisoning. Haematological (blood) studies by ICMR ruled out the possibilities of carbon - monoxide poisoning.

Cyanide on the other hand might have been inhaled directly as hydrogen cyanide or might have been released in the body after the breakdown of the MIC molecule.

Normally, there is a small cyanogen pool in the body formed by the generation of small amounts of cyanide or cyanogenic substance during normal metabolic processes. These cyanide or cyanogenic radicals are converted into relatively harmless thiocyanates by a liver enzyme called rhodanase and excreted in the urine. Certain foods like cabbage etc., and smoking are known to increase the cyanogen pool as evidenced by an increased excretion of thiocyanates in the urine. Cyanide/cyanogen interferes with oxygen utilization in the body.

The protagonists of the enlarged cyanogen pool theory have established that MIC in the body gets attached to the haemoglobin by a process of carbamylation. They believe that by a mechanism as yet unknown the cyanogen pool within the body is increased. In these circumstances, its conversion to thiocyanate by rhodanase, can be accelerated by administration of sodium thiosulphate (NTS). This is the rationale in using NTS as an antidote for cyanide poisoning. The resultant thiocyanates are excreted in urine, and this can be used to test the proposed theory itself.

The ICMR conducted a double blind clinical trial using sodium thiosulphate and glucose as a placebo on gas affected patients in January. Majority of patients who received NTS showed significant improvement and 10 out of the 19

patients showed an eight fold increase in urinary thiocyanate levels. Those who received glucose did not show significant changes. Unfortunately, and due to reasons best known to itself, the ICMR has not made the details of the findings of this crucial trial, public. The opponents of the theory too have conducted a trial-not double blind, which they say does not confirm the hypothesis. They too have withheld their findings from public scrutiny.

The Study by mfc

The mfc had decided at its annual meet held at the end of January 1985, to respond to a series of appeals from various non-governmental organizations(NGOs)and citizen's forums to undertake an epidemiological investigation, so as to support the victims and the NGOs in their struggle for proper relief and a more meaningful rehabilitation process. Some members of mfc visited Bhopal in mid-February to assess the situation and the actual epidemiological survey was conducted between 18-25 March 1985 by 11 members of mfc and 3 friends from the Baroda Medical College.

It must be admitted that the mfc had neither the human power nor the material resources to launch a full scale investigation. Our initial, fact finding survey revealed :

(i) official secrecy regarding all information on the disaster;

(ii) absence of open scientific debates;

(iii) lack of encouragement to NGOs.

The mfc therefore decided to:

(i) make an epidemiological assessment of the current health status and health problems of the people;

(ii) to examine the findings in the light of the two controversial theories;

(iii) to evolve a critique of the medical reasearch and relief programme;

(iv) to make recommendations for a more meaningful relief and rehabilitation policy.

The ICMR summaries of research undertaken and press releases available to us were inadequate and sketchy. We decided that we would go primarily by the broad range of symptomatology with which the patients in the community were presenting. We supplemented this by a thorough physical examination and undertook haemoglobin estimations and lung function tests. A criticism against this approach of reliance mainly on symptoms could be that it lacks objectivity. However, we believe that a thorough study of symptoms is a perfectly valid method of study as has been accepted in a whole range of medical conditions like chronic bronchitis, ischaemic heart disease, arthritis etc.

The study population

The study was a community based, case/control study. Two slums were selected for the study: (i) *J P Nagar* situated in the close vicinity of the Union Carbide factory and the worst affected by the gas leak. (ii) *Anna Nagar* 10 km away with the least exposure, which served as the control. There was no area which was similar to JP Nagar in socio-economic and environmental characteristics and yet escaped exposure and, therefore, Anna Nagar with the least exposure was the best control that could be chosen.

Rapport was established with the people by explaining to them our objectives and making it very explicit that we were not there to offer any financial compensation, medical treatment etc. The slum dwellers were given a hand out in Hindi explaining the role of mfc and a commitment was made that the salient findings of our study and our recommendations would be made available to them.

Sample Selection

The families for study were selected by random sampling, an accepted statistical method used in community

based studies. Only subjects above 10 years of age were selected. Those less than ten years were excluded in view of their probable inability to report symptoms correctly. All details were entered in a pre-designed proforma. In addition, lung function tests were done by standard procedures using a portable spirometer by a doctor fully familiar with measuring these under field conditions.

Observations

The two slum populations were similar in age and sex composition, in the number of smokers and of people with long standing respiratory problems like asthma, tuberculosis etc. The JP Nagar residents who were the more affected, were slightly better off economically but this is of no significance in so far as morbidity rates in JP Nagar are concerned. *(For details of actual figures, see our Report.)*

An unexpected finding was that people as far away as Anna Nagar (our control population) were minimally exposed and we observed a larger number of serious symptoms in this group than one would expect. This fact narrows down the differences in rates of symptoms observed between the two populations. The health impact of the toxic gases on the exposed population is therefore much greater than what our study reveals.

The subjects described *a broad range of symptoms arising from most of the different systems in the body.* Each symptom was described in such graphic detail that it was obviously based on the patient's own experience and could not be malingering or wild imaginations as some are apt to allege. Since these symptoms could arise due to different causes and since the residents of Anna Nagar, the controls, were also exposed to the gas, albeit to a small extent, the latter also reported those symptoms. However, *JP Nagar residents had a much higher (statistically highly significant) incidence of these symptoms compared to Anna Nagar.*

The commonest symptom was breathlessness on accustomed exertion. The following symptoms were highly significantly different (higher) in J P Nagar as compared to Anna Nagar: cough with expectoration, chest pain, blurred vision, photophobia, headache, fatigue, loss of memory for recent events, weakness in exremities, muscle ache, abdominal pain, nausea, and anxiety/depression (see table). The following six symptoms were also significantly different: dry cough, breathlessness at rest, watering of eyes, skin problems, bleeding tendency, and impotence. On grouping the symptoms according to the systems, most of them are related to the pulmonary system (respiratory), the gastrointestinal system (digestive), the eye and the central nervous system. It is important to note that this survey was conducted more than three months after the disaster, and the victims still continued to suffer so many multisystemic symptoms. Moreover *every individual in the J P Nagar sample reported atleast one serious symptom* but many in the Anna Nagar sample did not report any such. *Probably the most crucial finding of significance was that 35% of the patients had gastro-intestinal, central nervous system and eye symptoms in the absence of any lung findings.* This cannot be explained by the theory that the multisystemic symptoms are due to hypoxia (decrease of oxygen in blood stream) secondary to lung damage. It points to the possibility of a circulating toxin in the blood, affecting all the systems.

Our findings also refute the speculation that much of the present morbidity is due to a high prevalence of chronic diseases like tuberculosis, asthma, bronchitis etc., *and high rates of smoking* among the affected basti population.

Women in the reproductive age group reported menstrual irregularities such as shortened menstrual cycles, altered pattern of discharge, pain during menstruation and excessive white discharge. These symptoms were compared not only between the two populations, but also with respect to the

Salient Findings of the Study

Comparison of symptoms/investigations in J P Nagar and Anna Nagar

(expressed in percentage) (No. of cases are shown in brackets)

Sl No	Symptom	J P Nagar		Anna Nagar		P Value
1.	Breathless on usual exertion	87.16	(129)	35.50	(49)	<< 0.001
2.	Chest pain/tightness	50. 0	(74)	26.08	(36)	<< 0.001
3.	Weakness in extremities	65.54	(97)	36.95	(51)	<< 0.001
4.	Fatigue	81.08	(120)	39.85	(55)	<< 0.001
5.	Anorexia	66.21	(98)	28.26	(39)	<< 0.001
6.	Nausea	58.10	(86)	16.66	(23)	<< 0.001
7.	Abdominal pain	53.37	(79)	25.39	(35)	<< 0.001
8.	Flatulence	68.91	(102)	25.36	(35)	<< 0.001
9.	Blurred vision/photophobia	77.02	(114)	38.40	(53)	<< 0.001
10.	Abnormal distant vision	42. 0	(65/141)	21.88	(21/96)	< 0.001
11.	Loss of memory for recent events	45.27	(67)	11.59	(16)	<< 0.001
12.	Tingling & Numbness	54.72	(81)	20.28	(28)	<< 0.001
13.	Headache	66.89	(99)	42.02	(58)	<< 0.001
14.	Muscleache	72.97	(108)	36.23	(50)	<< 0.001
15.	Anxiety/depression	43.92	(65)	10.14	(14)	<< 0.001
16.	Impotence	8.10	(12)	0.72	(01)	< 0. 05
17.	Haemoglobin (male) (mean gm%)	14.68	(1.79)*	12.70	(1.35)*	< 0. 01
18.	Haemoglobin (female) (mean gm%)	12. 7	(1.46)*	10.79	(1.34)*	< 0.001

* Standard deviations of means

pattern in the same group before the gas disaster and the difference was found to be stastistically significant.

Nearly half of the nursing mothers in J P Nagar reported a decrease or complete failure of lactation.

8% of the men reported impotence.

The number of pregnant women in the sample is too small to come to any conclusion about the effect of the exposure on the outcome of pregnancy. We are conducting a detailed study of pregnancy outcome in September 1985.

Many residents had symptoms of anxiety, and some had frank depression. Many had loss of memory for recent events.

Mean pulse rates and respiratory rates were not significantly different in both sexes in JP Nagar and Anna Nagar. Mean haemoglobin concentrations in both males and females were significantly higher in JP Nagar than in Anna Nagar, suggesting that compensatory mechanisms in the body had begun to respond to the hypoxia.

The mean values of lung function tests were statistically significantly lower in JP Nagar as compared to Anna Nagar particularly in the age group 15-44 and 45-60 in both sexes. The pattern was primarily restrictive.

An important finding of grave significance is that 65% of the working persons in JP Nagar experienced a drop in income ranging from 20% to100% as opposed to only 9% in Anna Nagar. This reflects the way in which the physical/mental disability of the people caused by the disaster has affected their working and earning capacities.

The causative factor

The presence of such varied symptoms suggests the involvement of more organs and body systems than the lungs alone. These cannot be explained by the pulmonary

theory alone even though pulmonary lesions can cause peripheral hypoxia and hence muscular fatigue and so on. On the other hand, the enlarged cyanogen pool theory can better explain the varied and apparently unconnected symptomatology. It must be emphasised that both theories are probably playing a role in the causation of symptoms. However, the ICMR has not tested the cyanogen pool hypothesis rigourously. It has studied only the seriously ill, hospitalized patients and concentrated mainly on the lung symptoms. They do not say whether the non-pulmonary symptoms (symptoms not related to lungs) were also relieved by sodium thiosulfate and curiously has not made its findings public. One therefore, may also question whether the cyanogen pool theory is fully valid.

It must be stressed here that the mfc is not rejecting the cyanogen pool theory. It is only to point out that the country's main medical research pody has failed to be rigorously scientific in testing its own hypothesis.

Sodium thiosulphate therapy

We have already explained how sodium thiosulphate (NTS) will help remove cyanide radicals from the body. If the enlarged cyanogen pool theory has been established, even as one of two causative factors the victims should receive NTS treatment. Some of the local doctors and beaurocrats availed themselves of this, after the cyanide theory was proposed, yet the affected people in the bastis were not given the drug.

The ICMR at a meeting held on on 4 Feb 85, issued guidelines for NTS treatment. The medical group of Bhopal which was opposing the treatment, was also present at the meetings, according to the minutes. Yet they opposed the treatment later with the argument that they are not convinced of its efficacy. The question is not of a doctor's conviction. A doctor's choice of treatment cannot be arbitrary. The

question is whether there is scientific evidence in favour of NTS therapy and whether there is equally strong, if not stronger, evidence against the use of NTS in this situation.

NTS with its specific action is a better therapeutic agent than the non-specific remedies that are being used for the lung symptoms. A dominant section of the doctors of Bhopal are thus guilty of delaying treatment and by not revealing the findings of its clinical trial, the ICMR too has to accept part of the blame for the continuing suffering of the victims.

After a few weeks of controversy the NTS therapy has now been accepted but mass detoxification is still being strongly opposed.

The trial with NTS is not the only study launched by the ICMR. It has sponsored many other studies on the Bhopal victims, but they lack an integrated approach. Thus lungs, eyes etc., are being examined independent of each other, by different investigators and the ICMR is unwittingly lending support to the first theory, namely, that MIC gas damages only tissues with which it comes into dirrect contact.

What exactly happened to the gas victims?

So many months after the disastrous gas leak, one still does not know what exactly has happened to those who inhaled the gases and are still surviving. This is not because all attempts to unravel the mystery have failed but because an integrated approach has not been taken to do so. Months after the disaster, thousands of the survivors are still suffering from debilitating symptoms which prevent them from going back to work.

The medical community and the officialdom have been adhoc in their efforts to render adequate succour to these hapless victims. A powerful medical lobby in Bhopal have opposed sodium thiosulfate, a treatment, with good potential

to the patients. They have no convincing argument for their stand. The IMA, (Indian Medical Association) the organisation which has authority over the medical profession, has remained totally mute. The doctors as well as the ICMR have concentrated entirely on those who were hospitalised and have not evolved a holistic, community approach to understanding the problem. The ICMR sponsored local studies with exception of the NTS trials have lacked the rigour and the epidemiological orientation that are necessary in arriving at a meaningful understanding of the problem.

A point of utmost significance is that the victims of the Bhopal gas disaster mostly belong to the lowest strata of society and are not in a position to fight for their rights, be it medical aid or monetary compensation. It is, therefore, not very surprising that the government and its organisations have shown marginal interest in the after effects. It also reveals a lack of interest among our scientific community in investigating an environmental disaster of an unprecedented nature. On the other hand, one can observe the striking contrast with which all attempts were made to retrieve the Black Box of Kanishka, whose mid-air explosion resulted in the death of only 326 persons but needless to remind of the upper socio-economic class.

Recommendations

Research

1. The research and follow up studies should shift focus from hospital/dispensary based studies of seriously ill patients to family/community based ambulatory patients.
2. Well designed clinical trials should be further initiated using sodium thiosulphate as a therapeutic and epidemiological tool to further establish the significant could role it could play in mass therapy.

Care, Surveillance and Rehabilitation

3. Psychosocial assessment and consequent counselling and rehabilitation are urgently required.
4. Mass treatment with sodium thiosulphate based on ICMR guidelines should be initiated maintaining good medical records.
5. A surveillance programme should be undertaken to assess risks to pregnant mothers, unborn babies and new born babies. There should also be close monitoring of the gynaecological problems of women.
6. It is necessary to have a long term surveillance of lung function in view of the postulated damage to lungs and resultant lung fibrosis. Similarly, eyes should be examined regularly.
7. A comprehensive listing of all gas disaster victims is a long overdue task necessary for mass treatment, compensation and rehabilitation. This must be done immediately.

Communication

8. There is urgent need to evolve a continuing education strategy for all health personnel including doctors working in both government and non-governmental centres. These could be through newsletters, handouts and informal group meetings.
   The areas identified are:
   (i) sodium thiosulphate therapy;
   (ii) identification and management of psycho-social stress;
   (iii) risks to mothers and unborn foetus and need for surveillance;
   (iv) family planning advice till completion of detoxification;
   (v) role of respiratory physiotherapy;
   (vi) management of lactation failure;
   (vii) caution against overdrugging;

(viii) need for open minded surveillance of high risk groups;

(ix) importance of medical records.

9. There is also urgent need for dynamic creative non-formal health education of the affected community through group meetings, posters and pamphlets with information and messages built around their life style, culture and existing socio-economic situation.

The areas identified are :

(i) sodium thiosulphate therapy;

(ii) ongoing research programmes and informed consent;

(iii) risk to unborn and new born babies;

(iv) family planning advice;

(v) respiratory physiotherapy;

(vi) management of lactation failure including low cost weaning foods;

(vii) importance of records and regular check ups;

10. Occupational rehabilitation and compensation: In the ultimate analysis care of illness, health education, psychosocial counselling would be inadequate measures if they were not backed by adequate monetary compensation and urgent occupational rehabilitation of the disaster victims. This would have to be imaginatively done keeping their previous occupations and the residual disabilities in mind.

Coordination

11. The government machinery alone cannot handle such a massive task. The government must adopt a policy of enlisting the help of all non-governmental agencies and groups wishing to work in Bhopal. This enlistment must be active and supportive.

and finally

12. It is imperative that the victims as well as the entire country must be provided with all the details of how the accident occurred, of the nature of the chemicals released and of the reasons why the detoxification by sodium thiosulphate has been so badly mismanaged.

medico friend circle

The medico friend circle (mfc) is a circle of friends with medical /non-medical backgrounds who share the common conviction that the present system of health services and medical education is lopsided in the interest of the privileged few and must be changed to serve the interests of the large majority, the poor. mfc fosters a 'thought current': upholding human values, people and community orientation of health care and medical education, demystification of medical science and a commitment to the guidance of medical interventions by peoples' needs and not commercial interests.

mfc offers a forum for dialogue/debate, sharing of experience and experiments with the aim of realising the goals outlined above, and for taking up issues of common concern for action.

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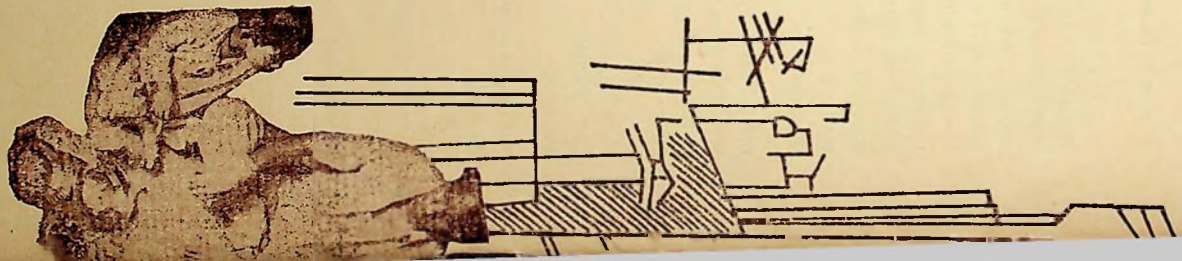
(A detailed report of the study including background, objectives, materials and methods, observations and results, discussion, recommendations, important appendices including proformas and references and reading list is also available on request from the **mfc organizational office** *326 V Main I Block Koramangala Bangalore 560034*

Price Rs. 8. 00)



हमारी सेहत हमारी लड़ाई

भोपाल गैस पीड़ितों के लिए स्वास्थ्य की पुस्तिका

मेडिको फ्रेंड सर्कल 1986 एकलव्य

इस किताब में क्या है?

इस किताब में भोपाल गैस हादसे से पैदा हुई स्वास्थ्य समस्याओं के बारे में चर्चा है।

- लोगों की स्वास्थ्य समस्यायें क्या हैं?
- उनके बारे में हम क्या जानते हैं?
- शरीर के बारे में जानकारी।
- सही इलाज के बारे में हमें आज तक क्या मालूम है और
- क्या मालूम नहीं है?
- सही इलाज कैसे प्राप्त किया जा सकता है?
- स्वास्थ्य के मामले में हमारे क्या हक हैं?

यह किताब इनके लिये है

- गैस पीड़ितों के लिये।
- स्वास्थ्य कार्यकर्त्ताओं के लिये।
- अन्य स्वयंसेवकों के लिये।
- आम नागरिकों के लिये।
- गैस पीड़ितों के बीच काम करने वाली संस्थाओं के लिये।
- स्वास्थ्य योजना बनाने वाले और स्वास्थ्य अधिकारियों के लिये।

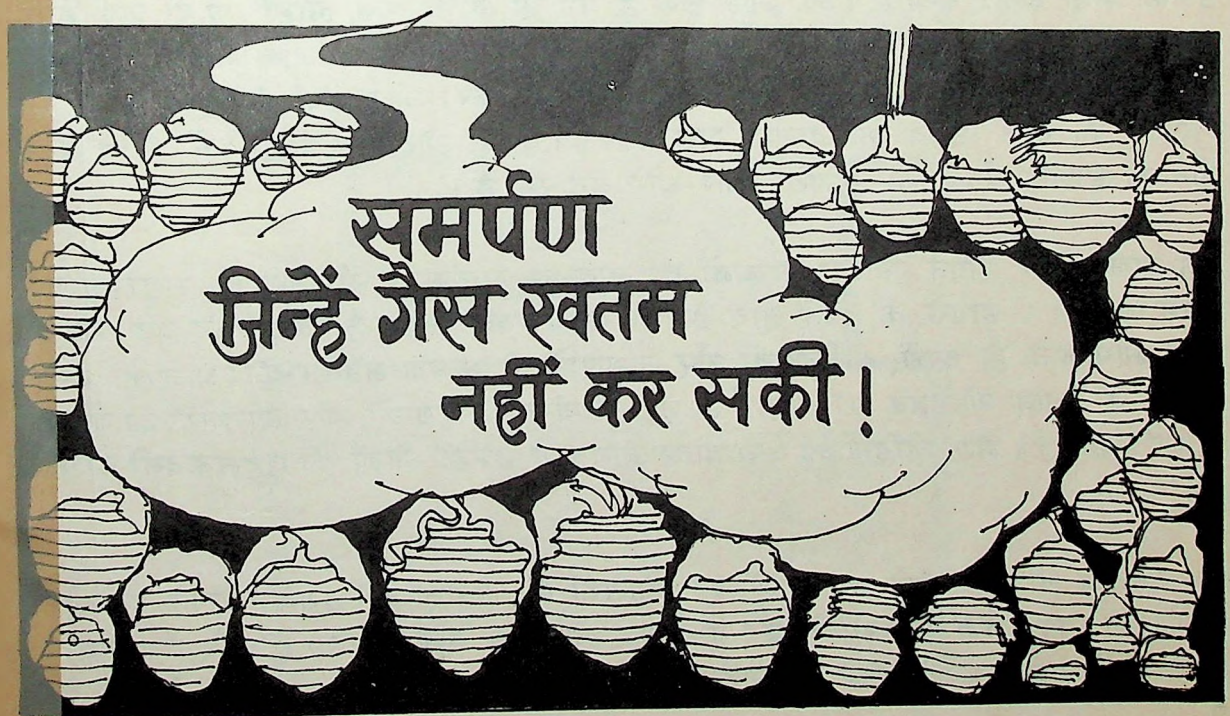
इस किताब का पूरा लाभ उठायें

- खुद पढ़कर।
- अनपढ़ लोगों को चित्रों द्वारा समझाकर।
- स्वास्थ्य कार्यकर्त्ताओं को प्रशिक्षण देकर।
- स्वास्थ्य और सूचना केन्द्रों में लोगों को जानकारी देने के लिये।
- स्वास्थ्य अधिकारियों और डाक्टरों को बताकर।

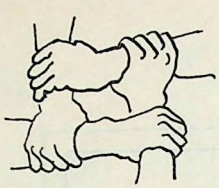
इस किताब की प्रतियाँ पाने के लिये इन पतों पर लिखें:

एकलव्य,
ई 1/208, अरैरा कालोनी,
भोपाल (म.प्र.)
462016

मेडिको फ्रेंड सर्कल
1877, जोशी गली
निपाणी 591 237
जिला. बेलगाम (कर्नाटक)



भूमिका



इस किताब का इतिहास गैस पीड़ितों की लड़ाई से जुड़ा है। यूनियन कार्बाइड से जहरीली गैसों के रिसन के बाद कुछ ही दिनों में यह साफ हो गया था कि ज्यादातर गैस से मरने वाले और गैस के असर से बीमार लोग गरीब हैं। इसलिये उनकी समस्याओं को नजरअंदाज करने की कोशिश लगातार होती रही है। गैस पीड़ितों को कदम-कदम पर अपने हक, मुआवजे, स्वास्थ्य और दोषी लोगों को सजा दिलवाने के लिए लड़ना पड़ रहा है। आज भी न तो सभी लोगों को अंतरिम राहत मिली है और न ही उनके इलाज का सही इंतजाम हो पाया है।

यह साफ है कि उनके स्वास्थ्य की समस्या कई सालों तक रहेगी। एक मुश्किल यह भी है कि इस तरह का हादसा पहले कभी नहीं हुआ था। इसलिये डाक्टर लोग खुद भी पूरी तरह से नहीं जानते कि इस हादसे से उपजी स्वास्थ्य समस्यायें क्या हैं, और उनका सही इलाज क्या है। जो जानकारी है वह भी बहुत कम लोगों को दी गई है। खासकर गैस पीड़ितों के पास तो बहुत ही कम लोगों ने सही जानकारी पहुँचायी है। इस माहौल में गलत इलाज, डाक्टरों (कुछ को छोड़कर) और दवा कंपनियों द्वारा मरीजों की लूट आदि का बाज़ार गर्म रहा है। दूसरी ओर गैस पीड़ितों में अपने अच्छे होने की उम्मीद बंधने के बजाय धीरे-धीरे टूट रही है।

इन हालातों में अपने सीमित साधनों के बावजूद स्वयंसेवी संगठनों ने महत्वपूर्ण काम किया है। हादसे के तुरंत बाद हजारों स्वयंसेवक मदद के लिए कूद पड़े। सबसे पहले भोपाल के ही छात्रों, कर्मचारियों और नागरिकों ने अथक मेहनत की। आज भी गैस पीड़ितों के इलाज और हक की लड़ाई में इन स्वयंसेवी संस्थाओं और व्यक्तियों का योगदान बहुत अहम है। गैस पीड़ितों को ज्यादातर जानकारी इन्हीं लोगों की पहलकदमी से मिली है।

यह किताब भी कुछ ऐसे ही लोगों की कोशिशों का नतीजा है। इसके लिखने वालों ने भोपाल में खुद 'जन स्वास्थ्य केन्द्र' में बैठकर लोगों का इलाज किया है और गैस पीड़ितों के घरों में जाकर उनसे लंबी बातचीत की है। इसके अलावा अन्य स्वयंसेवी संगठनों के

स्वास्थ्य कार्य और जनआंदोलनों से भी सीखा है। इन संगठनों की रपटों से भी काफी जानकारी मिली। कई अखबारों और पत्रिकाओं के छपे लेखों से महत्वपूर्ण जानकारी मिली। इन जानकारियों के मूल स्त्रोत के पीछे अक्सर कुछ सरकारी सेवा में काम करने वाले वैज्ञानिक और डाक्टर रहे हैं जिन्होंने तमाम तरह के दबावों के बावजूद सच्चाई को सामने लाने की कोशिश की है।

कहने का मतलब यह है कि यह किताब गैस पीड़ितों के पास सही जानकारी पहुंचाने और उनके हक की लड़ाई में भागीदारी की सारी कोशिशों का एक छोटा हिस्सा है। यह भागीदारी आगे भी रहेगी, क्योंकि यह लंबी लड़ाई है। हमें उम्मीद है कि इस किताब के सही उपयोग जैसे स्वास्थ्य कार्यकर्ताओं का प्रशिक्षण, जानकारी केन्द्र चलाना आदि के साथ हम भी रहेंगे। साथ ही यह किताब उन लोगों की भी मदद करेगी जो गैस पीड़ितों के राहत और पुनर्वास के लिये एक सही योजना बनाने की कोशिश कर रहे हैं।

हम यह उम्मीद भी करते हैं कि इस प्रकार के सामूहिक प्रयास से इस किताब की कमियाँ पूरी होंगी।

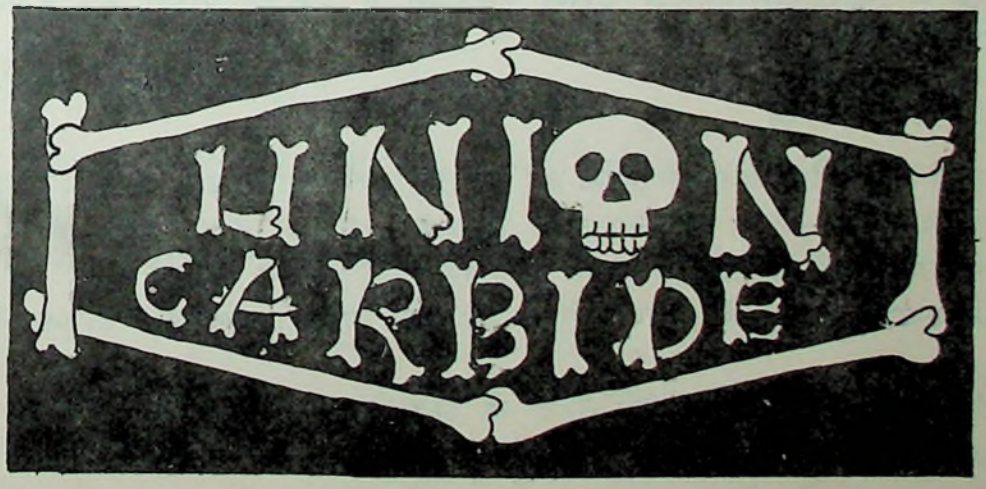
एक अच्छा नेता लोगों से यह नहीं कहता कि वे यह करें. वह तो उनके सामने खुद काम करके आदर्श पेश करता है.

लोगों के स्वास्थ्य की रक्षा का बहुमूल्य साधन स्वयं लोग ही हैं.

जब लोग अपने समुदाय के स्वास्थ्य की जिम्मेदारी अपने सिर पर लेने को तैयार हों तभी खास बदलाव हो सकते हैं.

इस किताब में क्या है?

डॉक्टर के नाम एक मज़दूर का पत्र - १



परिचय

यूनियन कार्बाइड से निकली गैस ने हजारों लोगों को मौत के घाट उतार दिया और लाखों लोगों को बीमार बनाकर छोड़ दिया है। हादसे के डेढ़ साल बाद भी गैस पीड़ितों को तरह-तरह की शारीरिक तकलीफें हैं जिनका पूरा और सही जवाब नहीं मिल पा रहा है। कुछ लोग तो इतने परेशान हैं कि वे कहते हैं, हमसे तो वे अच्छे रहे जो मर गये।

सवाल पर सवाल

- वह कौन सी गैस थी जिसने हम लोगों को इस तरह रातों-रात बरबाद कर दिया ?
- इस गैस से हमारी सेहत पर क्या असर हुआ है ? इसका इलाज क्या है ?
- आने वाले दिनों में हमें हमारी सेहत के लिए क्या करना चाहिये ?
- बच्चे, जो ज्यादा नाजुक हैं, उनकी सेहत का क्या होगा ? हमें क्या करना चाहिये ?

इस छोटी सी किताब में हम इस तरह के सवालों के जवाब देने की कोशिश कर रहे हैं। हालांकि हालात बहुत खराब हैं लेकिन आप हिम्मत न हारें। आदमी बड़ी से बड़ी

मुसीबतों का मुकाबला कर सकता है यदि वह हिम्मत रखे। हमें एक जुट होकर सही जानकारी और इलाज पाने के लिये लड़ना होगा। इसीलिये इस किताब का नाम 'हमारी सेहत - हमारी लड़ाई' रखा है।

सही जानकारी की खोज

यूनियन कार्बाइड ने शुरू से ही गैस रिसन के बारे में सही जानकारी को छिपाया है। उनकी यह कोशिश रही है कि हादसे की जिम्मेदारी उन पर कम से कम आये। ताकि वे कम से कम मुआवजा देकर छुट्टी पा लें। इस मामले में सरकार ने भी यूनियन कार्बाइड के खिलाफ कोई ठोस कदम नहीं उठाया है।

जो जानकारी हमारे पास है, वह अभी भी अधूरी है। यह कई वैज्ञानिकों, डॉक्टरों (जिनमें कुछ सरकारी भी है), अखबार के खोजी पत्रकारों और स्वयंसेवी संगठनों की कोशिश और लड़ाई का नतीजा है।

इन्होंने यह पता लगाया कि एम. आई. सी. (मिक) की टंकी नंबर 610 से दिसंबर 2 और 3, 1984 की रात को जो चीज निकली वह कई रासायनिक गैसों और चूरे का मिश्रण था। इनमें मिक गैस के साथ जहरीली हायड्रोजन सायनाइड गैस, कार्बन मोनो आक्साइड गैस और कई अन्य गैसें भी रही होंगी। इनमें मिक के साथ हमेशा रखी जाने वाली फास्जीन गैस भी जरूर रही होगी। मोनोमिथाइल अमीन नाम की गैस जो बहुत नुकसान देह है, हवा में मिक के छूटने से बनी होगी। इन जहरीली गैसों से ही कई हजार लोग कुछ ही समय में मर गये। बचे लोगों के शरीर में जहर फैल गया। इसमें कई तकलीफें लंबे समय तक रही हैं और रहेंगी।

नीचे उन तकलीफों की सूची दे रहे हैं जिनके बारे में लोगों ने बताया है या जो डॉक्टरी जाँच से सामने आयी हैं। साथ ही उन अध्यायों का नाम या संख्या भी लिखी है जिनमें उनकी चर्चा की गई है।

सेहत की आम तकलीफें

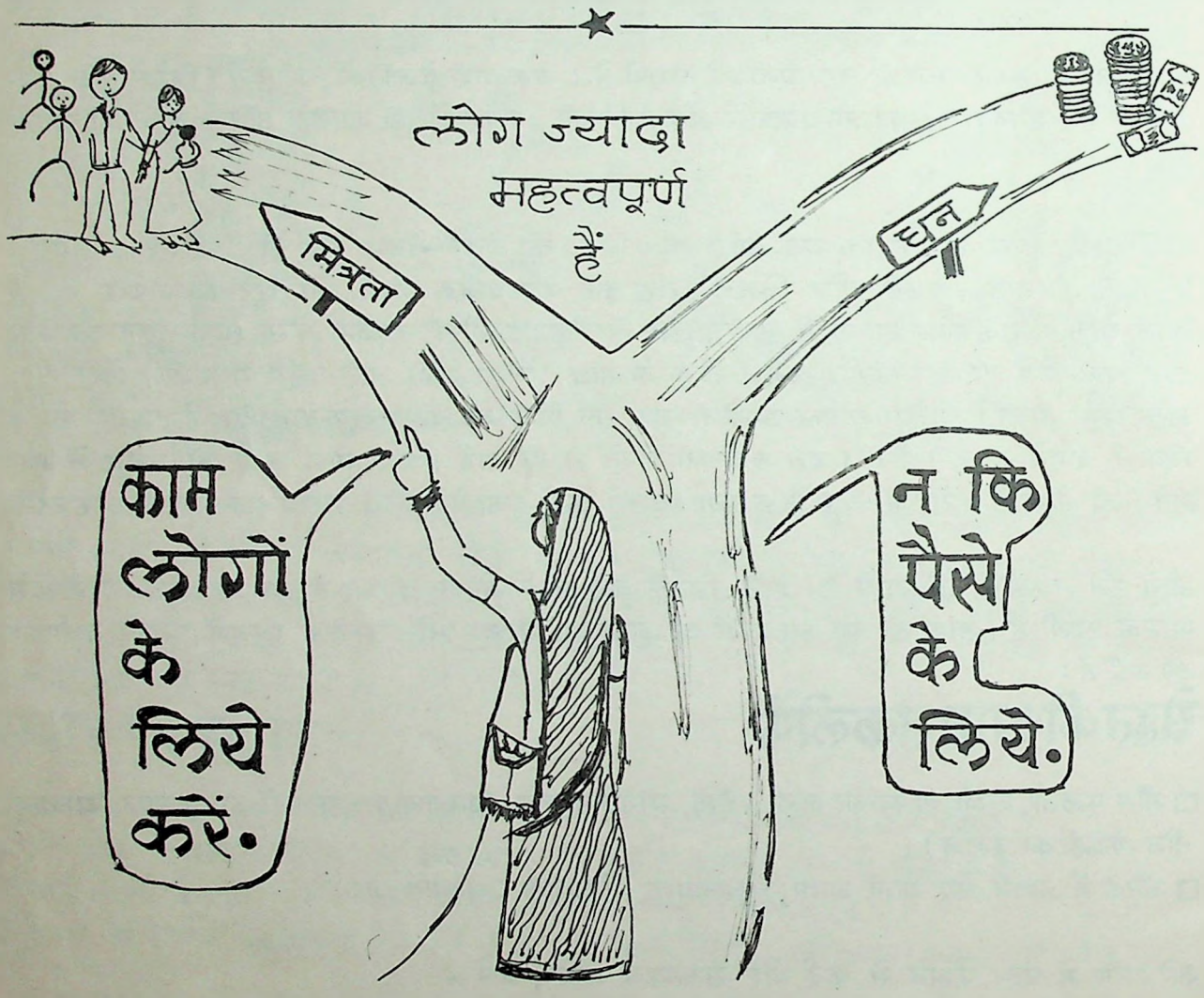
- ☐ साँस फूलना, सूखी या खरखर वाली खाँसी, सीने में जलन (अध्याय दो - फेफड़ों को नुकसान, अध्याय तीन - फेफड़ों का इलाज)।
- ☐ आँखों में जलन और पानी आना, धुंधलापन, चौंधियाना (अध्याय चार)

सारे शरीर में जहर फैलने से कई और समस्यायें आयीं, जैसे -

- ☐ कमजोरी और थकान के कारण पहले जैसा काम न कर पाना (अध्याय पाँच - खून पर असर)
- ☐ पेट और पाचन में गड़बड़ी (अध्याय छह)

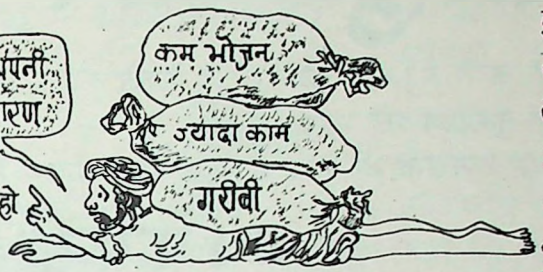
- महिलाओं और पुरुषों के प्रजनन अंगों की समस्यायें (अध्याय सात)
- कमजोर बच्चे पैदा होना और उनका बार-बार बीमार पड़ना (अध्याय आठ)
- दिमागी समस्यायें - दिल धड़कना, घबराहट, गहरी उदासीनता, याददाश्त कमजोर होना (अध्याय नौ)
- बूढ़े लोगों की विशेष समस्यायें (अध्याय दस)

अगले अध्यायों में हमने इन सब समस्याओं की सिलसिलेवार चर्चा की है। साथ ही दवाईयों के बारे में कुछ सलाह दी है (अध्याय ग्यारह)।



डॉक्टर के नाम एक मजदूर का पत्र

हमें मालूम है अपनी बीमारी का कारण
वह एक छोटा सा शब्द है
जिसे सब जानते हैं
पर कहता कोई नहीं
जब बीमार पड़ते हैं
तो बताया जाता है
सिर्फ तुम्हीं (डॉक्टर) हमें बचा सकते हो
जनता के पैसे से बने
बड़े-बड़े मेडिकल कालेजों में
खूब सारा पैसा खर्च करके
दस साल तक
डाक्टरी की शिक्षा पाई है तुमने
तब तो तुम,
हमें अवश्य अच्छा कर सकोगे।
क्या सचमुच तुम हमें स्वस्थ्य
कर सकते हो।
तुम्हारे पास आते हैं जब
बदन पर बचे, चिथड़े खींचकर
कान लगाकर सुनते हो तुम
हमारे नंगे जिस्मों की आवाज
खोजते हो कारण शरीर के भीतर।
पर अगर
एक नजर शरीर के चिथड़ों पर डालो
तो वे शायद तुम्हें ज्यादा बता सकेंगे
क्यों घिस-पिट जाते हैं
हमारे शरीर और कपड़े
बस
एक ही कारण है दोनों का
वह एक छोटा सा शब्द है
जिसे सब जानते हैं
पर कहता कोई नहीं।
तुम कहते हो

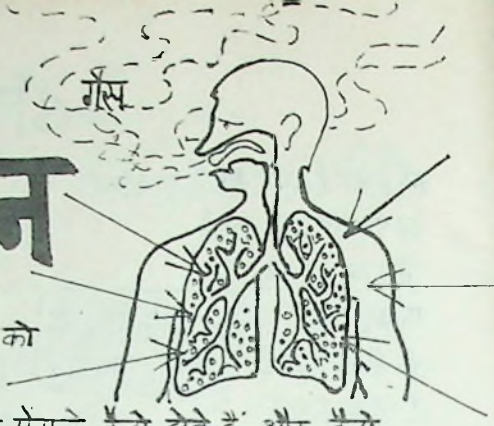


कंधे का दर्द टीसता है
नमी और सीलन की वजह से
डॉक्टर
तुम्हीं बताओ यह सीलन कहाँ से आई ?
बहुत ज्यादा काम
और बहुत कम भोजन ने
कमजोर और दुबला कर दिया है हमें
नुस्खे पर लिखते हो
'और वजन बढ़ाओ'
यह तो वैसा ही है
दलदली घास से कहो
कि वो खुश्क रहे।
डॉक्टर
तुम्हारे पास कितना वक्त है
हमजैसों के लिये ?
क्या हमें मालूम नहीं
तुम्हारे घर के एक कालीन की कीमत
पाँच हजार मरीजों से मिली फीस के
बराबर है
बेशक तुम कहोगे
इसमें तुम्हारा कोई दोष नहीं
हमारे घर की दीवार पर
छाई सीलन भी
यही कहानी दोहराती है
हमें मालूम है अपनी बीमारी का कारण
वह एक छोटा सा शब्द है
जिसे सब जानते हैं
पर कहता कोई नहीं
वह है 'गरीबी'।

बर्टोल्ड ब्रेख्त

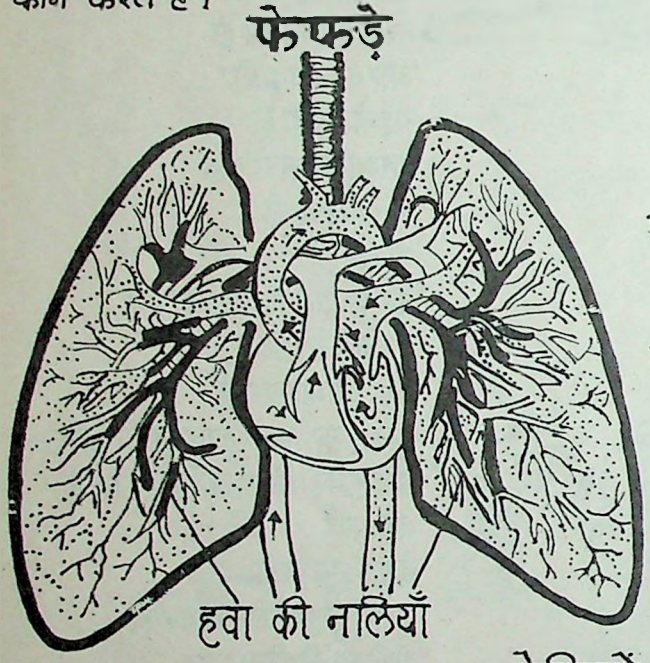
अध्याय 2

फेफड़ों को नुकसान



हम अपनी बात फेफड़ों से शुरू करते हैं। जहरीली गैसों ने फेफड़ों को बहुत नुकसान पहुँचाया है। इस नुकसान को पहचानना और समझना जरूरी है। इसके लिये यह समझना भी जरूरी है कि स्वस्थ फेफड़े कैसे होते हैं और कैसे काम करते हैं।

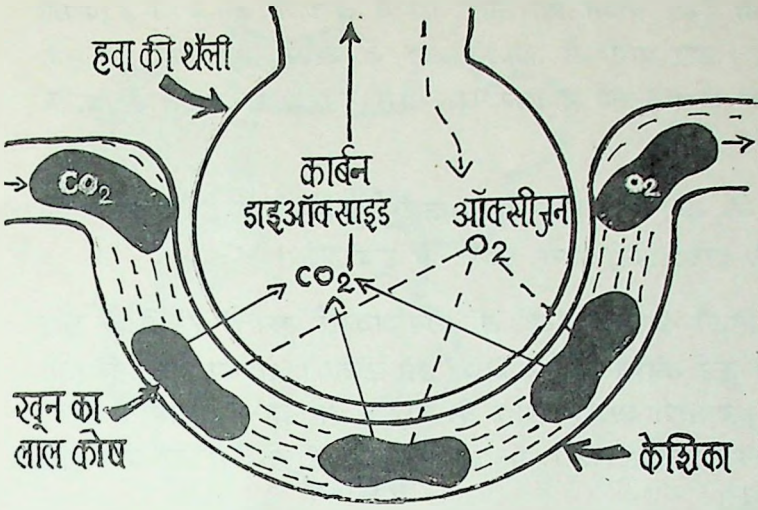
2·1 फेफड़ों की बनावट



हमारे फेफड़े नीचे लिखे तीन भागों से मिलकर बनते हैं:

1. हवा की नलियों का एक जाल जो पतली-पतली शाखाओं में बँटती जाती है। यह जाल बिल्कुल पेड़ की जड़ों के जाल जैसा दिखता है।
2. ये बारीक शाखायें छोटी-छोटी हवा की थैलियों के रूप में खत्म होती हैं। ऐसी हजारों थैलियों के गुच्छे हैं जो अंगूर के गुच्छे जैसे दिखते हैं।
3. ये थैलियाँ छोटी व नरम नलियों के एक जाल से घिरी रहती हैं। इनको केशिकायें कहते हैं और इनमें खून बहता है।

जब हम साँस लेते हैं तो हवा फेफड़ों की छोटी-छोटी थैलियों तक पहुँचती है। हवा में कई गैसों का मिश्रण होता है। इनमें से एक गैस ऑक्सीजन है जो जीवन के लिये बहुत जरूरी है। थैलियों की दीवारें बहुत पतली होती हैं। ऑक्सीजन इन दीवारों में से होकर केशिकाओं में बहने वाले खून तक पहुँचती है। खून में एक



लाल पदार्थ रहता है जिसे हीमोग्लोबिन कहते हैं। यह हीमोग्लोबिन आक्सीजन को अपने साथ जोड़ लेता है, जैसे एक चुम्बक लोहे के बुरादे को चिपका लेता है। खून के द्वारा यह आक्सीजन शरीर के सभी अंगों तक पहुँचती है।

आक्सीजन क्यों जरूरी है? हमारा शरीर एक इंजन की तरह है। उसे चलाने के लिये ईंधन की जरूरत पड़ती है। यह ईंधन हम अपने खाने से प्राप्त करते हैं। पाचन द्वारा यह खाना शरीर के लिये उपयोगी रसायनों में बदला जाता है।

आक्सीजन का उपयोग इसी ईंधन का इस्तेमाल करने में होता है। (चूल्हे की लकड़ी जलाने में भी इसी तरह से आक्सीजन की जरूरत पड़ती है।) आक्सीजन और भोजन की इस क्रिया से हमारे शरीर को शक्ति (या ऊर्जा) मिलती है। इसी शक्ति से हमारा शरीर ढेर सारा काम करता है।

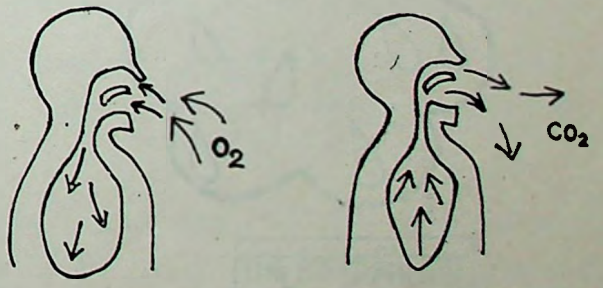
इस क्रिया में एक अन्य गैस बनती है - कार्बन डाय आक्साइड। यह बेकार गैस, शरीर के विभिन्न अंगों से खून के द्वारा फेफड़ों तक लायी जाती है। यहाँ कार्बन डाय आक्साइड केशिकाओं से होकर फेफड़ों की थैलियों में पहुँच जाती है। जब हम सांस छोड़ते हैं तब यह कर्बन डाय आक्साइड शरीर के बाहर चली जाती है।

शरीर को आक्सीजन मिलने व कार्बन डाय आक्साइड निकलने की पूरी क्रिया को श्वसन कहते हैं।

2·2 श्वसन पर गैसों का असर

यूनियन कार्बाइड की जहरीली गैसों ने श्वसन को मुख्य तौर पर तीन तरह से प्रभावित किया:

1. आसपास की हवा की आक्सीजन और शरीर के खून की आक्सीजन को हटाकर वहाँ विषैली गैसें फैलाकर।
2. फेफड़ों की नलियों में रुकावट पैदा करके और
3. थैलियों व केशिकाओं को खराब करके, जिससे आक्सीजन का खून में जाना रुका।



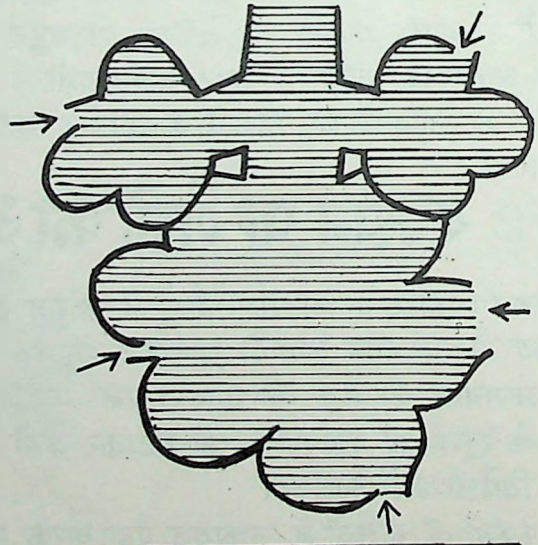
जहरीली गैस में साँस लेने पर लोगों को ऐसा लगा था जैसे मिर्ची जलायी जा रही है। फेफड़ों की नलियों में जलन होने पर पानी आता है। इस पानी ने आक्सीजन के रास्ते में एक हद तक रुकावट पैदा की। (पानी इकट्ठा होने की स्थिति को डॉक्टर पल्मोनरी इडीमा कहते हैं, यानी फेफड़ों में सूजन।)

यही पानी हवा से मिलकर सफेद झाग के रूप में मुँह से निकला। कई लोग इसी कारण से मरे। एक प्रकार से उनके फेफड़े खुद के द्वारा छोड़े गये पानी में डूब गये।

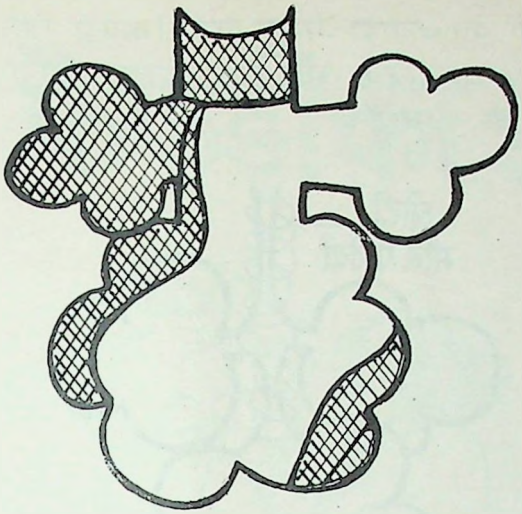
सामान्य तौर पर हमारे फेफड़ों की नलियाँ व थैलियों की कोशिकायें मरती रहती हैं और नई कोशिकायें बनती रहती हैं। ये मरी हुई कोशिकायें नलियों की दीवारों से झड़कर गिरती रहती हैं, जैसे पेड़ों से पत्तियाँ गिरती हैं। हमारा शरीर हवा के रास्ते में आने वाली ऐसी अनचाही चीजों को निकाल फेंकने के लिये खाँसी का सहारा लेता है। ठीक वैसे ही जैसे नाक में कुछ चला जाये तो हमें छींक आती है।

जहरीली गैस सूँघने के कारण नलियों व थैलियों की कोशिकायें बड़ी संख्या में मरीं। मृत कोशिकायें एक चिपचिपे पदार्थ के रूप में फेफड़ों में इकट्ठी हो गयी। इस पदार्थ को निकालने की कोशिश में लोगों को खाँसी आयी। जिनके फेफड़ों में अधिक नुकसान हुआ, वहाँ चिपचिपा पदार्थ नहीं निकल पाया। यह ठोस बलगम के रूप में फेफड़ों में जमा हो गया। इससे हवा के लिये रास्ता संकरा हो गया। धीरे-धीरे हवा का रास्ता बंद भी हो सकता है। इस बीमारी को डाक्टर ब्रोंकियोलाइटिस कहते हैं।

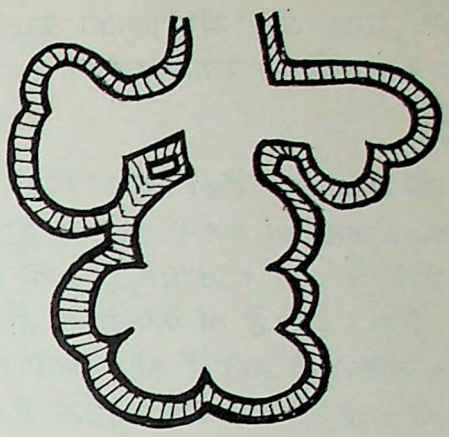
रासायनिक उत्तेजना से पानी आना



जख्म के कारण पानी आना "पल्मोनरी इडीमा"



श्वास नली व थैली में कचरा चिपकना
"ब्रोंकियोलाइटिस, एल्वीयोलाइटिस"



जख्मी नली व थैली पर रेशे की झिल्ली व सिकुड़न "फ्रायब्रोसिस"

ऐसे नुकसान के कारण फेफड़े कमजोर पड़ गये। इस हालात में संभावना यह है कि फेफड़ों के घावों में कीटाणु आसानी से घुस जाते हैं। कीटाणुओं के घुसने और उनके कारण शरीर में मवाद बनने को छूत की बीमारी कहते हैं। फेफड़ों की छूत की बीमारी को खखार में आने वाले मवाद को देखकर पहचाना जा सकता है। कभी-कभी बुखार भी आ सकता है। इससे खाँसी बढ़ती है और साँस भी अधिक फूलती है।

क्षय रोग या टी.बी. भी एक छूत की बीमारी है जो कि इसके कीटाणुओं द्वारा कमजोर फेफड़ों और शरीर पर हमला करने से होती है।

कुछ लोगों के फेफड़े गैस से रासायनिक रूप से जख्मी हुये हैं। जख्म धीरे-धीरे नये रेशेदार उत्तकों से भर गये। इसे फ्रायब्रोसिस कहते हैं। हमारी चमड़ी पर जब कोई घाव भरता है तो यही होता है और मुलायम चमड़ी की जगह पर एक दाग बन जाता है।

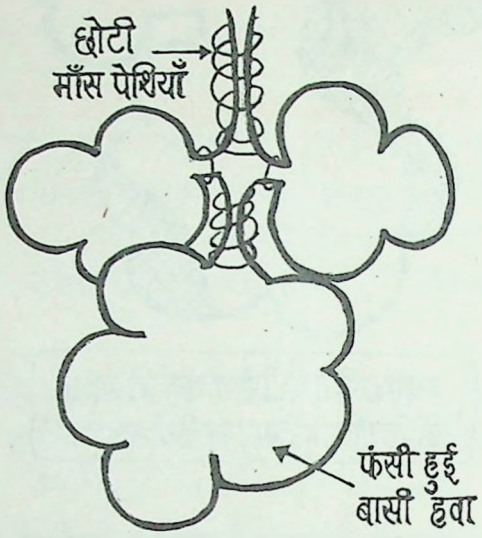
फायब्रोसिस के कारण फेफड़ों की नलियों और थैलियों की दीवारें मोटी हो जाती हैं। इससे ऑक्सीजन का केशिकाओं में पहुँचना और कार्बन डाय ऑक्साइड का निकलना धीमा और मुश्किल हो जाता है।

फ्रायब्रोसिस फेफड़ों को सिकोड़ सकता है जिससे फेफड़े पहले जितनी हवा भर सकते थे अब, उतनी हवा नहीं भर सकते हैं। फ्रायब्रोसिस गंभीर रूप से होने पर साँस हरदम फूलती है और बहुत तकलीफ होती है। यह रोग ऐसे मजदूरों को अक्सर होता है जो ऐसे काम करते हैं जिनमें फेफड़ों में रासायनिक गैसें, रेशे, धूल या धुएं के कण घुसते रहते हैं।

गैस पीड़ितों पर **पहले** के मुकाबले **अब इन** चीजों का ज्यादा असर होगा। कपड़ा मिल, दाल मिल, पत्थर और सीमेन्ट का काम, पुट्ठा मिल, प्लास्टिक और रासायनिक उद्योग, धुएं वाले चूल्हों पर खाना पकाना आदि इसी तरह के काम हैं।

दमा

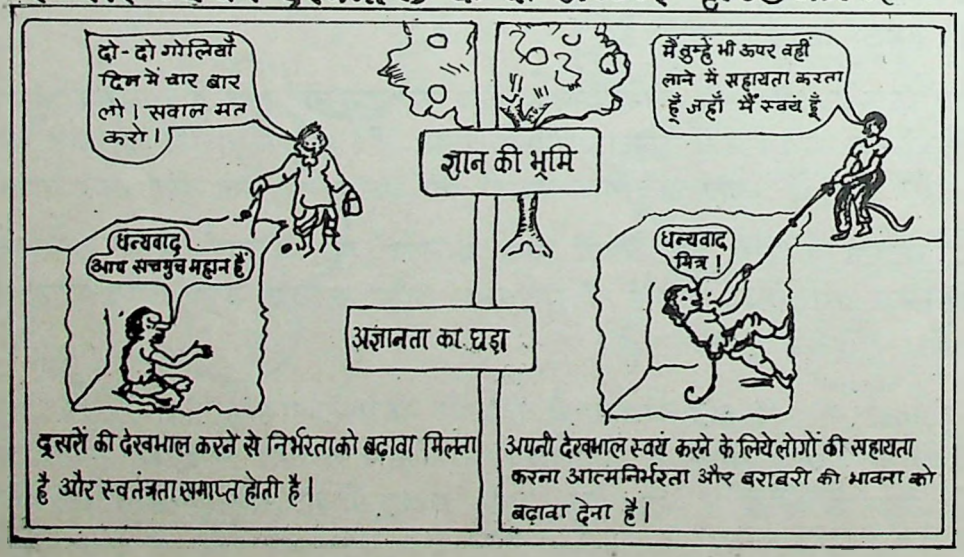
कुछ लोगों में जहरीली गैसों (शायद मिक ही से) ने अतिसंवेदन शीलता या एलर्जी पैदा कर दी है। इससे उन्हें दमे की शिकायत हो गयी है। जब दमे का दौरा पड़ता है तो फेफड़ों की नलियाँ यकायक संकरी हो जाती हैं और जितनी हवा शरीर को चाहिये उससे कम पहुँचती है। इससे साँस जोरों से फूलती है। संकरी हो गयी नलियों में हवा बहने के कारण सीटी बजने जैसी आवाज पैदा होती है। यह आवाज रोगी की पीठ या छाती पर कान लगाकर सुनी जा सकती है। रोगी को डाक्टरी सहायता की जरूरत पड़ सकती है।



पेशियों की थकान

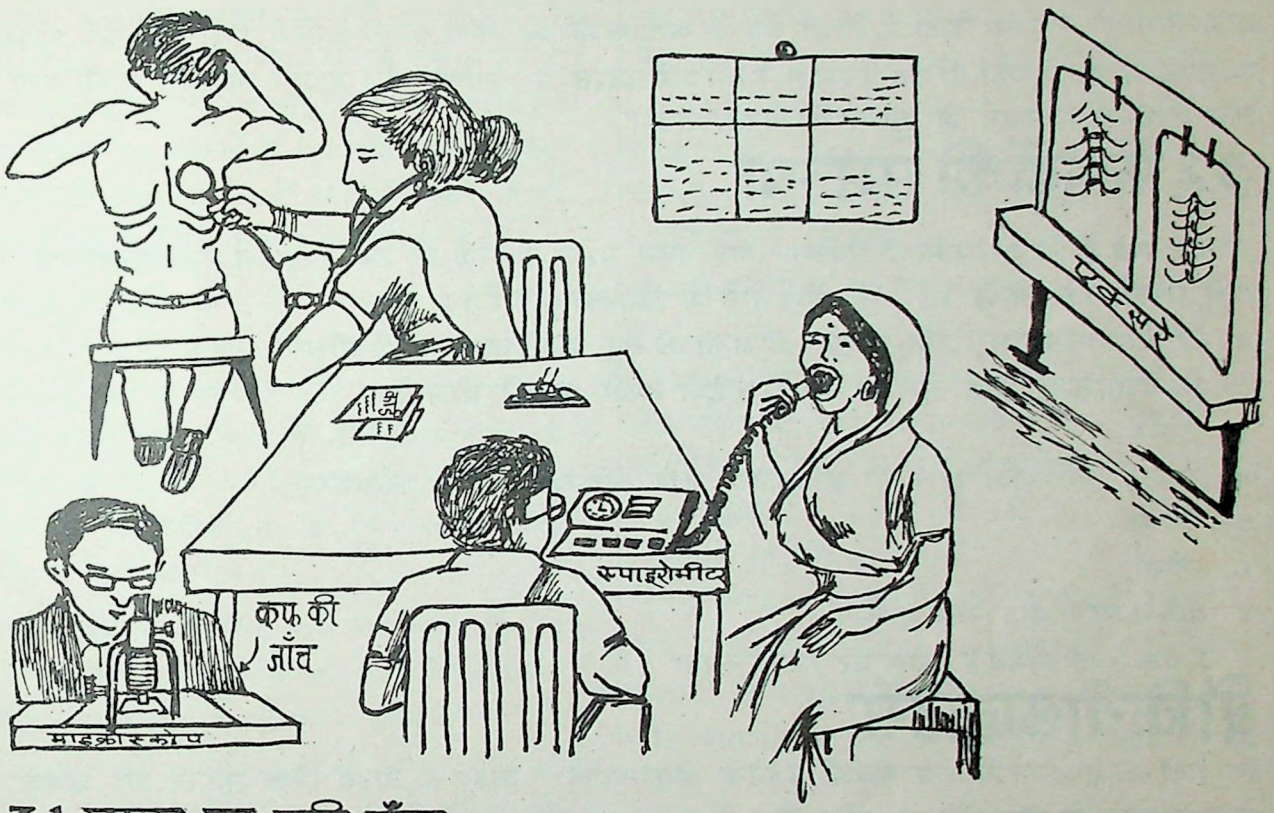
साँस फूलने का एक कारण यह भी है कि साँस लेने में लगने वाली पेशियाँ कमजोर पड़ गयी हैं। यह कमजोरी जहरीली गैस से किस तरह पैदा हुई है यह अब तक ठीक से मालूम नहीं हो सका है।

स्वास्थ्य की देखभाल के दो अलग दृष्टिकोण



अध्याय 3

फेफड़ों का इलाज



3·1 समय पर पूरी जाँच

अपने फेफड़ों और साँस लेने की ताकत की पूरी और समय-समय पर मेडिकल जाँच की जरूरत को समझें। यह आपके स्वास्थ्य और खुशहाली के लिये तो जरूरी है ही, जहरीली गैस का लोगों पर कितना असर पड़ा यह मापने के लिये भी महत्वपूर्ण है। अब तक स्वास्थ्य अधिकारियों ने इसे गंभीरता से नहीं लिया है। यदि वे लेते तो आपमें से हरेक के पास एक स्वास्थ्य कार्ड होता और डॉक्टर या स्वास्थ्य कार्यकर्ती समय-समय पर जाँच के लिये बुलाते। आपको सही इलाज की माँग करनी चाहिये और इसलिये इसका मतलब समझना होगा। यदि गैस रिसन के बाद आपको खाँसी या साँस फूलने की तकलीफ हुई है तो आपकी डॉक्टरी जाँच होनी चाहिये और एक कार्ड पर जाँच के कुछ महत्वपूर्ण नतीजों को दर्ज करना चाहिये। विशेष जाँच जरूरी हो तो वह होनी चाहिये। नयी जाँच के नतीजों को पिछली जाँच के नतीजों से तुलना करके देखना चाहिये।

डॉक्टर सबसे पहले शरीर की बाहरी जाँच करता है जिसमें वह स्टेथेस्कोप से आपकी छाती की आवाज भी सुनता है। उसके बाद फेफड़ों में हवा की जगह और आपकी साँस लेने की ताकत को मापना चाहिये। यह एक छोटी इलेक्ट्रॉनिक मशीन स्पाइरोमीटर की सहायता से करता है - जिसमें वह आपको फूँकने के लिये कहेगा। स्पाइरोमीटर जाँच के नम्बर को कार्ड में दर्ज करना चाहिये।

यदि खाँसी में बलगम आता है तो टी॰ बी॰ के कीटाणुओं की जाँच करनी चाहिये, विशेषकर यदि आपका स्वास्थ्य न सुधर रहा हो तब। एक्स-रे की भी जरूरत पड़ सकती है। आपका अधिकार है कि सभी जाँच सरकारी दवाखाने में मुफ्त में करवा सकें।

3·2 फेफड़ों की समस्या

जो बच गये हैं उनका पल्मोनरी एडिमा काफी दिन पहले ही ठीक हो गया है। आज गैस पीड़ितों को नीचे लिखी तकलीफें हैं जो उन्हें साँस लेने में दिक्कत देती हैं :

1. ब्रोंकियोलाइटिस, साँस की हवा की नली को बंद करने वाली लम्बी बीमारी,
2. फ्रायब्रोसिस, साँस लेने में तकलीफ देने वाली लम्बी बीमारी,
3. दमा,
4. फेफड़ों की आम छूत की बीमारियाँ जैसे ब्रोंकाइटिस और निमोनिया,
5. टी॰ बी॰
6. खाँसी,
7. थोड़े काम के बाद साँस फूलना,।

इलाज (जहां संभव है) रोग पर निर्भर करता है।

ब्रोंकियोलाइटिस

इन रोगों की शुरुआत में कुछ दवाओं से जिन्हें ब्रोंकोडायलेटर कहते हैं, राहत मिल सकती थी। इसके अलावा भाप से साँस लेने से, साँस लेने के व्यायाम करने से और सिर को छाती और बाकी शरीर की तुलना में नीचे रखकर साँस लेने व साथ-साथ पीठ और बगल में जोर-जोर से थपथपाने से फायदा हो सकता था। इससे हवा की नली में फँसे हुये चिपचिपे पदार्थों को निकालने में मदद मिल सकती थी। लेकिन जिन लोगों को यह रोग अब भी है, इन तरीकों से फायदा नहीं होगा। फिर भी इन्हें आजमाया जा सकता है यदि उनसे कुछ फायदा हो रहा है और खासकर यदि छूत की बीमारी हो।

फ्रायब्रोसिस

यह फेफड़ों में खिंचाव लाने वाला रोग है और एक बार इसके होने के बाद इसके लिये कुछ भी नहीं किया जा सकता है। सिवाय इसके कि इसे मापा जाये और इससे जितनी विकलांगता आती है उस अनुपात में मुआवजा माँगा जाये।

दमा

तकलीफ से बचने के लिये सही इलाज जरूरी है। लम्बे इलाज के लिये और दौरे पड़ने पर राहत के लिये साँस के व्यायाम मदद कर सकते हैं। इसके अलावा ब्रोंकोडायलेटरस दवाईयाँ भी कुछ राहत दे सकती हैं। आमतौर पर गोलियों से काम चल जाता है लेकिन बहुत गंभीर हालत हो तो इन्जेक्शन देने की जरूरत पड़ सकती है। आजकल दमे की दवा सुंघनियों (इनहेलर) में भी आती हैं जिससे जल्दी राहत पाने के लिये कम दवा लगती है।

एक दवाई, जिसे 'स्टीराइड' कहते हैं, दमें के गंभीर दौरे पड़ने पर जान बचा सकती है। किंतु दमे के रोगी स्टीराइड दवाओं पर जल्दी ही निर्भर हो जाते हैं और इनके काफी खराब असर भी होते हैं। इसलिये दमे के रोगियों को यह दवा कम से कम देनी चाहिये। यदि आप दमा के रोगी हैं तो यह जानना चाहिये कि कौन सी दवा स्टीराइड है।

यहाँ दवाओं के वैज्ञानिक नाम लिखे हैं। दवा कम्पनिया अलग-अलग नामों से दवाइयों को बेचती हैं किन्तु उन्हें दवाओं के वैज्ञानिक नाम भी छापना पड़ता है। अक्सर यह छोटे अक्षरों में अंग्रेजी में छपा होता है। इसलिये किसी की मदद से यह जानना चाहिये कि बाजार में बिकने वाली कौन सी दवा काम की है।

फेफड़ों की छूत की बीमारियाँ

ब्रोंकाइटिस और निमोनिया जैसी बीमारियाँ गैस पीड़ितों में अधिक हो सकती हैं, क्योंकि उनके फेंफड़े मिक गैस के कारण पहले ही कमजोर हो गये हैं मिक शरीर की छूत की बीमारियों से बचाने की ताकत को कम करती है। यदि रोगी को खाँसी के साथ पीला बलगम आता है, बुखार आता है और साँस फूलती है तो डॉक्टर को दिखाना चाहिये।

कुछ आम दवाईयाँ

ब्रोंकोडायलेटर (दमा) BRONCODILATORS

एड्रेनालीन (ADRENALINE)	इंजेक्शन
एफीड्रीन (EPHEDRINE)	गोलियाँ
अमीनोफायलीन (AMINOPHYLLINE)	गोलियाँ
थियोफायलीन (THEOPHYLLINE)	गोलियाँ और सिरप
डेरीफायलीन (DERIPHYLLINE)	इंजेक्शन
टरबुलालीन (TERBULALINE)	गोलियाँ
सालबूटामोल (SALBUTAMOL)	गोलियाँ, इंजेक्शन, सुँघनी

स्टीरायड (दमा) STEROIDS

हायड्रोकार्टीजोन (HYDROCORTISONE)	इंजेक्शन
प्रेडनीसालोन (PREDNISALONE)	गोलियाँ
डेक्सामथाजोन (DEXAMETHASONE)	गोलियाँ
बीटामेथाजोन (BETAMETHASONE)	गोलियाँ

एंटीबायोटिक (छूत की बीमारियाँ)

सल्फोनामाइड (SULFONAMIDE) (या सल्फा दवाईयां) (SULFA)	गोलियाँ
पेनीसीलीन (PENICILLIN)	गोलियाँ, इंजेक्शन
टेट्रासायक्लीन (TETRACYCLINE)	कैपसूल, इंजेक्शन
'सल्फा' और ट्रायमेथोपोरीन (SULFA/TRIMETHOPRIM) (को-ट्रायमोक्साजाल) (CO-TRIMOXAZOLE)	गोलियाँ, सिरप.
एरिथ्रोमायसीन (ERYTHROMYCIN)	गोलियाँ, सिरप

टी.बी.

स्ट्रेप्टोमायसीन (STREPTOMYCIN)	इंजेक्शन
आइसोनेक्स (या आई.एन.एच.) (ISONEX)	सफेद गोली
थायासेटाजान (या टी.एच.2) (THIACETAZONE)	पीली गोली
पी. ए. एस. (P.A.S.)	दाने या गोली

टी.बी. की नई दवाईयाँ

इथाम्बुटाल (ETHAMBUTOL)	गोली
रिफायम्पीसीन (RIFAMPICIN)	केप्सूल
पिराजीनामाइड (PIRAZANIMIDE)	गोली

एंटीबायोटिक दवाओं के पूरे कोर्स लेना चाहिये जो छूत की बीमारियों के कीटाणुओं को मारते हैं। टी॰ बी॰ भी कीटाणुओं द्वारा होने वाली छूत की बीमारी है। गैस रिसन के पहले भी यह रोग गैस प्रभावित इलाके के गरीबों में मौजूद था। गैस रिसन के बाद यह और बढ़ सकता है।

सरकार की टी॰ बी॰ रोकथाम की एक राष्ट्रीय योजना है जिसके अनुसार हरेक टी॰ बी॰ मरीज को पूरा इलाज मुफ्त मिलना चाहिये। इलाज पूरा होने में डेढ़ साल लगता है और समय-समय पर जाँच जरूरी है।

यदि इन दवाओं से फायदा न हो रहा हो या जिन लोगों का इलाज लगातार न हुआ हो और जिनमें ये दवायें अब असर नहीं करती हों तो अब कुछ नयी और मँहगी दवायें मिल रही हैं।

ज्यादा अच्छा होगा कि पहले तीन महिने लगातार सरकारी दवाखानों से पहले से चलने वाली और सस्ती दवाओं का इस्तेमाल करके देखें फायदा न होने पर मँहगी दवाओं का इस्तेमाल करें।

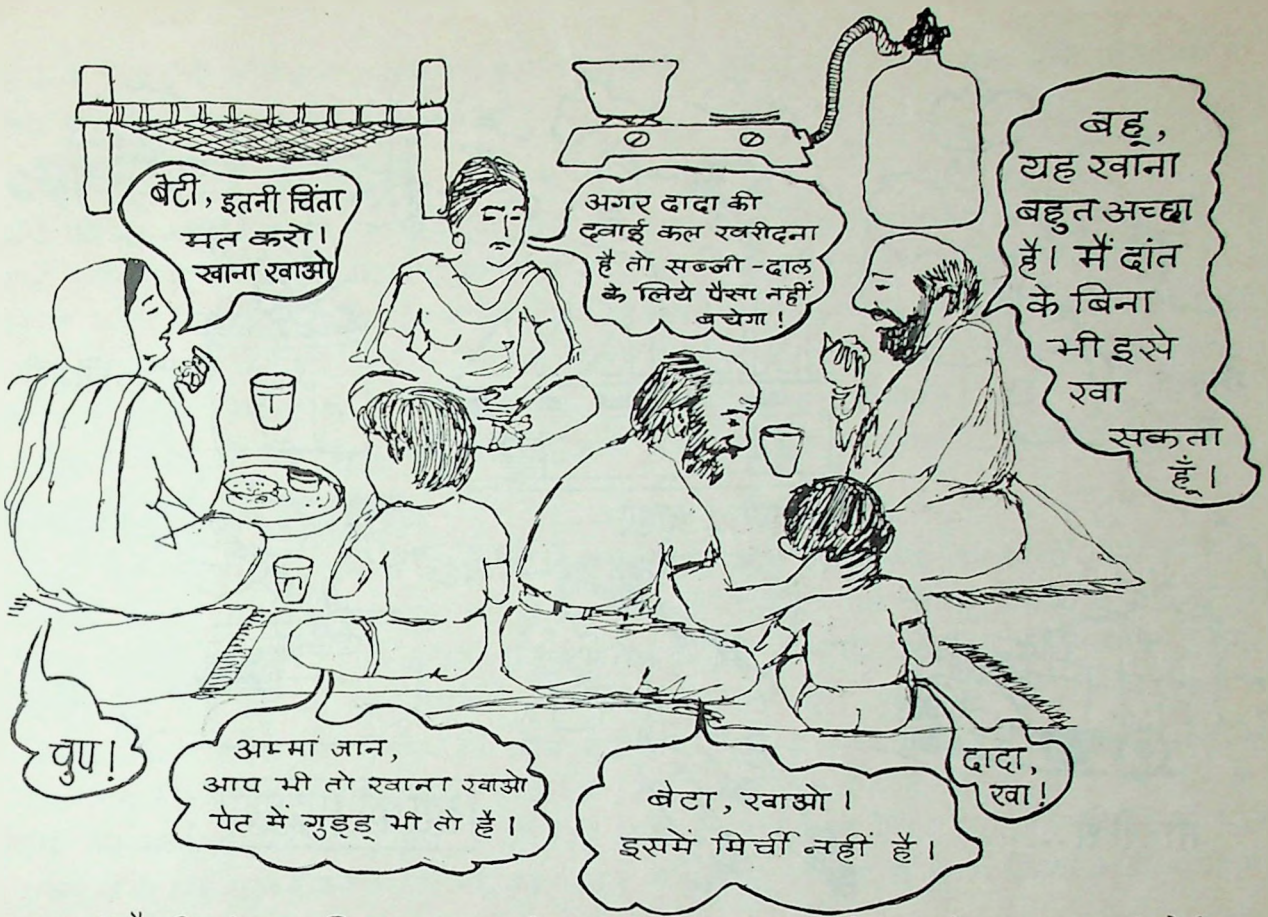
खाँसी

ज्यादातर फेफड़ों की बीमारियों से सूखी खाँसी या बलगम के साथ खाँसी आती है। यदि खाँसी में बलगम आता है और खासकर जब कि बलगम में छूत की बीमारी हुई है (मवाद है) तो यह जरूरी है कि फेफड़ों से ज्यादा से ज्यादा बलगम निकाला जाये। पीने की गरम चीजें और भाप की साँस लेने से फायदा होता है। सिर और छाती को नीचे करके खाँसने और पीठ थपथपाने से भी बलगम निकालने में मदद मिलती है।

यदि खाँसी सूखी है और रात को नींद नहीं आने देती है तो सस्ती एंटीहिस्टामीन की गोलियाँ काफी होंगी। इनमें सबसे आम दवा है क्लोरफेनीरामाइन, जो बाजार में कई नामों से बिकती है। यदि एंटीहिस्टामीन काफी नहीं है तो डॉक्टर आपको कुछ दिनों के लिये कोडीन की गोलियाँ देगा। रात को सोते वक्त एक गोली लेने से खाँसी से भी आराम मिलेगा और अच्छी नींद भी आयेगी। मँहगे कफ सिरप या कफ लोजेंज न खरीदें। इसके बदले गरम काढ़ा लें जिसमें अदरक, काली मिर्च, तुलसी, हल्दी, अजवाइन और गुड़ जैसी घरेलू दवायें होती हैं, जो पीढ़ी दर पीढ़ी लोगों को खाँसी से आराम देती आई हैं।

साँस फूलना

ज्यादातर गैस पीड़ितों की शिकायत है कि थोड़े से काम के बाद उन्हें थकान आती है और साँस फूलती है। इनका किसी फेफड़े की बीमारी से सीधा सम्बन्ध नहीं है। (बल्कि जैसा कि अध्याय पाँच में बताया जायेगा) यह शरीर में जहर फैलने के कारण हुआ है, जिससे खून में आक्सीजन के इस्तेमाल करने में रुकावट पहुँची। यह देखा गया है कि सोडियम थायोसल्फेट इन्जेक्शन से इस तरह की थकान और साँस फूलने में कुछ और कभी-कभी फायदा पहुंचता है। सोडियम थायोसल्फेट जो कि सायनाइड जहर की जानी मानी काट है, को बड़े-बड़े डॉक्टरों ने भोपाल में उपयोग करने के लिये कहा है। इनमें भारतीय आयुर्विज्ञान शोध परिषद (आ॰ सी॰ एम॰



आर.) भी हैं जिसने इस विषय पर जनवरी, 1985 में 'डबल ब्लाइंड' प्रयोग किया था। सोडियम थायोसल्फेट पर विस्तार से अध्याय पाँच में चर्चा की गई है। हम इसे उन गैस पीड़ितों को लेने के लिये कहेंगे जिनकी आज भी थोड़े से काम के बाद साँस फूलती है। उन्हें इसकी (नज़दीक के पॉली क्लीनिक या जन स्वास्थ्य केन्द्र से) माँग करनी चाहिये। क्योंकि इससे अब भी उन्हें राहत मिलने की और शरीर से बचा-खुचा जहर निकालने की संभावना है।

उ·उ और नुकसान से बचाव

गैस पीड़ितों को उनके फेफड़ों के और भी ज्यादा नुकसान होने से बचाने के लिये, बचाव के तीन पहलुओं पर ध्यान देना चाहिये:

1. शरीर और फेफड़ों को ताकत देने के लिये पौष्टिक भोजन
2. हवा में प्रदूषण (गंदगी फैलाने वाली चीजों) से बचाव और
3. व्यक्तिगत आदतों में सुधार

पोषण

इस पुस्तिका के अन्य अध्यायों में हमने बच्चों, गर्भवती महिलाओं और बूढ़ों के पोषण की

विशेष जरूरतों पर चर्चा की है। परन्तु साधारण वयस्क महिलाओं और पुरुषों के लिये भी, ताकत वापस लाने के लिये और बीमारियों से बचाव के लिये सन्तुलित और पर्याप्त आहार जरूरी है। चूँकि ज्यादातर गैस पीड़ितों की काम करने और आमदनी की क्षमता घट गई है, **पोषण** का प्रश्न बहुत महत्व-पूर्ण हो जाता है। जरूरत के मुताबिक मुफ्त राशन तब तक मिलना चाहिये जब तक कि लोगों का **स्वास्थ्य और** कमाने की ताकत पूरी तरह से सामान्य नहीं हो जाती है। राशन की दुकानों से अनाज **के अलावा** खाने का तेल, चीनी दाल **भी** मिलना चाहिये।

हवा में प्रदूषण

धुंआ, धूल रेशे और रासायनिक धूएं वाले वातावरण से बचिये। इसके लिये आप कुछ विशेष रोजगार या धंधे नहीं कर सकेंगे। या फिर कारखाने के मालिक को सुरक्षा के ऐसे उपाय करने होंगे जिससे खतरनाक पदार्थ साँस के साथ शरीर में घुसने से रोके जा सकें (जैसे सुरक्षा नकाब आदि)। सरकार को प्रदूषण रोकने के लिये कानून बनाने होंगे, ताकि उद्योगों का वातावरण प्रदूषित करने से रोका जा सके। चूँकि लकड़ी, कोयले या घासलेट से खाना पकाने में धुआँ पैदा होता है, इसलिये सरकार को चाहिये कि वह गैस पीड़ितों को गैस के चूल्हे प्राथ-मिकता के आधार पर मुहैय्या करवाये। गैस चूल्हों के बाद गैस पीड़ितों के स्वास्थ्य की दृष्टि

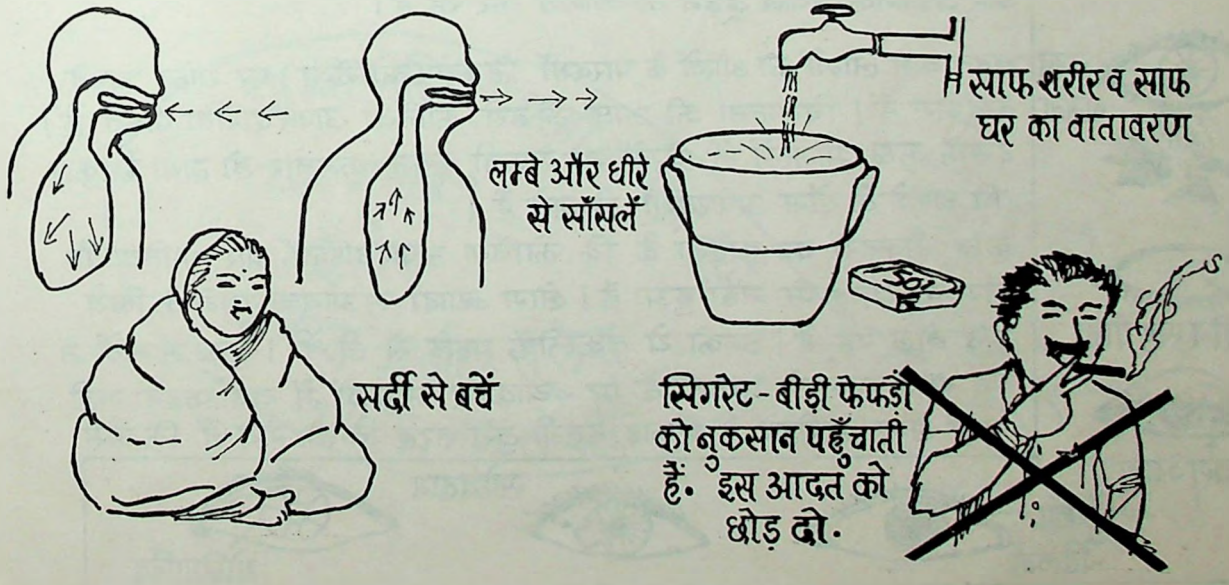
से नये किस्म के बत्ती वाले स्टोव का नम्बर आता है (जैसे नूतन स्टोव)। कारखानों और घरों में साफ हवा आने का इंतजाम होना चाहिये।

व्यक्तिगत आदतें

गैस पीड़ित व्यक्तियों को अपनी साँस लेने की आदत को थोड़ा बदलने से बहुत फायदा होगा। उन्हें एक खास तरीके से गहरी और लंबी साँसें लेनी चाहिये (इन्हें सिखाया जा सकता है) इससे उनके फेफड़ों में आक्सीजन घुसने और कार्बन डाय आक्साइड निकलने के लिये अधिक जगह और समय मिलेगा। स्वस्थ लोगों के लिये भी बीड़ी-सिगरेट पीना खराब है। गैस पीड़ित यदि बीड़ी पीना छोड़ दें तो उनकी ठीक होने की संभावना बढ़ जायेगी।
जहाँ तक संभव हो सके ठंड से बचें क्योंकि इससे फेफड़ों में छूत की बीमारियां हो सकती हैं।

३. नया रोजगार

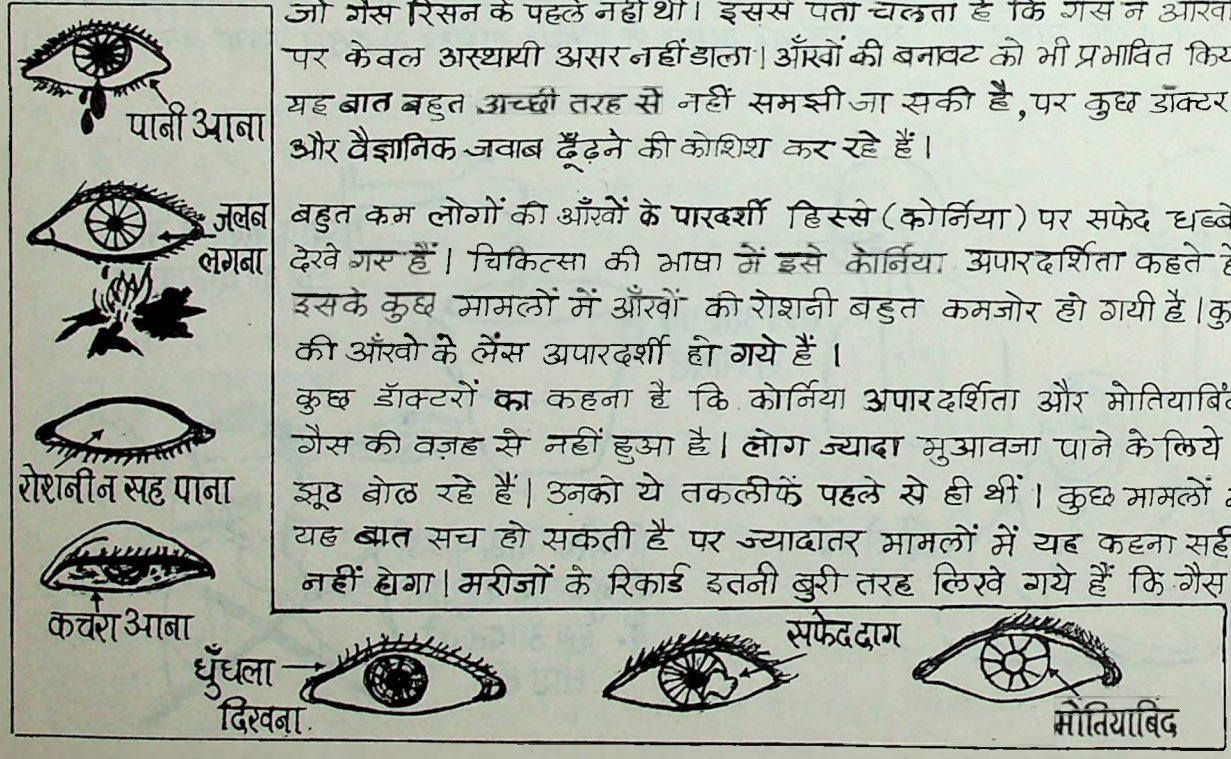
जैसा कि हमने पहले बताया डॉक्टर स्पाइरोमीटर जैसे आधुनिक उपकरणों की मदद से फेफड़ों की हर महिने जाँच करके यह बता सकते हैं कि आपको अपने वर्तमान रोजगार में रहना चाहिये या नहीं। यदि डॉक्टर को लगता है कि आपको मौजूदा काम छोड़ देना चाहिये तो वह यह भी बता सकेंगे कि किस प्रकार का काम आपके लिये ठीक होगा। आपको लगता है कि आप पहले जैसा काम नहीं कर पा रहे तो सरकारी डॉक्टर आपके फेफड़ों की क्षमता की जाँच करके प्रमाण पत्र दे सकते हैं। इस प्रमाण पत्र के आधार पर आप सरकार से मांग कर सकते हैं कि आपकी आय में जो कमी आयी है उसे पूरक पेंशन देकर पूरा किया जाये। इस प्रकार से जो खर्च सरकार को उठाना पड़े वह असल में यूनियन कार्बाइड से वसूल किया जाना चाहिये।



आँखों को नुकसान

गैस रिसन के समय गले में घाँस लगने के साथ-साथ आँखों में तेज जलन और पानी आने की शिकायत भी देखी गई है। आँखों को मसलने की इच्छा होती थी। बहुत कम लोगों को पता था कि मसलने के बजाय आँखों पर पानी छींटना था और पूरे चेहरे को गीले कपड़े से ढक लेना था। धीरे-धीरे आँखों में सूजन तथा अधिक पानी आने लगा। जो लोग फैक्ट्री के पास रहते थे, वे कई दिन तक आँख नहीं खोल सके। उनकी आँखों में तीखा दर्द होता रहा।

कुछ समय बाद सूजन कम हो गयी। पर जलन होती रही और पानी आता रहा। आग पर खाना पकाना मुश्किल हो गया क्योंकि धुएं से आँखों में तकलीफ होती थी। चकाचौंध के कारण धूप में काम करने में भी तकलीफ होने लगी। धुँधला नजर आने लगा। दर्जी, साइकल या मोटर मैकेनिक, बीड़ी मजदूर, ट्रक ड्रायवर आदि लोगों को अपना काम करने से आँखों में तकलीफ होने लगी। कइयों को तो काम छोड़ना भी पड़ा। कुछ लोगों को आज भी ऐसी तकलीफें हैं जो गैस रिसन के पहले नहीं थीं। इससे पता चलता है कि गैस ने आँखों पर केवल अस्थायी असर नहीं डाला। आँखों की बनावट को भी प्रभावित किया। यह बात बहुत अच्छी तरह से नहीं समझी जा सकी है, पर कुछ डॉक्टर और वैज्ञानिक जवाब ढूँढ़ने की कोशिश कर रहे हैं।



बहुत कम लोगों की आँखों के पारदर्शी हिस्से (कोर्निया) पर सफेद धब्बे देखे गए हैं। चिकित्सा की भाषा में इसे कोर्निया अपारदर्शिता कहते हैं। इसके कुछ मामलों में आँखों की रोशनी बहुत कमजोर हो गयी है। कुछ की आँखो के लेंस अपारदर्शी हो गये हैं।

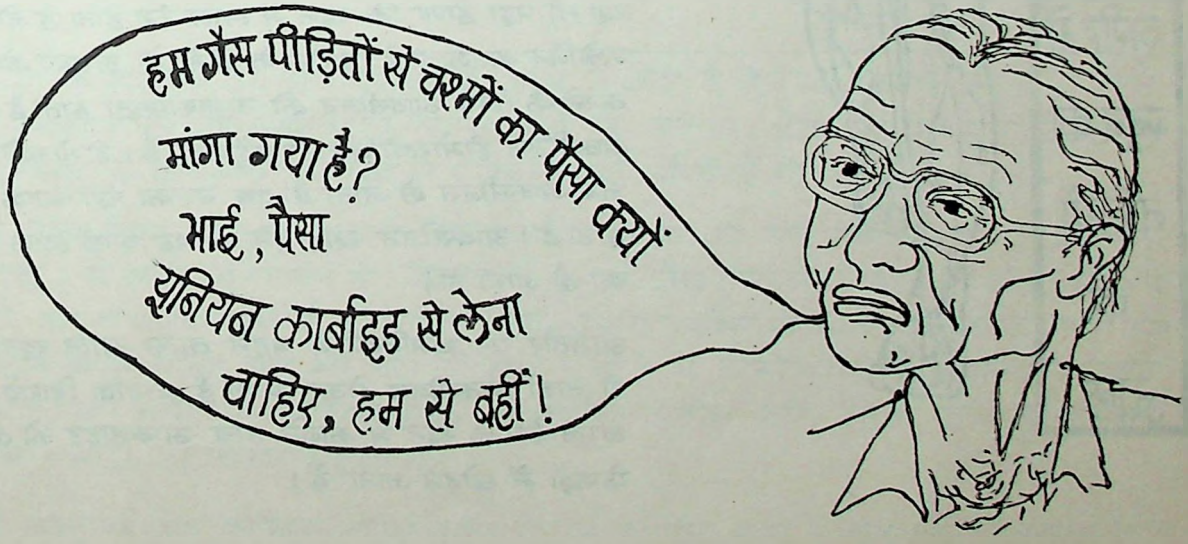
कुछ डॉक्टरों का कहना है कि कोर्निया अपारदर्शिता और मोतियाबिंद गैस की वजह से नहीं हुआ है। लोग ज्यादा मुआवजा पाने के लिये झूठ बोल रहे हैं। उनको ये तकलीफें पहले से ही थीं। कुछ मामलों में यह बात सच हो सकती है पर ज्यादातर मामलों में यह कहना सही नहीं होगा। मरीजों के रिकार्ड इतनी बुरी तरह लिखे गये हैं कि गैस

के देर से असर होने पर उभरी तकलीफों को साबित करना मुश्किल है।

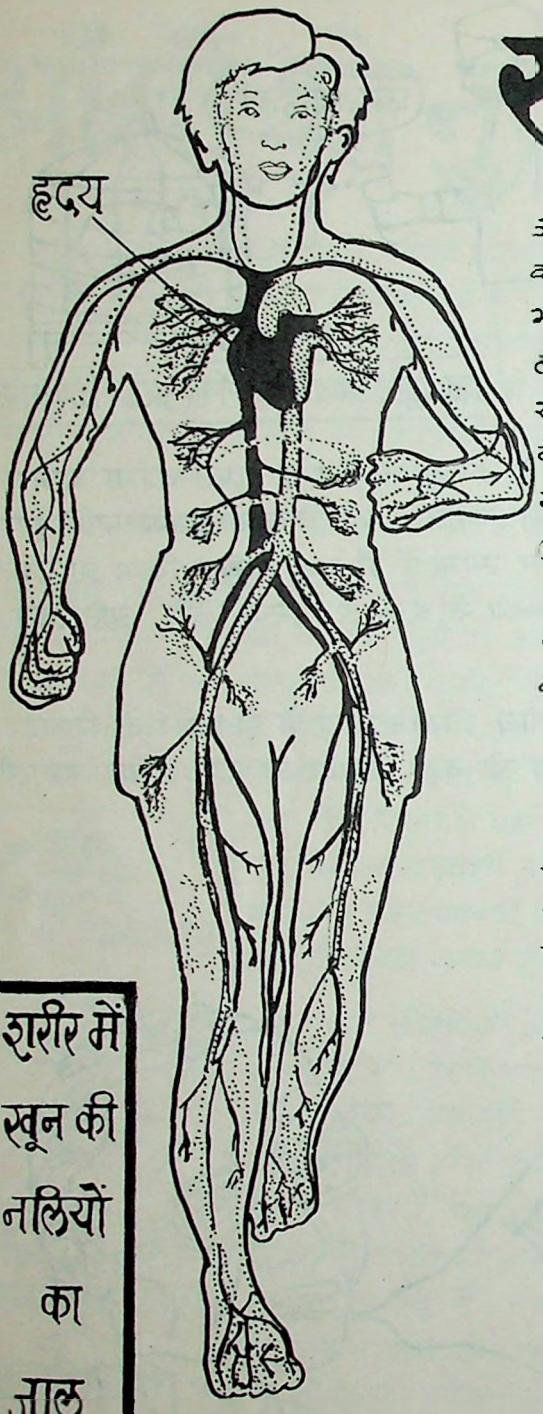
वैज्ञानिकों ने पाया है कि चूहों को मिक के पास रखने से कुछ समय बाद उनकी आँखों में मोतिया-बिन्द बन जाता है। इसलिये संभव है कि खासकर कम उम्र लोगों में मोतियाबिन्द गैस के असर से हुआ हो।

जिन लोगों को कोर्निया अपारदर्शिता या मोतिया-बिन्द के अलावा किसी और कारण से नजर में दिक्कत है उन्हें चश्मा लगाने से मदद मिलेगी। आँखों की मुफ्त जाँच व मुफ्त चश्मा पाना गैस पीड़ितों का हक है। कोर्निया अपारदर्शिता या मोतियाबिन्द की चिकित्सा आपरेशन के द्वारा की जा सकती है। यह सुविधा भी मुफ्त होगी। जिन मामलों में यह साबित किया जा सकता है कि कोर्निया अपारदर्शिता या मोतियाबिन्द गैस के प्रभाव से हुआ है, उनके लिये अतिरिक्त मुआवजे की माँग की जाना चाहिये।

लोगों को मांग करनी चाहिये कि उनकी आँखों की जाँच नियमित रूप से हो। जांच के रिकार्ड सरल हिन्दी में रखे जायें। इससे लोगों को पता रहेगा कि क्या लिखा जा रहा है। यह जानकारी पाना लोगों का हक है।



खून पर असर



शरीर में खून की नलियों का जाल

जहरीली गैसों के फेफड़ों में से होकर खून में मिल जाने के कारण फेफड़ों व आँखों के अलावा शरीर के अन्य अंगों पर भी असर पड़ा है। गैस रिसन के बाद पहले दो दिन में सैकड़ों लाशों के पोस्टमार्टम से यह पता चला कि पूरे शरीर का खून चटक लाल रंग का हो गया था। गैस पीड़ित लोगों के चेहरे व चमड़ी पर भी लाली देखी गयी थी। खींचे गये रंगीन फोटो में यह साफ दिखती है। कुछ अंगों (जैसे दिमाग) में तो शिराओं और धमनियों में अंतर कर पाना मुश्किल हो गया था। क्योंकि वे एक ही रंग की दिखती थीं। आमतौर पर शिरायें नीली दिखती हैं, क्योंकि उनमें काले लाल रंग का खून होता है। पर गैस रिसन के बाद शिराओं में भी धमनियों की तरह चटक लाल रंग का खून पाया गया।

खून इस तरह लाल क्यों हो गया था?

अध्याय दो में आपने पढ़ा होगा कि फेफड़े कैसे काम करते हैं। फेफड़े हवा से आक्सीजन लेकर खून में पहुंचाते हैं और कार्बन डाय आक्साइड छोड़ते हैं। आपने यह भी पढ़ा होगा कि खून में लाल रंग होता है जो हीमोग्लोबिन कहलाता है। शरीर के अंगों के ऊतकों को काम करने के लिये आक्सीजन की आवश्यकता होती है। यह आक्सीजन हीमोग्लोबिन ही पहुँचाता है। हीमोग्लोबिन जब आक्सीजन ले जाता है तब उसका रंग चटक लाल होता है। आक्सीजन छोड़ देने पर वह काले लाल रंग का हो जाता है।

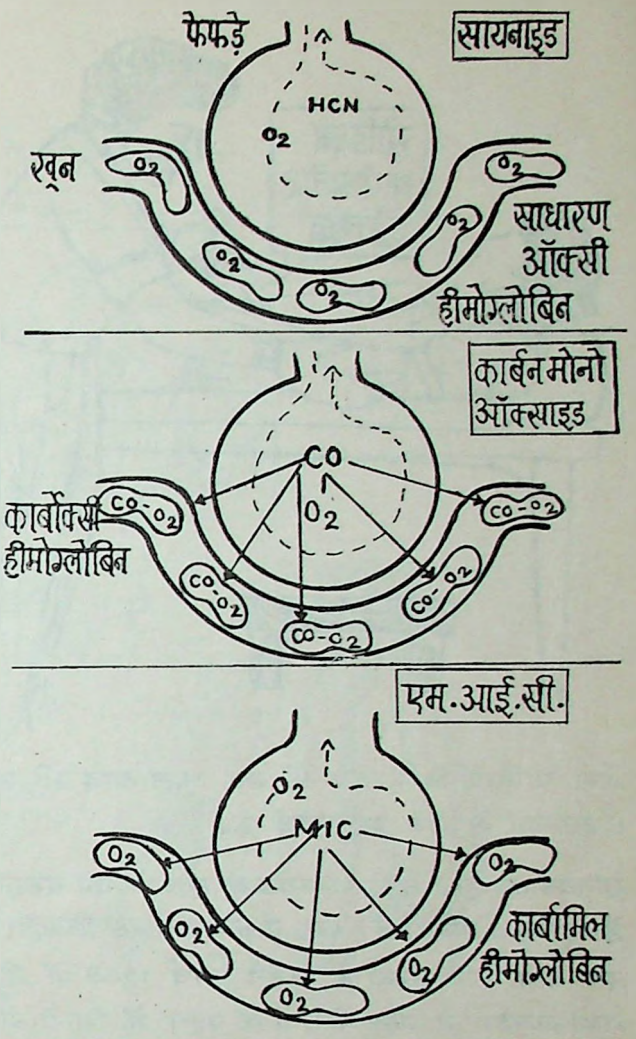
आमतौर पर धमनियों में बहने वाला लाल खून फेफड़ों से ताजी आक्सीजन लेकर आता है, जबकि शिरायें काले लाल रंग के खून में कार्बन डाय आक्साइड को लेकर फेफड़ों में छोड़ने जाती हैं।

शरीर में खून चटक लाल रंग का क्यों हो गया था? वैज्ञानिकों ने इसको समझने की कोशिश की है। उनका कहना है कि इस लक्षण के तीन संभव कारण हो सकते हैं;

1. सायनाइड गैस ने शरीर के सभी ऊतकों में जहर भर दिया। जिससे वे खून की ऑक्सीजन का उपयोग नहीं कर पाये।

2. कार्बन मोनो आक्साइड गैस हीमोग्लोबिन को इस तरह बदल देती है कि वह न तो आक्सीजन छोड़ सकता है और न ही कार्बन डाय आक्साइड ले सकता है।

3. मिथायल आइसो सायनेट (मिक) हीमोग्लोबिन के साथ जुड़कर उसकी आकृति बदल देता है, जिससे वह न तो आक्सीजन छोड़ सकता है और न ही कार्बन डाय आक्साइड ले जा सकता है।



इन सबके कारण जब तक गैस पीड़ितों के शरीर में जहर है वे चाहे कितनी ही साँस क्यों न लें, उनका शरीर आक्सीजन का फायदा नहीं उठा सकता। जैसा कि अध्याय एक में कहा गया है, शायद ये तीनों गैसें कार्बाइड से निकलने वाली गैसों में थीं।

खून में आक्सीजन और कार्बन डाय आक्साइड की मात्रा को एक मंहगी मशीन 'खून गैस विश्लेषक' से मापा जा सकता है। वैज्ञानिकों ने कई गैस पीड़ितों के खून की जाँच की और पाया कि वह सामान्य खून से भिन्न था। एक दूसरी मशीन से हीमोग्लोबिन को मापा गया। गैस रिसन के दो महिने बाद भी गैस पीड़ितों के खून में हीमोग्लोबिन की मात्रा सामान्य से अधिक पायी गयी। यह आश्चर्यजनक है क्योंकि अक्सर गरीब लोगों को 'अनीमिया' (खून की कमी) की शिकायत होती है।

खून में सायनायड जहर की मात्रा नापना कठिन है। पर यह जहर कटने के बाद सायनेट बनकर पेशाब

के साथ शरीर के बाहर निकलता है। तब 'स्पेक्ट्रोफोटोमीटर' से पेशाब में सायनेट की मात्रा मापी जा सकती है। इससे शरीर में सायनायड की उपस्थिति का पता चलता है।

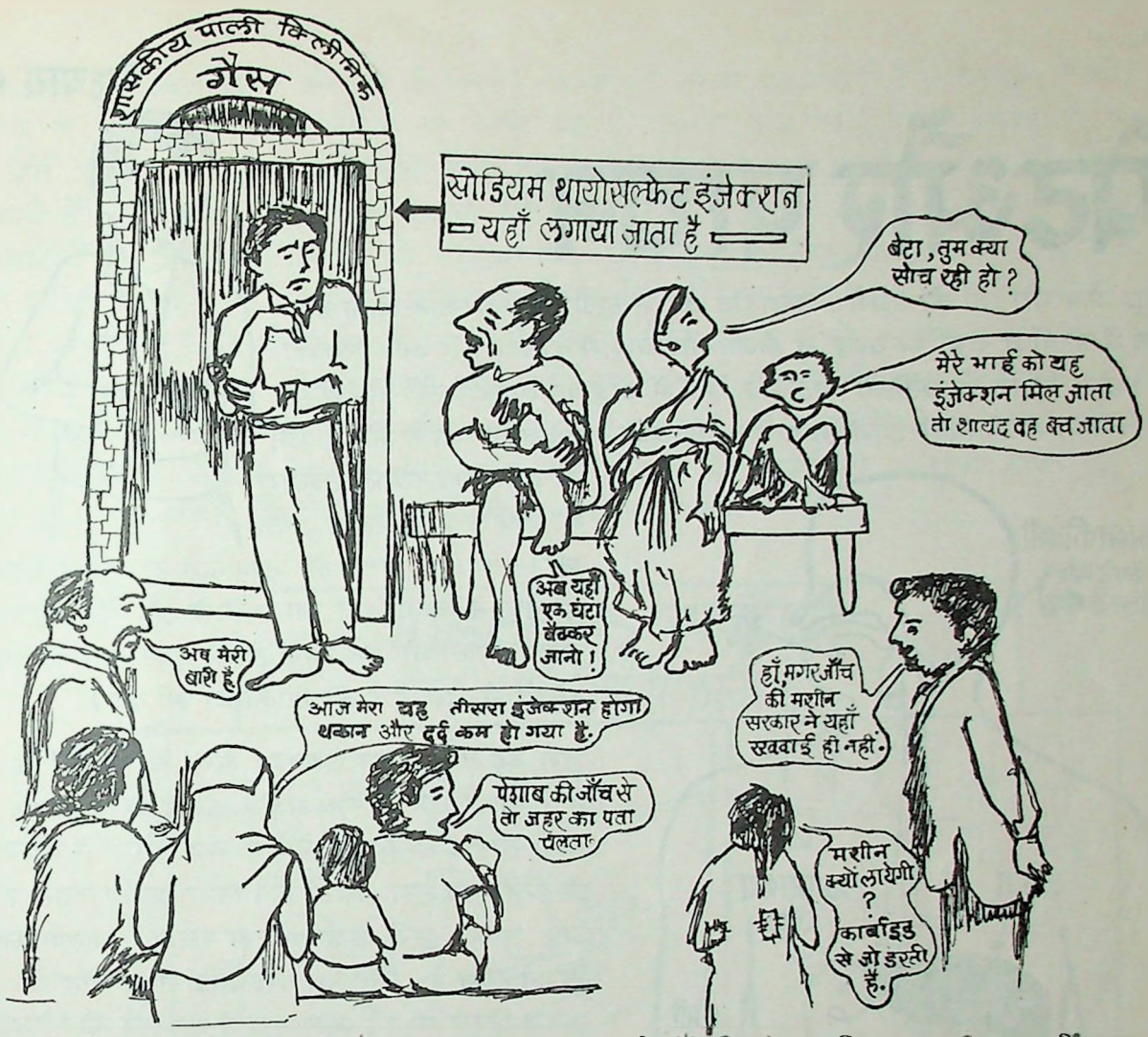
सायनायड जहर की जानी मानी काट सोडियम थायोसल्फेट है। गैस रिसन के बाद थायो-सल्फेट से इलाज की एक अजीब कहानी है। पूरा किस्सा 'थायोसल्फेट की लड़ाई' नामक पुस्तिका में छपा है। गैस पीड़ितों को सोडियम थायोसल्फेट इन्जेक्शन दिलवाने में भी 'जन स्वास्थ्य केन्द्र' ने एक बड़ी भूमिका निभाई है। गैस पीड़ितों को आज भी यह इंजेक्शन दिया जा रहा है। यह दवा सायनायड जहर को काटकर उसे अहानिकारक थायोसायनेट में बदल देती है। थायो सायनेट पेशाब के साथ बाहर निकल आता है।

गैस पीड़ितों के शरीर में एक साल बाद भी सायनायड जहर क्यों मौजूद है? यह अभी तक वैज्ञानिकों के लिये एक पहेली है।

यूनियन कार्बाइड ने सायनायड के मामले को दबाने की पूरी कोशिश की है। इसका यह नतीजा रहा है बहुत से वैज्ञानिकों ने इसे गंभीरता से नहीं लिया है। भारतीय आयुर्विज्ञान शोध परिषद (आई॰ सी॰ एम॰ आर॰) एक मात्र ऐसी संस्था है जिसने मार्च 1985 में दी गई अपनी रिपोर्ट में बताया कि, कैसे सोडियम थायो सल्फेट से गैस पीड़ितों के खून में मिली गैसें सामान्य हो जाती हैं और पेशाब मे थायो-सायनेट की मात्रा बढ़ जाती है।
किसी और वैज्ञानिक संस्था ने इस विषय पर कोई रिपोर्ट नहीं दी।

पर यह पाया गया कि गैस पीड़ितों को सोडियम थायो सल्फेट से राहत मिलती है। यदि आप गैस पीड़ित हैं और आपको अभी भी सिरदर्द, घकान, साँस फूलना, पेट में गड़बड़, माँस-पेशियों में दर्द आदि की तकलीफ है तो संभव है कि इस इन्जेक्शन से लाभ हो। आप नजदीक के सरकारी अस्पताल या पॉली क्लीनिक में जाकर इसके बारे में पूछें। सरकार द्वारा ये इंजेक्शन मुफ्त दिये जाते हैं। भारत सरकार के विशेष आदेश पर भोपाल के लिये एक सरकारी दवा कम्पनी आई॰ डी॰ पी॰ एल॰ द्वारा यह इंजेक्शन बनाया जा रहा है।

इन इन्जेक्शनों को पाने में यदि आपको कोई दिक्कत आती है तो आपको चीफ मेडिकल आफीसर, गैस राहत, बैरसिया रोड, भोपाल से शिकायत करनी चाहिये। आप जन स्वास्थ्य केन्द्र, भोपाल के



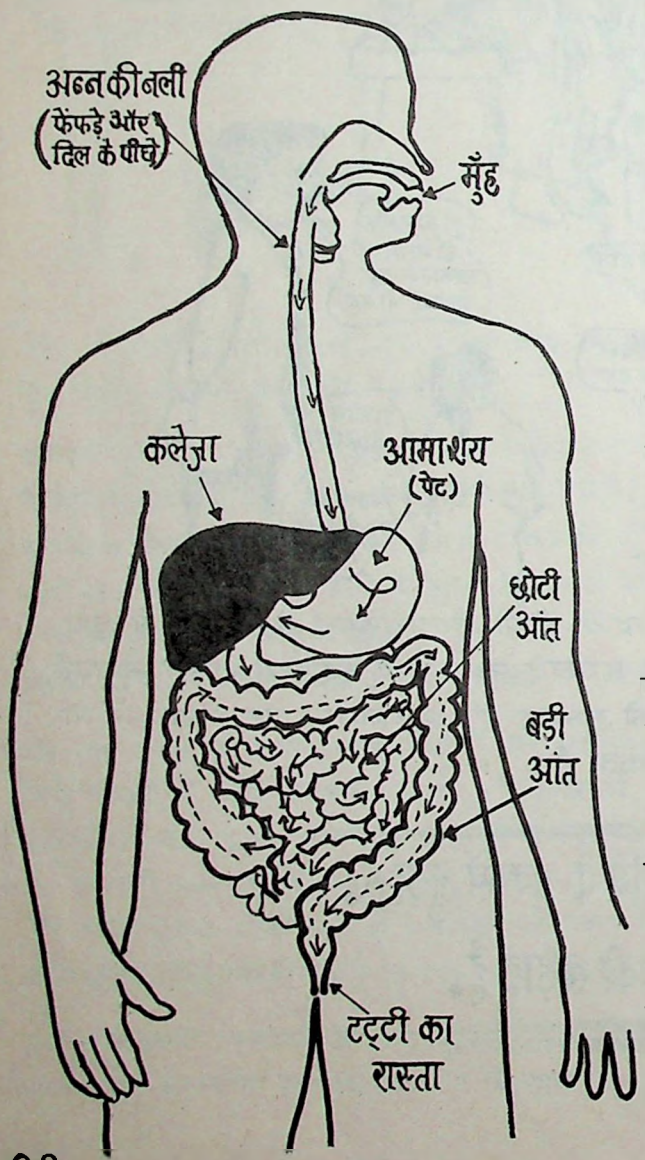
डाक्टरों के पास भी जा सकते हैं। जन स्वास्थ्य केन्द्र के कैंची छोला स्थित क्लीनिक में कुछ मरीजों को ये इंजेक्शन दिये जा रहे हैं। अन्य गैर सरकारी स्वयं सेवी स्वास्थ्य राहत संस्थाएँ भी सरकार से इन इन्जेक्शनों की सप्लाई लेने की हकदार हैं। और जनता यह मांग करे तो उन्हें इस काम के लिये तैयार भी किया जा सकता है।

अच्छी सेहत का हक हमारे जीने के हक से जुड़ा है.

सेहत की लड़ाई हक की लड़ाई है.

पेट और पाचन

कुछ गैस पीड़ितों को सबसे ज्यादा पेट की तकलीफों ने परेशान किया है। शुरू में उल्टी व टट्टी पर काबू न होना और बाद में दस्त बहुत आम शिकायत थी। गैस रिसन के महिनों बाद तक पेट में गड़बड़ लगती रही और थोड़ी सी उत्तेजना से मितली आने लगती। कुछ बीड़ी बनाने वाली औरतों को यह काम छोड़ना पड़ा। क्योंकि तम्बाखू की गंध से उन्हें मितली आती थी। ज्यादातर लोगों की भूख कम हो गयी। वे एक-दो रोटी से ज्यादा नहीं खा पाते थे और पेट में गड़बड़ लगने लगती थी। पेट भारी होकर फूल जाता था। कुछ लोगों ने पेट दर्द की शिकायत भी की।



जून, 85 में जब जन स्वास्थ्य केन्द्र के डॉक्टरों ने काम शुरू किया तो एक अजीब बात देखी। सोडियम थायो सल्फेट इन्जेक्शन लेने के बाद लोगों ने बताया कि उन्हें अब भूख लगती है। खाना अच्छा लगता है और सरकार द्वारा दिया जा रहा राशन अचानक कम लगने लगा है। सितम्बर 85 तक मरीज पेट के ऊपरी हिस्से में दर्द और दबाने पर दर्द की शिकायत कर रहे थे। सोडियम थायो सल्फेट देने से यह परेशानी भी दूर हुई। इन सब बातों के कारण अभी पूरी तरह नहीं समझे जा सके हैं। शुरू के पोस्टमार्टमों में पेट के अन्दर की झिल्लियां असामान्य रूप से लाल व सूजी हुई पायी गयी थी। ऐसा ही दुर्घटना के महीने भर बाद मरे लोगों में भी पाया गया। इससे ऐसा लगता है कि सोडियम थायो सल्फेट पाचन तंत्र में पहुँचे जहर को भी काटता है। और इसलिये सोडियम थायो सल्फेट से इलाज के बाद पाचन तंत्र ठीक से काम करने लगता है।

आमतौर पर जिन लोगों को पेट के ऊपरी हिस्से में जलन वाला दर्द है (जैसा कि हमने चित्र में दिखाया है) और थोड़ा-सा खाने पर ही अजीब तरह का भारीपन लगता है, उन्हें 'अति अम्लीयता' सता रही है। इन लोगों को अम्लनाशक या <u>एन्टासिड</u> नामक दवाईयाँ दी जाती हैं। यदि दर्द ज्यादा है तो उनके पेट व आँत को आराम देने के लिये कुछ और दवाईयाँ दी जाती हैं जिन्हें ऐंठन विरोधी या <u>एन्टीस्पास्मोडिक</u> कहा जाता है। डाक्टरों ने मरीजों को ढेर सारी अम्लनाशक व ऐंठन विरोधी दवाईयाँ दी हैं जिनसे मरीजों को कुछ वक्त के लिये थोड़ी राहत मिली है। परन्तु चूँकि उनके पीछे कारण काफी गहरे हैं इसलिये इन दवाईयों से बीमारी ठीक नहीं हुई। यदि आपको सोडियम थायोसल्फेट लेने के बाद भी पेट में तकलीफ है तो आपको इन दवाओं से राहत मिलेगी। कोई भी चीज जो उत्तेजक है आपके पेट में अम्लीयता बढ़ा सकती है। इसलिये अच्छा होगा कि आप कड़क चाय, काफी, मिर्ची, तम्बाकू आदि से परहेज रखें।

महिला : इतनी मंहगी दवा !

पुरुष : हां, पर डॉक्टर ने तुम्हें तीन गोली रोज खाने के लिए कहा है।

महिला : पर इसके लिए हमें मकान किराया, किराने दूध और सब्जी का खर्च बंद करना होगा।

प्रजननअंग

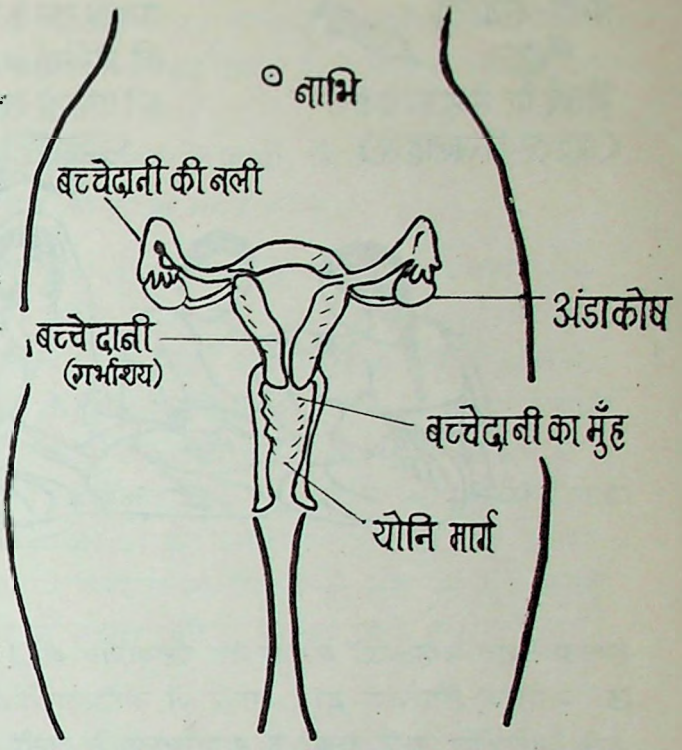
कई महिलाओं को गैस रिसन के बाद प्रजनन तंत्र से संबंधित दिक्कतों का सामना करना पड़ा। हमेशा की तरह डॉक्टरों द्वारा महिलाओं की समस्याओं की तरफ ध्यान नहीं दिया गया। आज तक भारतीय चिकित्सा अनुसंधान परिषद् या अन्य किसी संस्था द्वारा माहवारी की अनियमितता, योनि से बहुत ज्यादा सफेद पानी आना, सैकड़ों महिलाओं द्वारा बतायी गयी **दूध की कमी** आदि पर **एक भी** रपट नहीं दी गयी है। गर्भपात, मृत शिशु जन्म, जन्म के तत्काल बाद मौतें और **गैस** रिसन के बाद पैदा हुये बच्चों में विकृतियाँ अवश्य **सनसनी**-खेज खबरों का विषय रहे हैं। इनमें से कुछ खबरें सही भी नहीं थीं। ज्यादातर महिलाओं की प्रजनन से जुड़ी समस्याओं को घर ही घर में चुपचाप निपटा दिया जाता है। इसलिये ये कभी ठीक तरह से रिकार्ड में नहीं आ पातीं।

7.1 महिलाओं के रोग

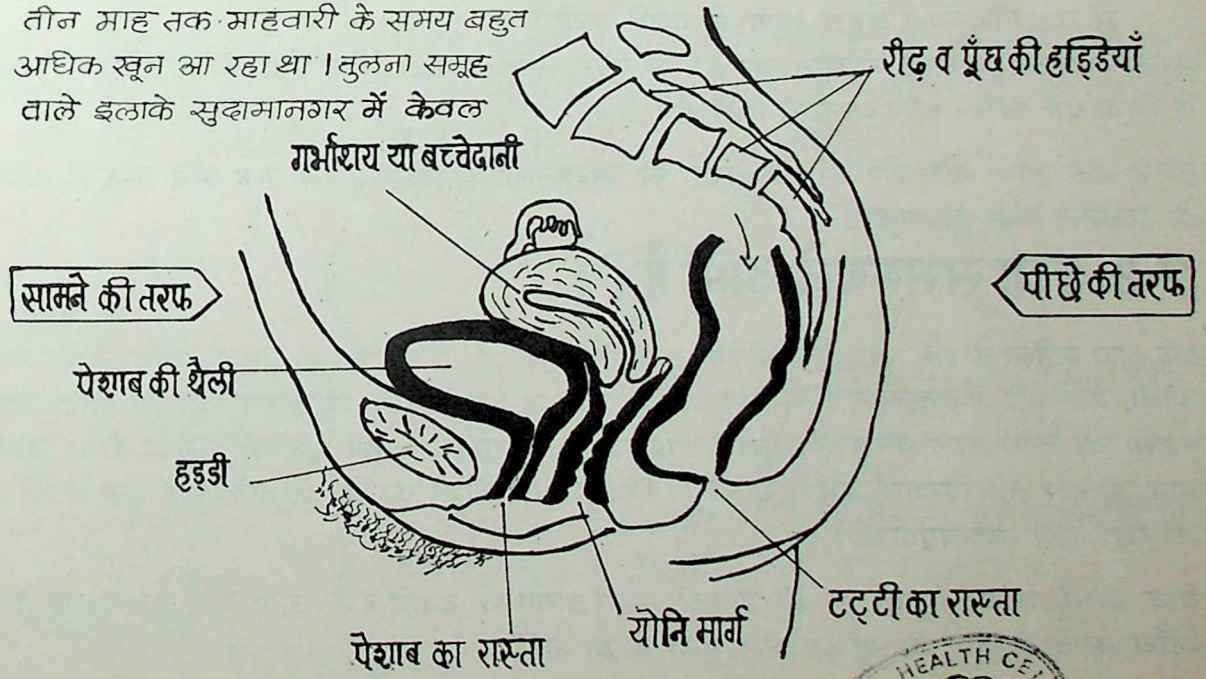
हांलाकि सरकार ने इस ओर कोई ध्यान नहीं दिया, लेकिन कुछ मेडीकल स्वयंसेवी संस्थाएं व महिला संस्थाओं ने जो कुछ हुआ है उसके बारे में जानने के प्रयत्न किये हैं।

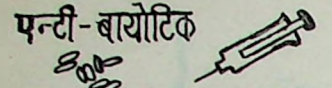
इन सभी संस्थाओं द्वारा किये गये अध्ययन में गैस रिसन द्वारा महिलाओं के रोगों संबंधी नीचे लिखी शिकायतें पायी गयीं।

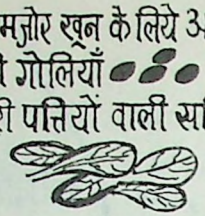
1. गैस रिसन के तुरंत बाद के महिनों में गैस प्रभावित अधिकांश महिलाओं की योनि से बहुत ज्यादा सफेद पानी निकल रहा था। यह विशेष रुप से गाढ़ा पीलापन लिये सफेद था. और इसमें कोई दुर्गंध न थी और न ही किसी तरह की जलन या खुजली थी। यह सामान्य तौर पर छूत के रोगों के कारण निकलने वाले सफेद पानी से बिल्कुल अलग था।

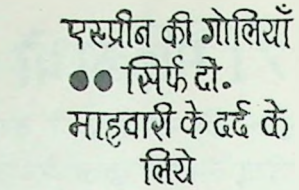


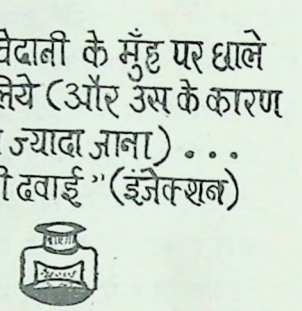
2. कई गैस प्रभावित महिलाओं को पहले तीन माह तक माहवारी के समय बहुत अधिक खून आ रहा था। तुलना समूह वाले इलाके सुदामानगर में केवल











एक प्रतिशत महिलाओं को ही यह शिकायत थी।

3. महिला डॉक्टरों द्वारा मार्च में महिलाओं के गर्भाशय की जाँच करने पर पाया गया कि अधिकांश महिलाओं के गर्भाशय के दोनों ओर (ऊपर व नीचे) सूजन आ गयी थी। सुदामा नगर मे जाँच करने पर पाया गया कि वहाँ यह शिकायत बहुत कम महिलाओं को थी।
4. अधिकांश महिलाओं के गर्भाशयों के मुँह पर छाले पाये गये। तुलना समूह सुदामा नगर में यह शिकायत बहुत कम में पायी गयी।

इन्हीं महिला डाक्टरों ने सितम्बर 85 में फिर से क्लीनिक में औरतों की जाँच की व पाया कि ये शिकायतें धीरे-धीरे कम हो रहीं हैं।

हमने इस भाग को और अच्छी तरह से समझाने के लिये चित्र 7.2 और 7.3 में महिलाओं के प्रजनन अंग दिखाये हैं।

7.2 क्या समस्यायें अभी हैं?

यदि आप महिला हैं और आपको अभी भी कुछ तकलीफें हैं, जैसे योनि से बहुत ज्यादा सफेद पानी आना, माहवारी में तकलीफ, निचले पेट में या पीठ में दर्द, पेशाब में जलन, खुजली और छाले पड़ना या इसी तरह की कोई खास शिकायत, या कोशिश करने पर बच्चे नहीं होना आदि। तो आप डॉक्टर को दिखायें और पूरी जाँच करवायें। तकलीफों का कारण जहरीली गैस न भी हो तो भी यह जाँच महत्वपूर्ण है।

यदि गर्भाशय पर सूजन हो तो डॉक्टर एंटी बायोटिक दवायें देंगे और एक हफ्ते बाद फिर जाँच करके देखेगें कि सूजन कम हुयी है या नहीं।

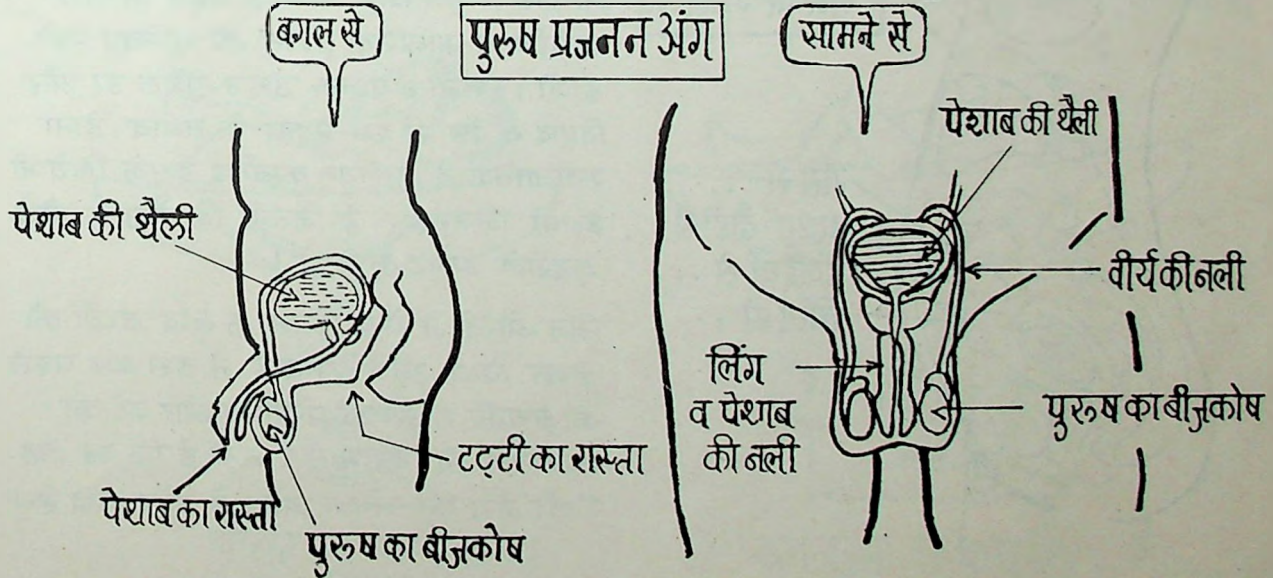
यदि आपको माहवारी में दर्द होता है तो 'एस्प्रिन' नाम की एक सस्ती गोली लेने से दर्द कम हो जायेगा। यह वही गोली है जिसे सिरदर्द होने पर लेते हैं। यदि एस्प्रिन से दर्द कम नहीं होता है तो डॉक्टर को दिखायें।

यदि माहवारी में बहुत खून निकलता है तो सरल और सस्ती **गोलियाँ**, जिन्हें 'फेरस सल्फेट' कहते हैं, **लेनी चाहिये** जिससे आपके शरीर में खून बनने में **मदद** होगी।

यदि योनि से बहुत **ज्यादा सफेद** पानी आने की शिकायत है तो डॉक्टर से अंदरुनी जाँच करवाना चाहिये। यह भी **याद** रखें कि थोड़ा बहुत सफेद पानी जाना आम बात है। थोड़ा बहुत **ध्यान** रखें तो पायेंगी कि एक माहवारी चक्र के बीच कुछ दिनों तक यह सफेद पानी अलग किस्म और अलग मात्रा में होता है। यह महिला के उपजाऊ दिनों की वज़ह से होता है यानी इन दिनों यदि संभोग किया जाये तो गर्भाधान की निश्चितता बढ़ती है। कुछ औरतों ने इन दिनों में संभोग न कर प्राकृतिक परिवार नियोजन का यह तरीका भी सीख लिया है। सफेद पानी में बदबू हो या जिससे जलन या खुजली हो या छाले पड़ गये हों, तब इलाज की **जरूरत** रहती है। 'जेंशन वायलेट' नाम का एक मरहम गर्भाशय के मुँह पर हुये छालों पर लगाने के लिये आता है। छालों की वजह से ही बहुत अधिक सफेद पानी जाने की शिकायत होती है।

आपको पति **से** माँग करनी चाहिये कि वे आपकी स्वास्थ्य समस्याओं के प्रति उतने ही संवेदनशील **हों** जितनी कि आप उनके प्रति हैं। यदि आपको संभोग के समय दर्द होता है तो उन्हें कहें कि वे इसके लिये जोर न दें। ऐसी समस्या के बारे में किसी महिला स्वास्थ्य कार्यकर्त्ता से सलाह लें।

कुछ गैस प्रभावित महिलाओं ने फरवरी'८५ में महिला डॉक्टरों को बताया था कि गैस रिसन के बाद उनके पति कमजोरी के कारण संभोग करने में असमर्थ रहते हैं। कई पुरुषों ने भी 'जन स्वास्थ्य



केन्द्र' के डॉक्टरों और स्वास्थ्य कार्यकर्ताओं को इस समस्या के बारे में बताया है। यह संभव है कि गैस रिसन के कुछ दिनों बाद तक ऐसा गैस के असर के कारण हुआ हो पर अब यह उसके कारण नहीं लगता। बहरहाल, यदि ऐसी कोई समस्या है तो डॉक्टर या स्वास्थ्य कार्यकर्ता से संपर्क करें। कभी-कभार इस ढंग की दिक्कत सभी पुरुषों को आती है परन्तु यह समस्या तभी बनती है जब इसकी बहुत चिंता की जाये। शारीरिक संबंध बहुत कुछ मूड और दिमागी हालत पर निर्भर करते हैं। याने इसका मतलब नहीं कि आप मर्द नहीं हैं। इस दिक्कत को नामर्दी का नाम भी नहीं देना चाहिये।

7.3 गर्भाशय व गर्भधारण

गर्भ पर जहरीली गैस का असर और खासकर गर्भ में बढ़ रहे बच्चों पर असर सबसे ज्यादा चिंता और विवाद का विषय रहा है। गर्भपात व मृत शिशु जन्म की संख्या में बढ़ोतरी हुई है, इस बात को मानने में सरकार को बहुत समय लगा। किंतु कुछ स्वतंत्र सर्वेक्षणों व महिला डॉक्टरों, दाइयों, गैस पीड़ितों के बयान और श्मशान के रिकार्ड शुरू से ही इससे ठीक उल्टी बात बताते हैं।

मेडिको फ्रेंड सर्कल द्वारा की गई पहली छानबीन (फरवरी 1985) के समय कई सरकारी और प्रायवेट डाक्टरों ने आंतरिक गर्भपात की बात बतायी। आंतरिक गर्भपात का मतलब है कि शिशु गर्भ में मर गया और मृत अवस्था में माँ के गर्भ में ही रहा। इससे यह समझ में आया कि भ्रूण (बढ़ता हुआ शिशु) को नुकसान अथवा मौत तो जहरीली गैस के संपर्क में आने पर ही हो गयी थी परंतु गर्भ गिरा कुछ समय बाद ही। किन्तु अब तक किसी रपट में इस अनुमान का वैज्ञानिक प्रमाण नहीं छपा है।

गर्भपात व मृत शिशु जन्म दर बढ़ने के पीछे शारीरिक व मानसिक तनाव की भूमिका रही होगी। इतनी भयानक उथल-पुथल डर और विषाद के दौर में इस प्रकार के तनाव होना स्वाभाविक है। यूनियन कार्बाइड इसके लिये भी उतनी जिम्मेदार है जितनी कि गैस के सीधे जहरीले असर के लिये।

जिन औरतों ने गैस रिसन के बाद बच्चों को जन्म दिया उनमें से कई ने इस बार पहले की जचकी से ज्यादा परेशानी और दर्द की शिकायत की। यह मालूम नहीं है कि यह जहरीली गैस का सीधा असर है और यदि ऐसा

है तो क्या ?

7·4 दूध आना

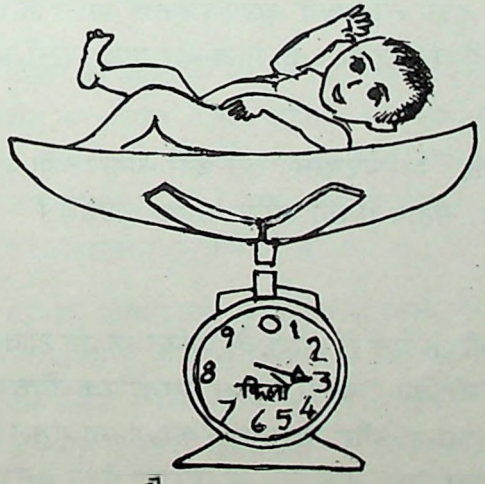
गैस रिसन के समय जो माँयें बच्चों को दूध पिलाने की अवस्था में थीं उनमें से अधिकांश ने दूध की कमी हो जाने की शिकायत की है। यहाँ तक कि सरकारी सूत्रों के अनुसार गाय व भैंसों का दूध भी बहुत कम हो गया है। औरतों के मामले में दूध को नापना वैसे ही मुश्किल है और इस तरफ अधिकारियों ने ध्यान भी नहीं दिया। इस कारण से कुछ भी साबित कर पाना कठिन है। परंतु हमने कई बहुत कमजोर बच्चों को देखा जिन्हें हमारे पास दस्त के कारण लाया गया था। बोतल से दूध पिलाने के कारण भी ऐसा हुआ था।

दूध की कमी

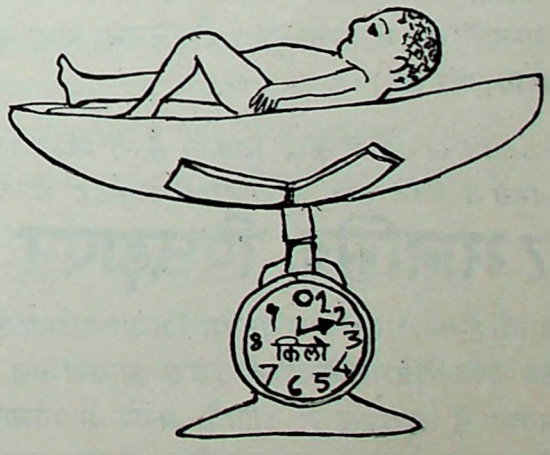
7·5 नवजात शिशु

कई माँओं ने हमें बताया कि जन्म के समय उनके बच्चों की हथेलियों और एड़ियों की चमड़ी खिर रही थी और शरीर के दूसरे हिस्से पर फफोले थे। ऐसे कुछ मामले हमने खुद देखे। उन्होंने यह भी बताया कि बच्चों का रंग हरा-सा था जो कि करीब एक महिने तक रहा। इस बात की पुष्टि हम खुद देखकर नहीं कर पाये हैं।

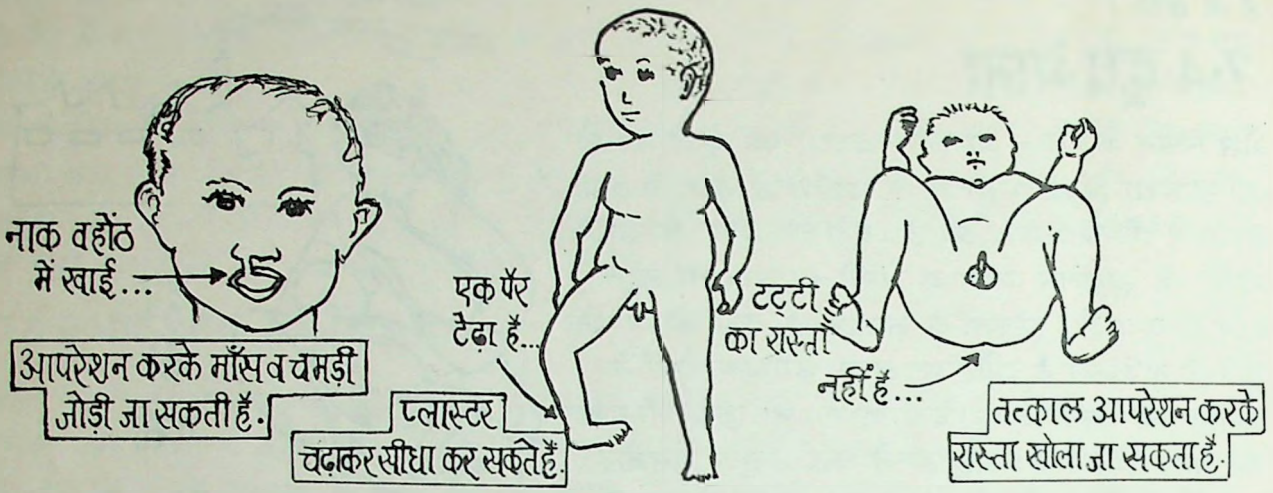
आमतौर पर यह बताया गया कि अभी जन्मे बच्चे अपने बड़े भाई-बहनों के जन्म के समय के आकार की तुलना में छोटे थे। जैसा कि हाल की सरकारी रपट में बताया गया है कि



औसत वजन का स्वस्थ्य बच्चा



कम वजन का कमजोर बच्चा



गैस प्रभावित इलाकों में जन्म के एक महिने के अंदर नवजात शिशुओं की मृत्यु दर सामान्य से अधिक बढ़ गई है।

7.6 बच्चों की विकृतियाँ

हाल ही में सरकारी रपट में कहा गया है कि नवजात शिशुओं में 3 से 4 प्रतिशत विकृतियाँ आयीं है। यह सामान्य से लगभग दुगुनी है पर आशंका इससे भी ज्यादा की है। किन्तु दुर्भाग्य से कई बार शव परीक्षा ही नहीं की गई और कई बार डॉक्टर नहीं थे, जिससे यह पता लगे कि जहरीली गैस से कितनी और किस तरह से विकृतियाँ पैदा हुई।

हमने पाया कि सबसे अधिक मामले दिमाग न बनने (जिसे एनेन सिफेली कहते हैं) और रीढ़ की हड्डियों में दरार रह जाने (जिसे स्पायना बिफिडा कहते हैं) के थे। पहले वाली विकृति में खोपड़ी भी नहीं बनती और दूसरी वाली में रीढ़ की हड्डी में होने वाली तंत्रिकायें बाहर निकल आती हैं। कुछ ऐसे मामलों का भी पता चला है जिनमे रीढ़ की हड्डी की विकृति के साथ बंद गुदा नली और पैरों में भी विकृति थी।

यदि आपके बच्चे में कोई विकृति है तो संभावना है कि **आपरेशन** से इसे ठीक किया जा सके। ऐसे बच्चे के लिये आपको यूनियन कार्बाइड से आजीवन सहायता की माँग करना चाहिये।

7.7 मानसिक पिछड़ापन

जैसा कि हमने पहले बताया था कि हो सकता है कि माँ के पेट में शिशु के मस्तिष्क को आवश्यकता से कम आक्सीजन मिली हो। इस आक्सीजन की कमी का एक परिणाम मानसिक पिछड़ापन हो सकता है। बचपन में आपके बच्चे के मानसिक विकास और क्षमताओं का नापना बहुत आसानी से हो सकता है। यदि आपको चिंता है कि आपका बच्चा मानसिक रूप से पिछड़ा है तो आप नजदीक के सरकारी पॉली क्लीनिक के बच्चों के डॉक्टर के पास जायें। जो बच्चे गैस रिसन के कारण

मानसिक रूप से पिछड़ गये हैं उन्हें यूनियन कार्बाइड व सरकार से आजीवन सहायता मिलनी चाहिये। उनके माँ-बाप को इसकी माँग करना चाहिये

7.8 भविष्य में गर्भधारण

वे सारे शिशु जो गैस रिसन के समय गर्भ में थे सितम्बर के अन्त तक जन्म ले चुके हैं। उसके बाद गैस प्रभावित दंपत्तियों के जो बच्चे होंगे वे गैस रिसन के बाद के गर्भ धारण से होंगे।

आज हम यह कहने की स्थिति में नहीं हैं कि आपके अजन्मे बच्चों या बच्चों के बच्चों में गैस के प्रभाव से कोई नुकसान होगा या नहीं। सरकार को चाहिये कि वह आने वाली दो पीढ़ियों तक लगातार जाँच करती रहे कि कोई नई बात तो नहीं हो रही है।

यदि आप अभी बच्चा नहीं चाहते हैं तो इसके लिये सबसे अच्छा तरीका यही होगा कि पुरुष निरोध का इस्तेमाल करें। आपके स्वास्थ्य को देखते हुये गर्भ रोकने वाली हारमोन गोलियों या इन्जेक्शनों का उपयोग न करें। आप देखती रहें कि आपके पति निरोध का बराबर इस्तेमाल कर रहे हैं या नहीं।

आपको प्राकृतिक परिवार नियोजन के लिये ग्यूकस वाला तरीका भी सीखना चाहिये जिससे आप अनचाहे गर्भ से बच सकें। इन तरीकों से आपको पता चल जायेगा कि महिने के किन दिनों में आपको संभोग नहीं करना चाहिये। यदि आप सचमुच भविष्य में कोई बच्चा नहीं चाहते हैं तो पति या पत्नी अपना आपरेशन भी करवा सकते हैं।

गैस रिसन से कुछ लोगों के छोटे बच्चे मर गये हैं और वे फिर से बच्चा चाहते हैं लेकिन उन्होंने आपरेशन भी करवा लिया था। वे लोग अपना आपरेशन उलटवा सकते हैं। कई लोग अपना आपरेशन उलटवा भी चुके हैं। इसमें कुछ हद तक सफलता मिल सकती है। अपने स्वास्थ्य कार्यकर्ता से इस बारे में जानकारी प्राप्त करें। आपरेशन के दौरान और तुरन्त बाद में आपको विशेष देखभाल की जरूरत रहेगी। आपरेशन मुफ्त में होगा।

यदि आपको पता चलता है कि आप गर्भवती हैं तो हम चाहेंगे कि आप अपनी दैनिक देखभाल के लिये आवश्यक सलाह लें। ये सलाह सभी गैस प्रभावित गर्भवती महिलाओं के लिये है। सरकार ने इसके लिये विशेष केन्द्र स्थापित किये हैं। ऐसे और भी केन्द्रों की जरूरत है, जो और भी अधिक और बेहतर सुविधायें मुहैय्या करा सकें।

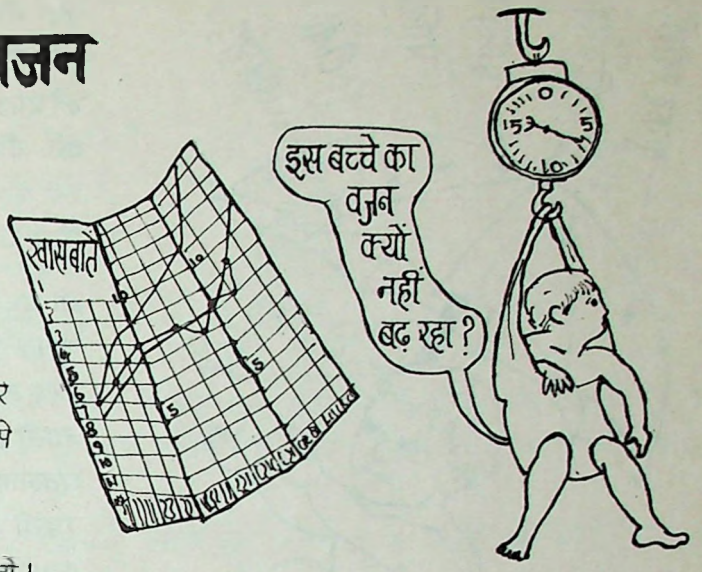
बच्चों का स्वास्थ्य

बड़ों के मुकाबले बच्चों का शरीर मुलायम और नाजुक है। इसलिये उन पर गैस का ज्यादा असर हुआ है। उनमें से कुछ तो इस नुकसान के बोझ को जिंदगी भर उठायेंगे। कुछ बच्चों में हो सकता है कि यह उम्र के साथ बढ़ता जाये। उन्हें स्वास्थ्य की सही देखभाल और सही सलाह मिलना जरूरी है। इसके साथ-साथ इन बच्चों के स्वास्थ्य की प्रगति और किसी भी गड़बड़ी का लेखाजोखा रखना होगा। इसी के आधार पर इनके लिये जो विशेष साधन जुटाने होंगे उनका हर्जाना यूनियन कार्बाइड से वसूल किया जा सकेगा। यह सरकार की नैतिक जिम्मेदारी है कि गैस प्रभावित इलाके के बच्चों के स्वास्थ्य की सही देखभाल हो।

8.1 बीमारी में चिकित्सा

बच्चों की खास देखभाल के लिये सरकार को चाहिये कि वह गैस प्रभावित इलाकों में पर्याप्त डॉक्टर व स्वास्थ्य कार्यकर्ता मुहैया कराये। कमजोर हो गये बच्चों (जिन्हें ज्यादा खतरा है) को खोजने में स्वास्थ्य कार्यकर्ताओं को डॉक्टर की मदद करना चाहिये। बार-बार डाक्टर और स्वास्थ्य केन्द्र बदलना ठीक नहीं। बल्कि एक ही केन्द्र पर रहें। इससे आपके बच्चे को सबसे अच्छी स्वास्थ्य सुविधा मिल सकेगी।

४.२ नियमित जाँच व वज़न



डॉक्टर या स्वास्थ्य कार्यकर्ता द्वारा आपके बच्चे की नियमित जाँच हर महिने होनी चाहिये। जाँच का एक महत्वपूर्ण हिस्सा बच्चे का वज़न लेना होगा। जन्म से पाँच साल तक यह नियम से होना चाहिये। इससे आप जान सकेंगे कि बच्चे का वजन उसकी उम्र के मुताबिक है या नहीं। इसी स्वास्थ्य कार्ड पर स्वास्थ्य कार्यकर्ता और भी बातें लिखेंगे, जैसे बच्चे को कोई बीमारी या कमजोरी या उसे टीका देने की तारीख आदि। इस स्वास्थ्य कार्ड की नकल आपके पास भी रहनी चाहिये। एक स्वास्थ्य कार्यकर्ता घर-घर जाकर बच्चों का वजन ले सकता है। सरकार से यह सुविधा मांगना आपका हक है।

यदि जाँच के दौरान यह पता चलता है कि बच्चा ठीक से बढ़ नहीं रहा है तो आपको पास के सरकारी स्वास्थ्य केन्द्र पर जाना चाहिये, इसे टालें नहीं। न बढ़ने के कारणों का जल्दी पता लगा लेना बेहतर होता है। इसके कई कारण हो सकते हैं। जैसे आवश्यक भोजन न मिलना, जब-तब दस्त लगना, कीड़े, कान बहना, चमड़ी पर रोग या टी.बी. आदि। ऐसा भी हो सकता है कि आपके बच्चे के फेफड़े गैस के कारण कमजोर हो गये हों या बच्चे में रोग से लड़ने की ताकत कम बची हो।

४.३ टीके

टीके देने से बच्चे की कुछ खास छूत की बीमारियों से लड़ने की ताकत बढ़ाई जा सकती है। यह इसलिये भी जरूरी है क्योंकि मिक ने शरीर की आत्मरक्षा प्रणाली को कमजोर कर दिया है। टीके इन्जेक्शन से भी दिये जाते हैं, और पिलाये भी जाते हैं। टी.बी., कुकर खाँसी, डिप्थीरिया, टिटेनस, पोलियो और खसरा (मिजल्स) के टीके होते हैं। कुकर खाँसी डिप्थीरिया और टिटेनस का एक ही मिला-जुला टीका होता है, जिसे 'तिहरा टीका' कहते हैं। ध्यान रखें कि आपके बच्चे को सही समय

पर टीका लगे। टीकों के लगाने के सही समय की जानकारी आगे दी है।

भोपाल में पाँच वर्ष तक के सभी बच्चों को टीका लगना चाहिये। यदि किसी बच्चे को समय पर टीका नहीं लगा है तो देर होने पर भी उसे टीका अवश्य लगवायें।

जो बच्चा कमजोर है या जिसका परिवार बहुत गरीब है उसके लिये खसरा रोग के परिणाम भयानक हो सकते हैं। इससे भूख कम हो जाती है और बच्चे की अन्य बीमारियों के खिलाफ अपना बचाव करने की ताकत जाती रहती है। ऐसा बच्चा खाँसी निमोनिया, दस्त, कान बहने और चमड़ी रोग पैदा करने वाले कीटाणुओं के खिलाफ ठीक से नहीं जूझ पाता। इसलिये रोग होने के बाद बच्चा अक्सर बीमार रहता है। बार-बार उसे छूत की बीमारियां होती हैं और धीरे-धीरे कमजोर होता चला जाता है। वह काफी भोजन नहीं पचा पाता और छूत की बीमारियों से जूझ नहीं पाता। इस प्रकार वह कुपोषण और छूत की बीमारियों के ऐसे दुष्चक्र में फंस जाता है जिससे उसे बचा पाना एक अच्छे डाक्टर के लिये भी संभव नहीं होता। यह दुष्चक्र बच्चे की मौत में बदल सकता है।

टीका लगाने का समय चक्र

कौन सा टीका?	किस बीमारी के खिलाफ	टीका कब दिया जाये
बी. सी. जी. टीका	टी. बी.	जन्म के समय एक ही बार।
तिहरा टीका (इन्जेक्शन)	कुकर खांसी, डिप्थीरिया टिटेनस	जन्म के तीसरे, चौथे व पांचवे महिने। तीन खुराक।
पोलियो (पिलाने की दवाई)	पोलियो	चौथे महिने से शुरू करके हर महिने एक बार, पाँच खुराक
खसरा टीका (इन्जेक्शन)	खसरा	नौवें महिने के बाद जितनी जल्दी हो सके, एक खुराक।

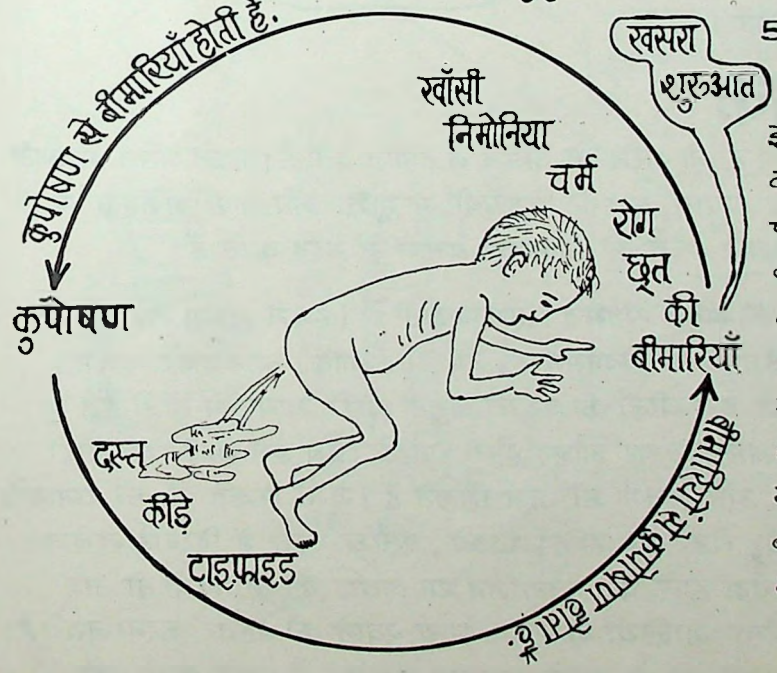
नोट: कोई टीका समय पर न लगने पर भी कोई हर्ज नहीं। बाद में भी लग सकता है। पर टीका लगवाये जरूर।

एकतरह से खसरा भारत व अन्य गरीब देशों में नम्बर एक की जानलेवा बीमारी है। इसलिये खासकर भोपाल में यह बहुत जरुरी है कि पाँच वर्ष तक के सभी बच्चों को खसरा का टीका दिया जाये। यह बहुत सस्ता टीका है और इसका कोई खराब असर नहीं होता है। इसे सरकार को उच्च प्राथमिकता देकर मुहैया करवाना चाहिये।

8.4 सफाई क्यों और कैसे?

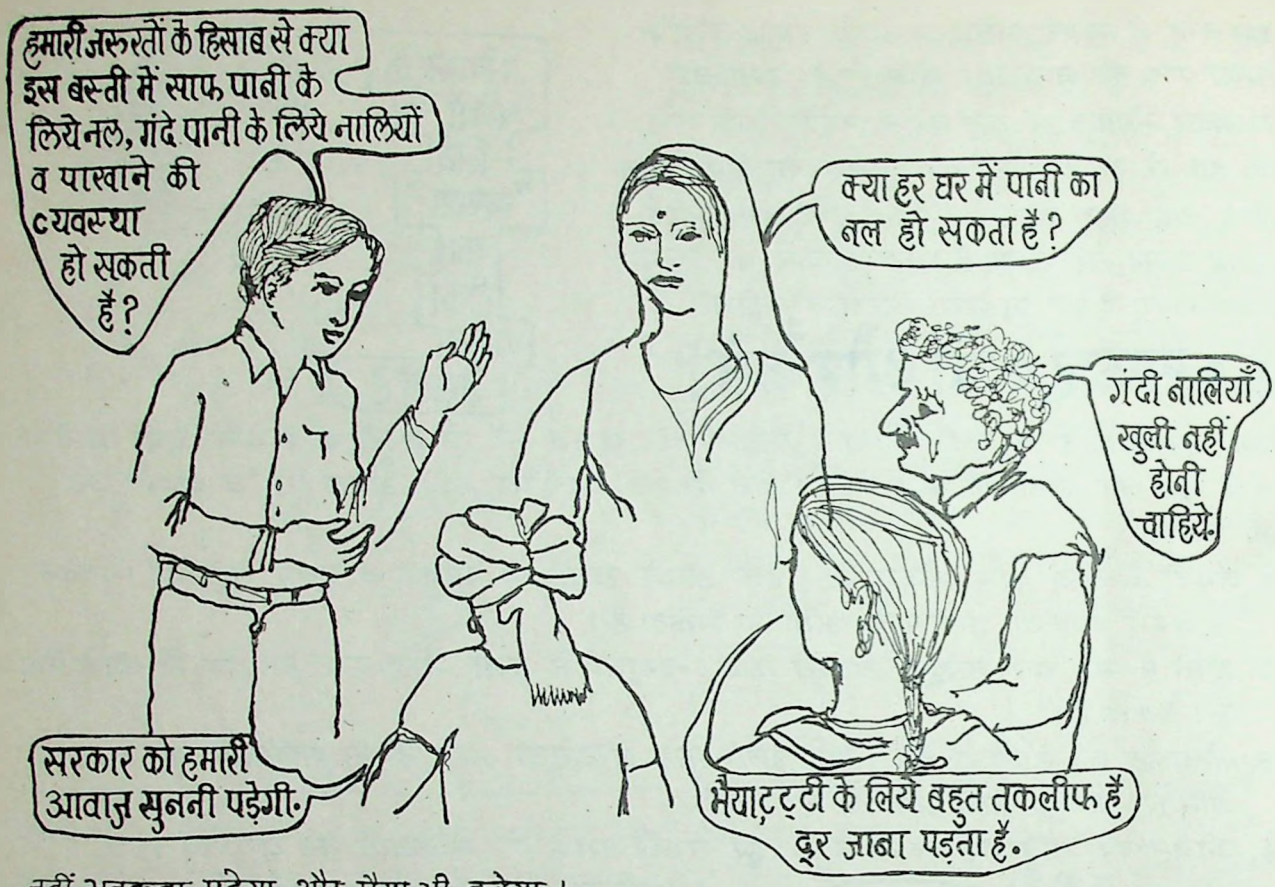
अगर हम सफाई के कुछ आसान नियमों का पालन करें तो दस्त, कीड़े और चमड़ी के रोगों जैसी छूत की बीमारियाँ कम होंगी। नीचे दी गई बातों पर खुद अमल करें व बच्चों को भी सिखायें:

1. टट्टी के बाद और भोजन के पहले अपने हाथों को साबुन व पानी से धोयें। साबुन के बदले राख का इस्तेमाल किया जा सकता है।
2. हफ्ते में एक बार नाखून अवश्य काटें। नाखूनों में जमा मैल दस्त या पेट में कीड़े पैदा कर सकता है।
3. शौचालय का उपयोग करें। यदि आप खुले में टट्टी करते हैं तो मक्खियाँ या अन्य जानवर कीटाणु फैला सकते हैं।
4. भोजन पर मक्खियाँ न बैठने दें। हर संभव तरीके से मक्खियों को दूर रखें।



5. रोज साबुन लगाकर नहायें। इससे चमड़ी के रोगों से बचाव होगा।

इन नियमों पर अमल के लिये सरकार को काफी कुछ करना होगा। सरकार को चाहिये कि वह ज्यादा पानी मुहैया करे। नालियों की बेहतर व्यवस्था करे और बस्तियों में साफ सुथरे शौचालयों का काफी सँख्या में निर्माण करे। आपको संगठित होकर माँग करना चाहिये कि आपकी बस्ती में लोग स्वस्थ रह सकें। यह सरकार का फर्ज है। सफाई की ये आदतें बच्चे तभी सीखेंगे जब माँ-बाप उन्हें खुद करें। इससे उन्हें भी फायदा होगा क्योंकि उन्हें बीमार बच्चे को लेकर जगह-जगह



नहीं भटकना पड़ेगा और पैसा भी बचेगा।

8·5 भोजन या टॉनिक

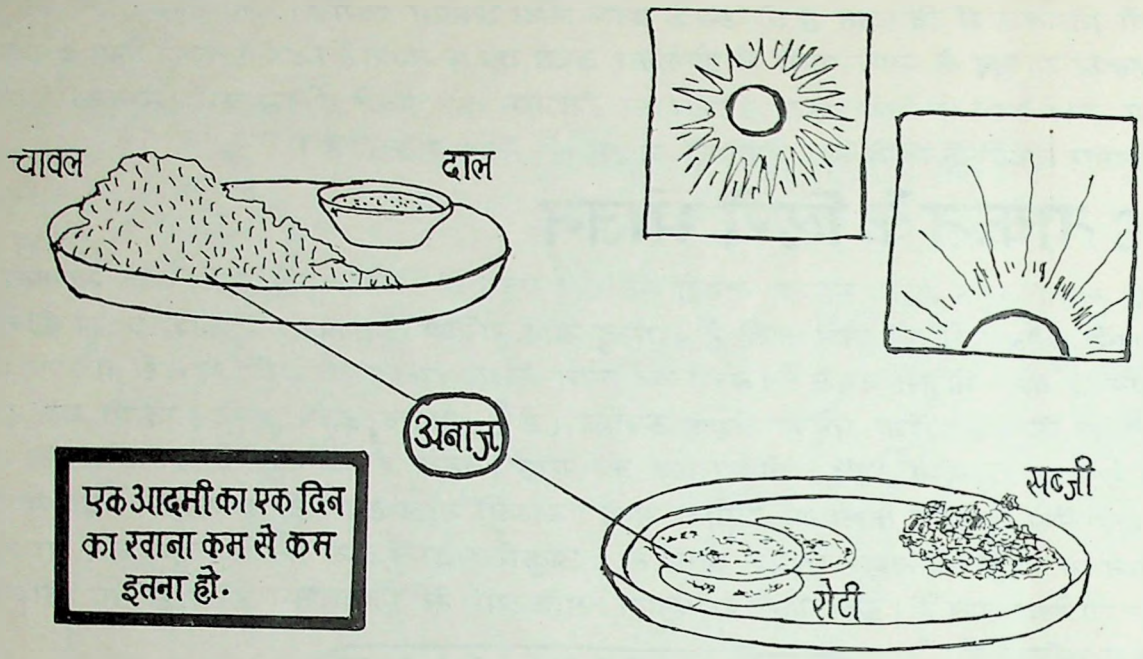
दुनिया में ऐसी कोई टानिक की शीशी नहीं हैं जो शरीर को असल में ताकत देती हैं। ताकत असल में आती है तो पर्याप्त भोजन, पर्याप्त व्यायाम और आराम, छूत की बीमारियों से मुक्ति और साफ आबोहवा से। इनके अलावा माँ-बाप का प्यार और ध्यान बच्चे को ताकतवर बनाने में मदद करते हैं।

बाजार में मंहगे बिकने वाले टानिकों की बहुत सीमित भूमिका होती है। इनमें मुख्य तौर पर दो प्रकार की चीजें होती हैं। एक तो विटामिन (जैसे विटामिन ए, बी, सी, आदि) और दूसरे लवण। शरीर को बढ़ने और काम करने के लिये इन चीजों की जरूरत बहुत थोड़ी मात्रा में होती है। ये विटामिन या लवण हमारे भोजन में आमतौर पर मौजूद होना चाहिये। जब हमें काफी या सही खाना नही मिलता तो हमें विटामिन और लवण भी कम मिलते हैं। ऐसी स्थिति में कई समस्यायें पैदा हो सकती हैं, जैसे मुँह में छाले, चेहरे पर सफेद धब्बे, रतौंध (रात में दिखाई न देना) भूख न लगना आदि। ये समस्यायें पैदा होने पर विटामिन या लवण की गोलियाँ दी जा सकती हैं। ये बहुत सस्ती होती हैं। परन्तु गोलियों के साथ-साथ खाने को बेहतर करना जरूरी है। क्योंकि पर्याप्त संतुलित भोजन की कमी ही तो सारी समस्या की जड़ है। यदि बच्चे को

गोलियाँ निगलने में दिक्कत है तो उसके बदले मीठा सिरपन खरीदें। आप खुद गोली को पीस-कर शक्कर या गुड़ के साथ पानी में घोलकर बच्चे को दे सकते हैं। इससे काफी पैसा बचेगा जिससे आप बच्चे के लिये बेहतर भोजन का इंतजाम कर सकते हैं। सरकारी स्वास्थ्य कार्यकर्ती से कमजोर बच्चों के लिये यह गोलियाँ मुफ्त भी मिल सकती हैं।

8·6 ताकत के लिये भोजन

अच्छा खाना बहुत मंहगा हो यह जरुरी नहीं है। बच्चे के लिये जरुरी सारी चीजें सामान्य शाकाहारी भोजन में भी मिल जाती हैं। परन्तु **याद** रखिये कि अलग-अलग प्रकार की चीजों से मिलकर बना भोजन जरुरी है। बच्चे का काम केवल चावल या रोटी से नहीं चलेगा। कई चीज़ों को मिलाकर देना पड़ेगा। **एक अनाज** (गेहूँ, चावल, ज्वार आदि) किसी एक दाल के साथ (अरहर, चना आदि) जो अनाज का एक तिहाई हो और कोई एक मौसमी सब्जी या फल जैसे, **अमरुद**, केला या पपीता आदि। सब्जी दाल **या** रोटी **के साथ** थोड़ा-सा तेल मिलाने से बच्चे को बहुत फायदा होता है। अंकुरित दालें, जैसे भिगोये हुये चने या मूंग बहुत पौष्टिक होते हैं। **हरी**, पीली या लाल सब्जियों में विटामिन होते हैं जो लोगो को फायदा पहुँचाते हैं।



फायदा पहुँचाते हैं। यदि कुछ अधिक पैसे हों तो माँसाहारी लोग अन्डे, मछली या माँस खरीद सकते हैं और शाकाहारी परिवार दूध, मूंगफली और गुड़ आदि। ये बढ़ती उम्र के बच्चों को ताकतवर और स्वस्थ बनाते हैं।

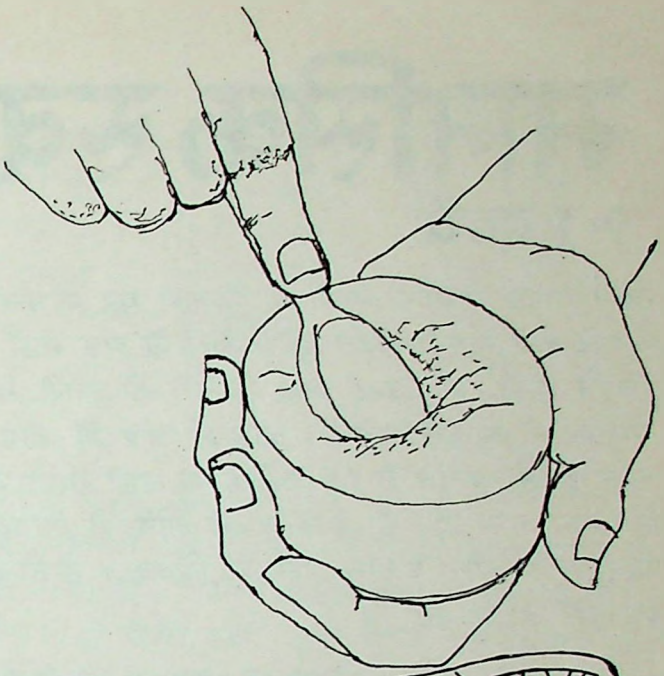
४.७ छोटे बच्चों का भोजन

बहुत छोटे बच्चों को खाना खिलाने में काफी सावधानी की जरूरत है। पहले छह महिनों तक माँ का दूध सबसे अच्छा है। इसके लिये जरूरी है कि माँ को संतुलित भोजन मिले। कई गैस पीड़ित माँओं ने दूध की कमी की शिकायत की है। इससे उनके बच्चे भूखे रह जाते हैं। ऊपर का दूध देने में कुछ सावधानियाँ रखनी पड़ती हैं। ऊपर का दूध बोतल से न पिलायें। इसके बजाय कटोरी व चम्मच का इस्तेमाल करें जिसे आसानी से साफ कर सकते हैं। शुरुआत में ऊपर के दूध को जो गाढ़ा होता है, आधा पानी मिलाकर पतला कीजिये व थोड़ी शक्कर डालें ताकि यह माँ के दूध के समान मीठा हो जाये।

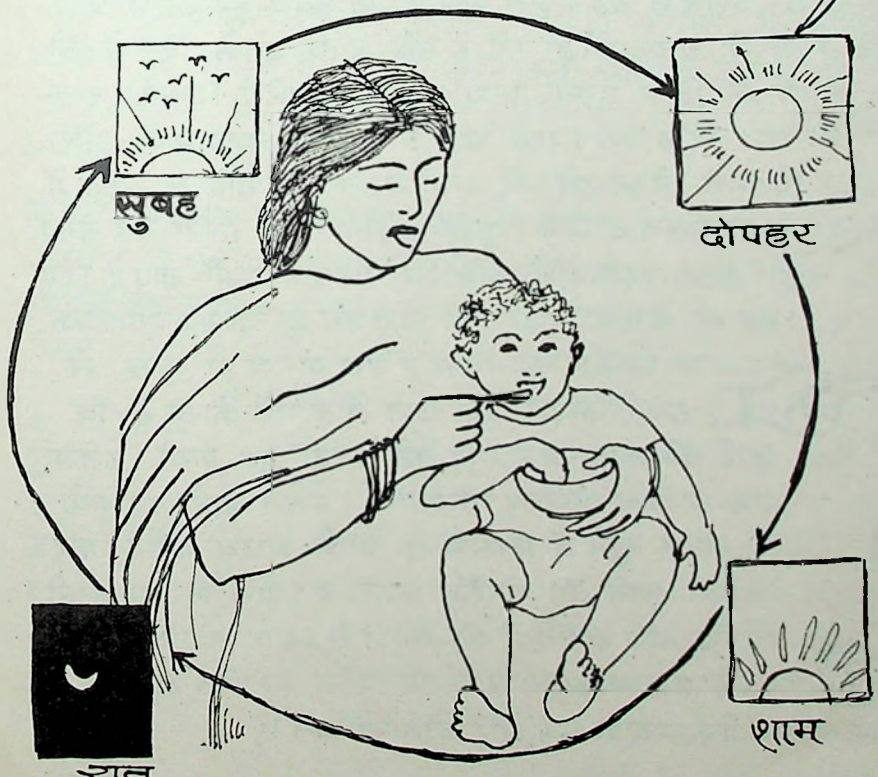
माँ का दूध बच्चे को स्वस्थ्य रखने के लिये पहले छह महिने तक ही काफी होता है। जो बच्चे इसके बाद दूसरा खाना नहीं खाते हैं वे कमजोर हो जाते हैं और बीमार भी ज्यादा पड़ते हैं। बड़ों को सिर्फ काम करने के लिये खाने की जरूरत

होती है जबकि बच्चों को बढ़ने के लिये भी भोजन की जरूरत होती है। इसलिये उनकी भोजन की जरूरत दुगुनी होती है। वैज्ञानिकों ने पता लगाया है कि दो वर्ष के स्वस्थ बच्चे को उसकी माँ जो खाती है, उसके डेढ़ गुना भोजन की जरूरत है। इतना खाने के लिये बच्चे को कम से कम चार बार खिलाना पड़ेगा।

इसलिये बच्चे को छह महिने की उम्र से ही कुछ खिलाना शुरू करें। यदि किसी कारण से दूध काफी नहीं है तो चार महिने से शुरू कर दें। शुरुआत नरम और आसानी से पचने वाले भोजन से करें। छोटे बच्चों को कब और क्या खिलाना चाहिये यह जानकारी अपने इलाके में काम करने वाले डॉक्टर या स्वास्थ्य कार्यकर्ता से लें।



चार महिने से नरम खाना खाने की आदत बन गई है.



बच्चों को स्वस्थ्य रखने और कई बीमारियों से बचाने वाले तीन महत्वपूर्ण अंगरक्षक हैं :

- पोषक आहार
- स्वच्छता
- टीके (प्रतिरक्षक)

मानसिक स्वास्थ्य

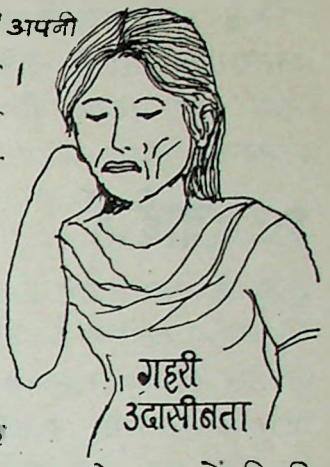
१·१ बच्चे

गैस रिसन ने सभी लोगों के दिमाग पर गहरा असर किया है। पर बच्चे सबसे बुरी तरह प्रभावित हुये क्योंकि वे यह नहीं समझ पाये कि क्या हुआ जिसने उनके माँ-बाप, भाई-बहनों को उनसे अलग-अलग कर दिया। कुछ बच्चे तो अपने परिवार मे अकेले बचे हैं। आज भी जब माँ-बाप अपने बच्चों को 'जन स्वास्थ्य केन्द्र' में लाते हैं तो बताते हैं कि वे ठीक से नहीं खाते हैं। रात में बच्चे घबराये से सोते हैं, बीच-बीच में डरकर जाग जाते हैं। कुछ बच्चे नींद में पेशाब कर देते हैं। इन बच्चों को स्कूल में बातें याद रखने और ध्यान देने में दिक्कत होती है। कुछ बच्चे जो काम करते थे, अब काम पर नहीं जा पा रहे हैं।

इन दिक्कतों के लिए बच्चों को डाँटे या मारें नहीं। मार से ये दिक्कतें शायद और गहरी हो जायें। **डाँटने**- मारने से फायदा नहीं उल्टा नुकसान है। आपको बच्चे का मन जीतना चाहिये ताकि अपने अन्दर के डर के बारे में **वह** सब कुछ बता दे। इस तरह आप बच्चे के दिमाग से डर को बाहर निकालने में सफल हो सकेंगे। इससे वे यह समझ सकेंगे कि उनके डर के पीछे **उस** समय हुई घटनायें हैं। अब न तो ये घटनायें हो रही हैं और न ही इनके फिर से होने की संभावना है। बच्चे में हौसला बढ़ाने के लिए उसके साथ वक्त गुजारिये। उसकी क्षमताओं व पहले की कामयाबियों की याद दिलाइये। यदि आप थोड़ा पैसा बचा सकें और समय हो तो बच्चों को ऐसी जगह दिखाने ले जाइये जो उन्हें पसंद हो। यदि वे स्कूल में हैं तो उन्हें उनकी पढ़ाई में मदद व प्रोत्साहन दीजिये। कुछ लड़कियों के लिए यह समय लड़कों की बनिस्वत ज्यादा बुरा रहा। कुछ लड़कियों के भाई मर गए। ऐसे माँ-बाप के लिए

यह न केवल दुःख की बात थी बल्कि एक सामाजिक व आर्थिक घटना भी। इस कारण से कुछ ने अपनी लड़की को इस बात पर कोसा है कि भाई की जगह वह खुद **क्यों नहीं** मर गयी। इससे एक अपराध भावना पनपती है। हमने कई लड़कियों के सपने **सुने हैं जिसमें** वे अपने भाइयों को ढूँढकर वापिस **लाने की कोशिश** करती है। ऐसे में यह जरूरी है कि आप बच्चियों को ज्यादा से ज्यादा प्यार करें व उन्हें इसका अहसास कराये। गैस प्रभावित बस्तियों में ऐसी व्यवस्था करायी जानी चाहिये। जिससे ये लड़कियाँ रोज़गार पा सकें, और बोझ न बनें।

बच्चियों से प्यार करने की यह सलाह शायद आपके लिए मुश्किल हो। अपनी रोजमर्रा की जरूरतें पूरी करने में ही शायद बहुत मेहनत करनी पड़ती हो। शायद आप स्वयं भी उतनी अच्छी दिमागी हालत में न हों। इसके बावजूद हम कहेंगे कि आप कुछ करें। क्योंकि इस मामले में आपके सिवा बच्चे की मदद कोई और नहीं कर सकता। यदि मदद की जरूरत हो तो आप ऐसा स्वास्थ्य कार्यकर्ता या डॉक्टर ढूँढे जिसकी सहानुभूति और सलाह पर आपको भरोसा हो।

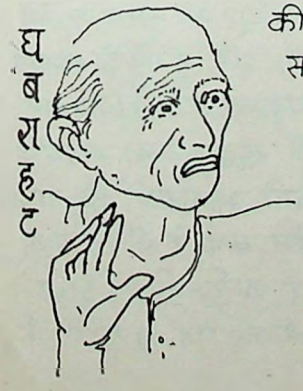


१.२ बड़े

शायद गैस दुर्घटना का आपके दिमाग पर इतना गहरा असर हुआ है कि आप रोजमर्रा के जीवन को मुश्किल से संभाल पा रहे हैं। या आपके घर में किसी को या किसी दोस्त को मानसिक बीमारी हो गयी हो, जिसमें डॉक्टरी इलाज की जरूरत पड़ी हो। यह बीमारी एक भयानक यातना बन गयी होगी, और कई लोग इसी कारण से काम पर न लौट सके हों। कुछ लोगों की पहले से चली आ रही मानसिक बीमारी और बिगड़ गयी होगी। ऐसे सभी लोगों को सहानुभूति व उचित देखभाल की जरूरत है।

गैस रिसन के कारण दो प्रमुख मानसिक परेशानियाँ पैदा हुयी हैं, गहरी उदासीनता और घबराहट। उनींदापन, कमजोरी, दुःख, भूख न लगना, यौन इच्छा न होना आदि गहरी उदासीनता के लक्षण हैं। छाती में कसाव, धड़कन बढ़ना, छोटी-छोटी साँसें, ज्यादा पसीना, उचटी हुई नींद या भयानक सपने आना, याददाश्त की कमजोरी, शरीर में तनाव व दर्द आदि घबराहट के लक्षण हैं।

गहरी उदासीनता व घबराहट आमतौर पर साथ-साथ होते हैं। दिन भर इनमें उतार-चढ़ाव भी आते रहते हैं। एक तरह की अपराध भावना व स्वयं तथा औरों के प्रति नकारात्मक विचार गहरी उदासीनता की आम बातें हैं। घबराहट के कारण अत्यधिक डर व आतंक का भाव पैदा होता है। जिन लोगों को ऐसा नहीं होता उन्हें ये भावनायें अवास्तविक लगती हैं और अक्सर वे इन्हें फितूर कहकर टालने की कोशिश करते हैं। सच यह है कि इन लोगों की भावनायें हमसे कहीं ज्यादा तीव्र होती हैं। ऐसे व्यक्ति आत्महत्या तक कर सकते हैं। हमें ऐसी भावनाओं को नकारना नहीं चाहिये बल्कि उस व्यक्ति के साथ बैठकर, बतियाकर व आदर से उसकी बात सुनकर उसकी भावनाओं के बोझ को हल्का करने में मदद देनी चाहिये। इससे व्यक्ति के जीवन में काफी बदलाव आयेगा और वह अपना खोया आत्मविश्वास, वास्तविकता का अहसास और आत्मसम्मान सब पा लेगा। आत्मसम्मान के लिए यह भी जरूरी है कि व्यक्ति को यह महसूस हो कि वह उपयोगी है। वह कुछ कमा सके तो बहुत ही अच्छा है।



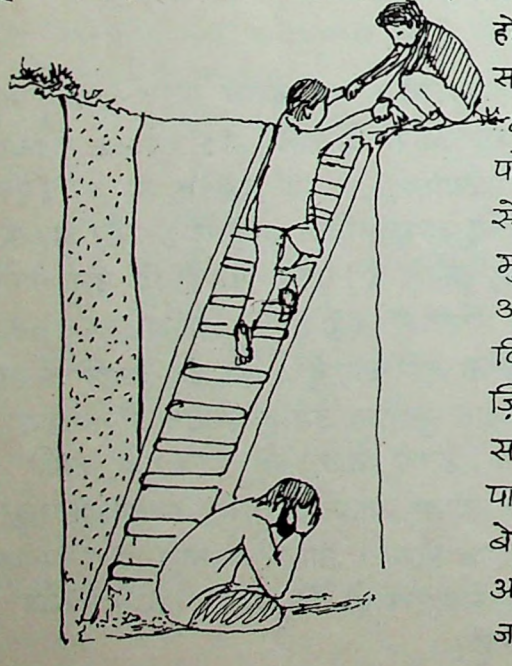
जिन्हें ऊपर बतायी गई तकलीफें हैं उनसे हमारा कहना है कि ये तकलीफें जीवन के लिए खतरनाक नहीं हैं, चाहे आज वे परेशानी का कारण हों। जैसे दिल की धड़कन बढ़ने से घबरायें नहीं। सारी परेशानियाँ डाक्टर या भरोसेमंद व्यक्ति से कहें। डॉक्टर, रिश्तेदार सबको आपकी समस्या सुननी चाहिए। शायद वे इससे उबरने का कोई रास्ता बता सकें।

१.३ दवाईयाँ

कुछ ऐसी दवाईयाँ हैं जो इस हालत से उबरने में मदद कर सकती हैं। ये डॉक्टर द्वारा दी जा सकती हैं। कई बार ये दवाईयाँ तकलीफ को बहुत हद तक कम कर देती हैं और हालत जल्दी सामान्य होने लगती है। किसी मानसिक संकट से निकलने के लिए यदि कुछ दिन दवा लेना पड़े तो इसमें डर महसूस करने की कोई बात नहीं हैं। यदि आपको लगता है कि जीने का कोई मतलब नहीं है और आत्महत्या करने या दूसरों पर हमला करने की इच्छा होती है तो तुरंत डॉक्टर से सलाह लीजिये। डॉक्टर दवाईयाँ देंगे व दवाई की खुराक पर निगरानी रखेंगे। किसी भी हालत में डॉक्टर की राय से ज्यादा दवाईयाँ न खायें। आखिर में आपको अपने पैरों पर ही खड़े होना है, दवाईयों की बैसाखियों पर नहीं। मानसिक बीमारी में दवाईयों से ज्यादा जरुरत दोस्तों और रिश्तेदारों के सहयोग की होती है। स्वास्थ्य कार्यकर्ता भी मदद कर सकते हैं।

१.४ दोस्त और रिश्तेदार

दोस्तों, रिश्तेदारों और स्वास्थ्य कार्यकर्ता को धीरज के साथ रोगी के साथ समय बिताना होगा। उसकी रूचियों को उजागर करना होगा। उसे ऐसी बातों, गतिविधियों या हुनर से जोड़ना होगा जो उसकी रूचि के रहे हैं। धीरे-धीरे उसकी पुरानी सफलताओं की याद दिलानी होगी। उसकी नयी पहलकदमियों को सराहें व प्रोत्साहन दें। ऐसा भी हो सकता है कि मानसिक परेशानी भुगतने वाले कुछ लोग एक साथ स्वास्थ्य कार्यकर्ता से मिलें और चर्चा करें। क्यों उन्हें हर काम करने में इतनी मुश्किल होती है, सब कुछ इतना उरावना क्यों लगता है? आदि बातों पर बातचीत हो सकती है। वे यह भी सोच सकेंगे कि वे एक दूसरे की मदद कैसे करें या एक दूसरे को सामान्य ज़िंदगी की समस्याओं से जूझने की तरकीब बतायें। कई बार सामान्य लोगों से ज्यादा बीमार लोग खुद ज्यादा मदद दे पाते हैं क्योंकि वे एक दूसरे की अंदरूनी भावनाओं को ज्यादा बेहतर तरीके से समझते हैं। परन्तु इस चर्चा के दौरान एक अनुभवी व परिपक्व मानसिक स्वास्थ्य कार्यकर्ता का होना जरुरी होगा (जो स्वयं कभी इस ढंग से बीमार पड़ चुका हो)।



इससे स्थायी मानसिक स्वास्थ्य समूह बन सकेगा। जिससे मानसिक संकट के समय लोगों को मदद मिल सकेगी। मानसिक रूप से विचलित व्यक्ति भी हमारे आदर के हकदार हैं। कभी मत भूलिये कि वे भी इंसान है। ठीक होने के लिए उन्हें प्यार की जरुरत है।

१.५ असली पागल कौन है?

अक्सर लोग अपने आसपास के अन्याय और निर्दयता से तालमेल न बैठा पाने के कारण मानसिक परेशानियाँ झेलते हैं, या वे किसी भयानक और दर्दनाक अनुभव को भुला नहीं पाते, जैसे - बलात्कार जिसमें उनको ताकत से दबा दिया जाता है और उनकी ज़िंदगी का संतुलन अस्त - व्यस्त कर दिया जाता है। या उन्हें ऐसी स्थितियों में जीने को मजबूर किया जाता है जिसमें उनकी जरुरतों और इच्छाओं का दमन मानवीय सहनशक्ति की सीमा से बाहर हो जाता है। या हो सकता है कि पारिवारिक जिम्मेदारियों का बोझ उनकी ताकत के बाहर हो जाता है और काफी काम करने के बावजूद या काम न मिलने के कारण काफी पैसा भी नहीं पाते हों।

ऐसे लोगों को पागल कहा जाता है। या कहा जाता है कि वे बीमार हैं और उन्हें इलाज के लिए डॉक्टर के पास ले जाया जाता है या कई बार कहा जाता है कि उन पर भूत लग गया है और झाड़फूँक करवायी जाती है।

परंतु ऐसा कहते हुए हम अपने समाज की उन गलत बातों को भूल जाते हैं जिनके कारण ये लोग टूटन की स्थिति में पहुँचे हैं। क्या हमें खुद समाज में हो रहे शोषण की जानकारी नहीं है? क्या हम खुद रोजाना अन्याय, भ्रष्टाचार, निर्दयता और हिंसा से परेशान नहीं होते या नहीं जूझते? यदि ये चीजें थोड़ी ज्यादा हो जायें तो शायद हम भी पागल हो जायेंगे।

और क्या हममें से कई को इस बात का डर नहीं? परन्तु क्या हमारे अन्दर कुछ गड़बड़ है?

जिस तरीके से हमें जीने को मजबूर किया जाता है, जिस समाज में जीने के लिए जरूरी है कि घुटने टेक दें या बेईमान हो जायें, भ्रष्ट हो जायें या हिंसक हो जायें, क्या यह सब ठीक है? जहाँ यूनियन कार्बाइड हजारों लोगों को कीड़े मकोड़ों की तरह मारकर भी मुजरिम नहीं, सजायाफ्ता नहीं, क्या उस समाज में गड़बड़ नहीं है?

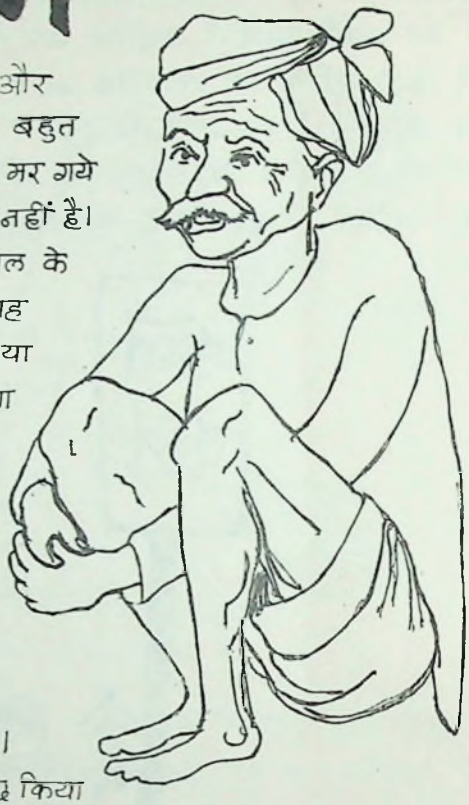
यदि इस सब के बारे में सोचें तो क्या आपको अब भी लगता है कि टूटे हुए लोग समस्या की जड़ हैं? या बीमारी समाज में है? और वास्तव में पागल तो वे हैं जो पैसा बनाने में मशगूल हैं, जो पैसा बनाने के लिए बेकसूर लोगों की जान लेने से भी नहीं चूकते?

जब आप इस प्रकार से समस्या को देखते हैं तो हम कहेंगे कि आप हमारी तरह सोच रहे हैं। और अब अगर आप मानसिक स्वास्थ्य के बारे में चिंतित हैं तो आइये हम सब मिलकर इस बीमारी को समाज से उखाड़ फेंकने के लिए तैयार हो जायें। ताकि सबके लिए सुंदर जीवन बनाया जा सके। एकजुट होकर यूनियन कार्बाइड के खिलाफ लड़िये। उन सभी ताकतों के खिलाफ लड़िये जो कार्बाइड की मदद करती हैं और उसे बचाती हैं। उन सभी ताकतों के खिलाफ लड़िये जो इंसान की जान की इज्जत नहीं करतीं और आपको दबाती हैं। हार मानने से काम नहीं चलेगा।

9.6 मुआवजा

मुआवजे और गैस रिसन से मानसिक स्वास्थ्य पर असर को लेकर हम कुछ कहना चाहेंगे। अमेरिका में ऐसे मामले लोगों ने सामूहिक रूप से अदालत में उठाये हैं। इन मामलों से यह साबित हुआ है कि किसी दुर्घटना का मानसिक असर भी उतना ही नुकसान देह है जितना शारीरिक असर। वहाँ की अदालतों ने इस तरह की दुर्घटना से प्रभावित लोगों की मानसिक वेदना, उनकी ज़िंदगी और इंसानी रिश्तों में उथल पुथल के लिये भरपूर मुआवजे दिलवाये हैं। इन दुर्घटनाओं के लिये जिम्मेदार कंपनियों को प्रभावित लोगों को ये मुआवजे देने पड़े हैं।

बूढ़े लोगों के बारे में



अन्य अल्पसंख्यकों की तरह बूढ़े लोग भी हमेशा लापरवाही और उपेक्षा के शिकार रहते हैं। बच्चों की तरह बूढ़ों को भी गैस ने बहुत ज्यादा नुकसान पहुँचाया है। और प्रभावितों में से अधिकांश मर गये हैं। जो बच गए हैं, स्वास्थ्य की दृष्टि से उनकी स्थिति ठीक नहीं है। लेकिन लोगों के पास उनकी ओर ध्यान देने और सही देखभाल के लिये (जिसकी जरूरत है) बहुत कम समय या ताकत है। लोग यह अहसास करने के लिये ही तैयार नहीं हैं कि बूढ़े लोग उपेक्षा या लापरवाही के शिकार हैं। लोग हमेशा बूढ़ों को भूले रहते हैं या भूले रहना चाहते हैं क्योंकि वे परिवार के कमाऊ सदस्य नहीं होते हैं।

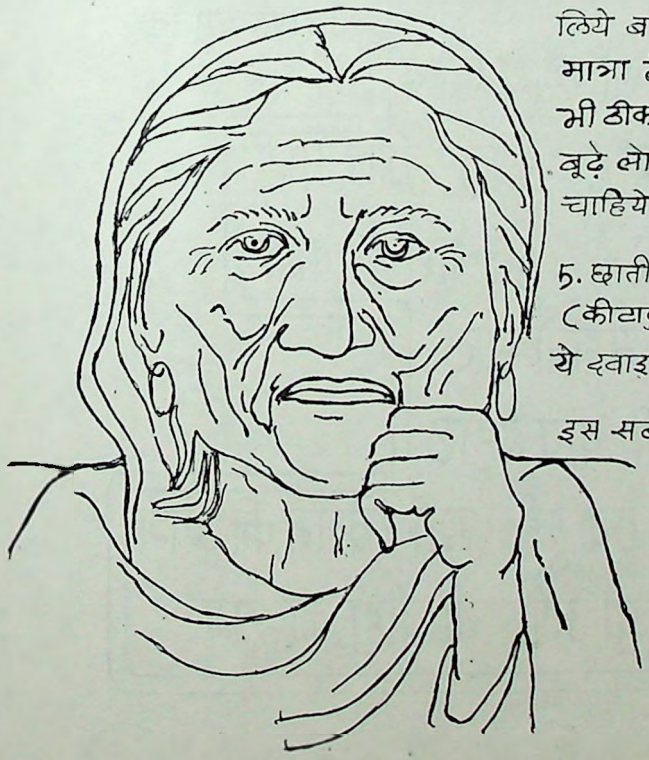
बूढ़े लोगों को विशेष देखभाल और प्यार की जरूरत होती है। यह सच है कि वे अब परिवार को आर्थिक या और किसी तरह की मदद नहीं कर सकते हैं, लेकिन उन्होंने अपने जीवन में समाज और परिवार के लिये बहुत कुछ किया है। त्याग और कड़ी मेहनत से वे हमें बड़ा करते हैं। उन्होंने अपने से पहले की और हमारी पीढ़ी के लिये बहुत कुछ किया है। हमारी संस्कृति को बनाये रखने में उनका बड़ा योगदान है।

यदि हम उनकी उचित देखभाल करेंगे तो वे हमें बहुत कुछ मदद कर सकेंगे। यह बहुत आसान है कि हम उन्हें भुला दें और किसी चीज के लिए उनका अहसान न मानें। अधिकतर बूढ़े लोग कोने में अकेले पड़े मौत का इंतजार करते रहते हैं। उन्हें इस तरह न छोड़ें। उनकी ठीक से देख-भाल की कोशिश करें। बूढ़े लोगों की कुछ खास शिकायतें होती हैं। शरीर ठीक से काम नहीं कर पाता है। हमेशा तकलीफ और दर्द होता रहता है। अक्सर छाती में छूत की बीमारी होती है। गैस की वजह से यह आसानी से निमोनिया में बदल सकती है। कब्ज भी आसानी से हो जाती है क्योंकि पेट की आंतें ठीक से काम नहीं कर पातीं। यदि उन्हें दस्त लग जायें तो बूढ़ी सूखी देह से शरीर का सारा पानी निकल जाता है। हड्डियाँ कड़ी हो जाती हैं और गिरने या फिसलने पर तुरंत टूट जाती हैं। बूढ़े लोगों की आँखें वैसे ही कमजोर होती हैं, गैस ने उन्हें और

भी धुँधला बना दिया है। चूँकि अधिकतर बूढ़े लोगों के दांत नहीं होते हैं **इसलिये** वे आवश्यक मात्रा में भोजन खा या चबा नहीं सकते और न ही अपनी जरूरत के हिसाब से भोजन पका सकते हैं। यही नहीं वे यह भी महसूस करते हैं कि वे अपने लिये कोई खास भोजन की माँग नहीं कर सकते हैं। इसलिये वे हमेशा कुपोषण से पीड़ित रहते हैं। बूढ़े लोगों के दिमाग कभी-कभी कमजोर हो जाते हैं, खासकर बीमारी के समय। ऐसे समय वे बड़ी **मुसीबत** में फंस जाते हैं और कमजोर महसूस करते हैं। यदि इन सब बातों की ओर ध्यान **देकर बूढ़ों के लिये थोड़ा समय निकाला जाये** तो उनका स्वास्थ्य सुधर सकता है **और** साधारण बीमारी को भी वे किस्मत की बात कहकर टालने से बच सकेंगे।

स्वास्थ्य कार्यकर्ता के रूप में हम, लोगों को बुढ़ापे में ठीक **ढंग** से **जिन्दगी** बिताने में मदद कर सकते हैं। बुढ़ापा ज़िंदा मौत नहीं है। कुछ साधारण बातों को ध्यान रखकर परिवार और पड़ोस के बूढ़ों को **स्वस्थ्य** व खुश रखा जा सकता है।

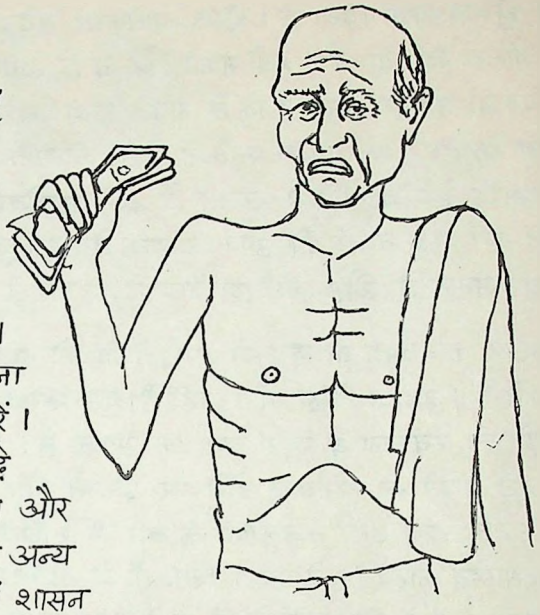
1. बूढ़े लोगों से मुलाकात होने पर इज्जत और लगाव के साथ हाल-चाल पूछें।
2. उनके दर्द और तकलीफों के बारे में पूछिये। जाँच व दवाइयों के बारे में आवश्यक सलाह दीजिये। प्रोत्साहित करिये कि वे राहत शिविरों के डॉक्टर या स्वास्थ्य कार्यकर्ता से मिलें।
3. ध्यान रखें कि सर्दियों में उन्हें आवश्यक गर्मी मिल पा रही है या नहीं। धूप में या आग के पास वे रोज बैठ सकें, इसकी व्यवस्था करें।
4. जिनके दांत नहीं है, उनके लिये **पर्याप्त** मात्रा में **पौष्टिक भोजन जुटाइये**। भोजन मुलायम और आसानी से पचने वाला होना चाहिये। ऐसा भोजन बनाया जाये जैसा एकदम छोटे बच्चों के लिये बनाया जाता है। पकी हुई हरी सब्जियाँ भरपूर मात्रा में दें जो ताकत भी देंगी और आंतों की सफाई भी ठीक से करेंगी। **इससे वे कब्जियत से भी बच सकेंगे।** बूढ़े लोगों को **काफी मात्रा में पानी व अन्य चीजें पीना** चाहिये, खासकर जब दस्त लग रहे हों।



5. छाती की छूत की बीमारियों के लिये एंटी बायोटिक (कीटाणुनाशक) दवाइयों की निश्चित मात्रा देनी होगी। ये दवाइयाँ शासकीय चिकित्सा केन्द्र से मुफ्त मिलती हैं।

इस सबके अलावा हमेशा कोशिश करिये कि बूढ़े लोगों को लगे कि परिवार व समाज को उनकी आवश्यकता है। यदि आप ऐसा करेंगे तो वे भी बच्चों को बड़ा करने में आपकी मदद करेंगे और यह सभी के लिये अच्छा होगा।

बूढ़ों के लिये पेंशन



जिनका कोई करीबी रिश्तेदार नहीं है या जिन्हें रिश्तेदार सहारा नहीं देते, उन बूढ़े लोगों के लिये शासन की पेंशन योजना है। गैस प्रभावित क्षेत्रों में इस योजना को विस्तार दिया गया है व वहाँ सभी बूढ़े व्यक्तियों को पेंशन मिल सकती है। साथ ही उन्हें पौष्टिक आहार भी उपलब्ध हो सकता है। स्वास्थ्य केन्द्रों के काम का एक भाग यह भी होना चाहिये कि वह बूढ़े लोगों की पूरी देखभाल करें। इससे हर परिवार का बोझ कम होगा और बूढ़े लोगों को न्यूनतम स्तर की चिकित्सीय सुविधा और पौष्टिक आहार मिल सकेगा। इस समस्या को अन्य किसी तरीके से नहीं सुलझाया जा सकता। हमें शासन पर दबाव डालना चाहिये कि स्वास्थ्य केन्द्रों में ये सुविधायें मिलें।

जली हुई बीड़ी बुझी खाली-खाली जेब
अच्छा खासा आदमी सौ-सौ खाये फरेब

-अरविंद चतुर्वेद

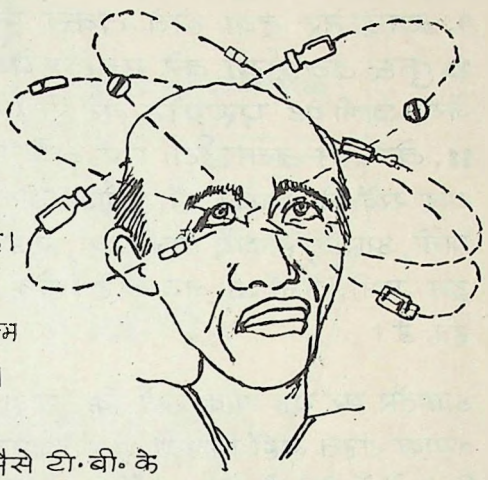
बस्ती-बस्ती धुआँ है जंगल-जंगल आग
दिल्ली में दरबार है हरा-भरा है बाग

बिन बरसे बादल गये गये महीनों साल
देश तरक्की कर गया अभी आप बेहाल

खाँसी की ठक-ठक हुई जगी चिलम की आग
दिल से एक धुआँ उठा या पीड़ा का राग

दवाईयाँ: कुछ सलाह

इस पुस्तक में हमने कुछ बीमारियों के साथ उनसे जुड़ी दवाईयों की बात भी की है। मगर दवाईयों को इस्तेमाल करते समय कुछ आम नियमों का ध्यान रखें।



1. दवा की सही खुराक, सही समय पर लें।
आवश्यकता से ज्यादा दवा लेने पर नुकसान हो सकता है। बतायी गई खुराक से कम दवा लेने पर असर कम हो सकता है।

2. कुछ दवायें पूरी खुराक से कम न लें।
जैसे एंटीबायोटिक (कीटाणु विरोधी) दवा बीमारी के लक्षण खत्म हो जाने के बाद भी नुस्खे के अनुसार पूरी खुराक में लेते रहें।

3. इन्जेक्शन से बचें।
जब तक कि बहुत जरूरी न हो इन्जेक्शन न लें (जैसे टी॰बी॰ के लिए स्ट्रेप्टोमायसिन या दमा के दौरे में ब्रान्कोडायलेटर्स)। तिहरा टीका व खसरा का टीका केवल इन्जेक्शन के रूप में ही दिया जाता है।

4. मंहगी दवाओं से बचें।
शीशी, केप्सूल या डिब्बे में मिलने वाली दवाओं के लिये अधिक पैसा खर्च करना पड़ता है। ज्यादातर दवायें सस्ते दामों पर मिल सकती हैं। ये भी मंहगी दवाओं की तरह असरकारक होती हैं। दवा कंपनियाँ लोगों को उल्लू बनाने और पैसा कमाने के लिए ऐसे तरीके सोचती हैं।

5. नकली दवाओं से सावधान।
उन्हीं लोगों या दुकानों से दवा लें जिन पर आपको भरोसा हो। कुछ दवायें एक निश्चित समय के बाद इस्तेमाल नहीं की जा सकतीं। दवाओं के पैकेट या लेबल पर उनके बनाने की तारीख और वह तारीख जिसके बाद उसे इस्तेमाल नहीं करना है, छपी रहती है। दवा खरीदते समय देख लें कि उसकी इस्तेमाल करने की तारीख निकल तो नहीं गयी।

6. सभी दवाओं को बच्चों की पहुँच से दूर रखें।

7. स्टीरायड नामक दवा से बचें।
स्टीरायड दवाओं के बारे में अध्याय तीन में (दमे के इलाज के साथ) चर्चा की गई है। ये दवायें अन्य रोगों में भी दी जाती हैं। ये कभी-कभी मरीज की जान बचा लेती हैं। किन्तु कुछ डॉक्टर इन दवाओं का उपयोग अन्य दवाओं के साथ जरूरत न होने पर भी करते हैं। मरीज जल्दी अच्छा हो जाता है, पर स्टीरायड दवा असली रोग को दबा देती है। आगे चलकर मरीज की हालत और खराब हो जाती है।

8. गर्भ के दौरान अनावश्यक दवाईयों से बचें।
खासकर गर्भ के पहले तीन महिनों में तो यह बहुत जरूरी है। यदि आप गर्भवती हैं तो यह बात डॉक्टर को जरूर बता दें। कई दवायें आपके बच्चे को नुकसान पहुँचा सकती हैं या उसके कारण विकलांग बच्चा पैदा हो सकता है। गर्भवती महिलाओं को जाँच केन्द्र से दी गई आयरन और कैल्सियम की गोलियाँ बच्चे को नुकसान नहीं पहुँचायेंगी, बल्कि आपको भी बहुत फायदा करेंगी!

9. ज्यादातर दवा लेते वक्त पूरे दिन खूब पानी पियें।

10. कुछ दवाईयों को खाली पेट कभी नहीं लेना चाहिये।
जैसे, खाली पेट एस्प्रीन लेने से पेट में छाले हो सकते हैं।

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याद रखें कि आपका शरीर मौका मिलने पर खुद ही ठीक हो सकता है। सही खाना और पीने का पानी, आराम, सफाई, ताजी हवा, कुछ व्यायाम और प्यार। अच्छी तरह से ठीक होने के लिये इन सभी चीजों की जरूरत है। हरेक व्यक्ति को इस तरह की सुविधाओं के साथ जीने का हक है।

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किसी भी दवा के इस्तेमाल में कोई न कोई खतरा जरूर होता है.

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लोगों को दवाइयों के बारे में मोटी-मोटी बातें और स्वास्थ्य के बारे में आम नियमों को जानना चाहिये ताकि वे अपने और परिवार के स्वास्थ्य को बचा सकें। डॉक्टर अक्सर ज्यादा प्रसिद्ध होने के लिये, ज्यादा मरीजों को खींचने के लिये और अन्य डॉक्टरों के मुकाबले ज्यादा कमाने के लिये जनता के अज्ञान का फायदा उठाते हैं। डाक्टर यह भी कहते हैं कि कुछ दवाईयों को जैसे, टॉनिक या इन्जेक्शन देने के लिये वे मजबूर हो जाते हैं क्योंकि मरीज उनकी माँग करते हैं।

अपने डॉक्टर से कहें कि आपको अनावश्यक दवाईयाँ नहीं चाहिये। डॉक्टर को यह किताब दिखायें। इससे आपको सही इलाज पाने के हक को साबित करने में मदद मिलेगी।

किसी भी दवा के इस्तेमाल में कोई न कोई खतरा जरूर होता है.

अपने सुझाव और विचार
— जरूर भेजें —

यह किताब सही जानकारी, सही इलाज और स्वास्थ्य के मामले में अपने हकों को पाने के लिये लड़ाई का एक हिस्सा है। इस तरह यह हम सब लोगों की किताब है।

हम इसे और अच्छी एवं उपयोगी बनाना चाहते हैं- आपकी मदद से।

यदि आप इसे सुधारने के लिये सुझाव देना चाहते हों तो जरूर भेजें।

आप हमें यह भी बतायें कि –

किताब के कौन से हिस्से आपको सबसे ज्यादा काम के लगते हैं,

और कौन से हिस्से, पृष्ठ, पैरा एवं रेखाचित्र उलझाने वाले या खराब लिखे गये हैं,

या सबसे कम काम आने वाले तथा गलत लगते हैं।

हमें खासकर गैस पीड़ितों और उनके बीच काम करने वाले स्वास्थ्य कार्यकर्त्ताओं, अन्य स्वयं सेवकों के सुझाव पाने में खास दिलचस्पी है।

सुझाव इस पते पर भेजें :

हमारी सेहत, हमारी लड़ाई
द्वारा, एकलव्य,
ई 1/208, अरेरा कालोनी
भोपाल (म.प्र.) 462 016

भोपाल गैस हा[illegible]

ो यह बात
रा विकलां

★ पुराने भोपाल में गरीब लोगों की बस्तियों के पास यू[illegible]नियन कार्बाइड कंपनी का कारखाना था। इसमें सेविन नाम का एक कीटनाशक बनता था। इसे बनाने के लिये एक जहरीली गैस एम.आई.सी.(मिक) रखी जाती थी।

★ कंपनी का यह फर्ज था कि इस गैस के खतरे के बारे में सरकार को, नगरपालिका को, और आसपास रहने वालों को आगाह करती। और गैस रिसने पर क्या करना चाहिये, इसकी पूरी तैयारी रखना चाहिए थी। यह और भी जरुरी था क्योंकि इसके पहले भी कुछ दुर्घटनायें हो चुकी थीं। लेकिन करोड़ों रुपयों का मुनाफा कमाने वाली कंपनी कुछ चंद रुपयों की बचत के लिये लोगों की जान से खेलने पर उतारू थी।

★ और हुआ भी यही। दो और तीन दिसंबर, 1984 की काली रात को 12·30 बजे मिक टैंक नं. 610 फट गया और जहरीली गैसों का मिश्रण सफेद बादल के रुप में आसमान में छा गया।

★ चंद मिनटों में लोग खाँसते, उल्टी करते, आँखों पर हाथ रखे सड़कों पर अस्पताल की ओर, शहर के बाहर की ओर भागे।

★ कुछ ही घंटों में 10,000 से ज्यादा लोग शहर छोड़कर भाग गये और 20,000 से अधिक लोग अस्पताल में पहुंचे तथा 500 से ज्यादा मारे गये। अनगिनत पशु और पक्षी भी मर गये। दूर-दूर तक पेड़ों की पत्तियाँ झड़ कर गिर गईं।

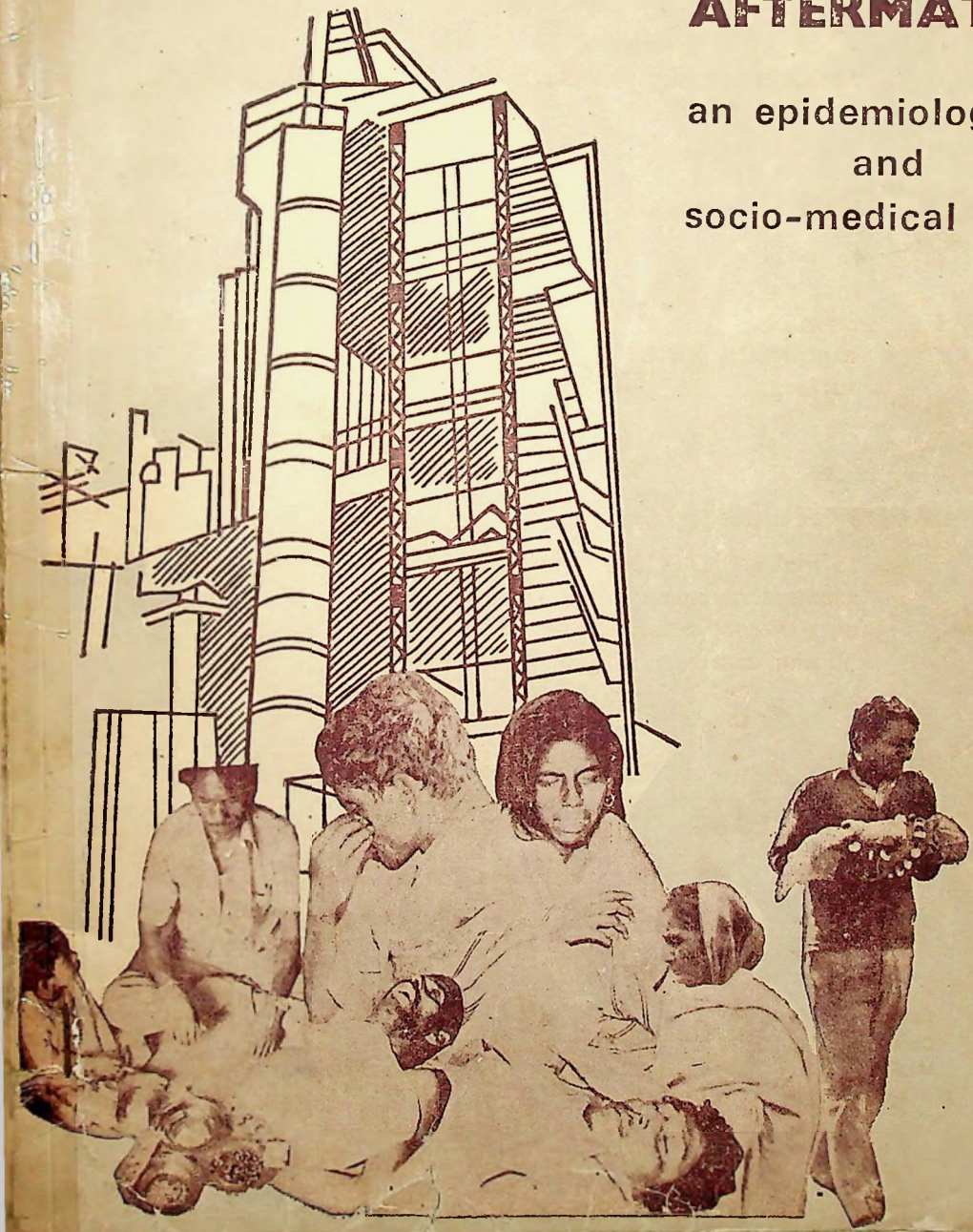
★ कुल कितना नुकसान हुआ इसका अंदाज आज तक ठीक से नहीं मिल पाया। सरकारी सूत्रों से पता चलता है कि कम से कम 2500 लोग मरे और करीब ढाई लाख लोग गैस से प्रभावित हुए। लोगों का कहना है कि यह सँख्या कम करके बताई गई है।

★ यह दुनिया की सबसे बड़ी औद्योगिक दुर्घटना है। ऐसा हादसा पहले कभी नहीं हुआ था। इसलिये इसका मुकाबला कैसे करना है यह किसी को पहले से मालूम नहीं था। आज भी हादसे की और इलाज की पूरी तथा सही जानकारी हमें मालूम नहीं है।

मिलेगा।

THE BHOPAL DISASTER AFTERMATH:

an epidemiological and socio-medical survey



medico friend circle

ACKNOWLEDGEMENTS

To,

The people of Jaya Prakash Nagar and Anna Nagar for their warm and welcoming attitude which greatly helped our study.

Rukmini Bahen and friends of SEWA and Ramachandra Bhargava and colleagues of Gandhi Bhavan for their hospitality in Bhopal.

The Preventive and Social Medicine Department of Baroda Medical College for their technical cooperation.

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Jan Vigyan Samiti, Kanpur and all our generous friends and members for their donations, big and small.

A large circle of mfc friends and contacts for their support and encouragement, and for their critical comments on the draft manuscript of this report.

ERRATA

Page	Line	
1	3	'where' should read 'were'
6	34	'except' should read 'accept'
6	40	'polo' should read 'pool'
13	19	'weight (ii)' should read '(ii) weight'
43	24	'rigorouly' should read 'rigorously'
46	14	'Hindu' should read 'The Hindu'
52	16	'Gag' should read 'gas'
56	16	'muscie aches' should read 'muscle aches'
62	36	'paramteers' should read 'parameters'
63	31	'on' should read 'of'
65	7	'vlctims' should read 'victims'

TABLES

Page	Table No.	
18	1C	'Others' in Anna Nagar 13.36 should read '13.86'
24	3A	Blurred vision/photophobia J P Nagar 77.02 (144) should read '77.02 (114)' A. Nagar 33.40 (53) should read 38.40 (53)
32	6C	After J P Nagar 468 should read (46.8)
35	7	15-44 Female FEV (Lit) in A.N. 2.25 (2.42) should read '2.25 (0.42)'

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The Preventive and Social Medicine Department of Baroda Medical College for their technical cooperation.

Friends of the Gujarat Sangharsh Vahini (Rashmi, Ambarish, Trupti, Rajesh and Kaumudi) for their help in tabulating and analysing data.

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PREFACE

The Bhopal disaster has been an unprecedented occupational and environmental accident. Equally unprecedented have been the imperatives for relief, rehabilitation and research in the aftermath of the disaster.

The local situation has been extremely complicated and dynamic. While health service providers and researchers have had to face many medical challenges, government and voluntary agencies involved in relief and rehabilitation have had to face many logistical and organizational challenges.

For the medico friend circle too, in its intervention in research and continuing education strategies in support primarily of voluntary agencies, it has been both a challenge and a thought provoking learning experience. The experience of planning, organising, analysing and communicating our research findings based on a modest study has brought us further in touch with the apathy, vested interests and status quo factors which obstruct action in favour of the disadvantaged in society.

Having seen the intensity of health problems of the disaster victims and the inadequacies in the strategies employed to ameliorate them we cannot but help raise critical comments on all components of the social medical system who are there to handle such problems.

Our objective, however, is more than critical analysis. Through this epidemiological study we have tried to make our own small contribution to a better understanding of the health problems that prevail in the aftermath of the disaster. We have also made suggestions for a more comprehensive relief and rehabilitation strategy.

A word of caution here—most of our observations are of the situation as it existed at the end of March 1985. Six months have passed in the process of analysis, consensus seeking and understanding our findings. During these six months, many further developments--both positive and negative--have taken place in Bhopal at the governmental and the non-governmental initiative.

We hope that this report will atleast help to highlight to our readers among other matters that--

(i) what people say and feel is as important evidence as what we can discover through our over-mystified medical technological approach;

(ii) in the absence of a community oriented epidemiological perspective, decision making about relief efforts, following a disaster can be adhoc and often irrelevant; and

(iii) for research to be relevant to the lives of the people, the findings and inferences drawn must be communicated to the health service providers and the patients themselves through an effective communication strategy.

Finally we hope that through this report, we shall stimulate debate, dialogue and a commitment to a deeper understanding of the problem, leading to more relevant and meaningful interventions.

Bangalore
2 Oct 1985

Ravi Narayan
Convenor

CONTENTS

CHAPTER 1

INTRODUCTION

Many months after the Bhopal gas tragedy, conflicting reports kept coming in from Bhopal. There were reports that the gas victims continued to present at the out patients departments with serious physical symptoms and they where getting very little relief by the standard package of treatment which included antibiotics, steroids, antacids, cough mixtures, eye drops and bronchodilators.

Doubts were being raised that the disaster victims were developing a sense of dependence and were exaggerating their symptoms in order to draw more and more benefits. It was also felt that the first wave of mortality and morbidity had receded and that there was no significant residual damage and morbidity. The feeling of *"all was well"* was becoming stronger.

In February 1985, another dimension of the human suffering in Bhopal came to light. The Indian Council of Medical Research (ICMR) came out with a finding that the gas affected population of Bhopal was probably suffering from a chronic cyanide like poisoning and that the use of an antidote - sodium thiosulfate— could improve their condition. The situation was, however, further compounded by a total clamp down of information by local state health authorities.

The medico friend circle (mfc) had decided at the annual meeting in Bangalore, end of January 1985, to respond to a series of appeals from various non-governmental groups and to undertake an epidemiological and medico social investigation with the primary purpose of supporting disaster victims, citizens' groups and voluntary agencies in their struggle for meaningful relief, rehabilitation, justice, and for information.

However, at that point the collective knowledge of mfc was too inadequate (cyanide poisoning was still in the future) for a meaningful formulation of the problem in Bhopal. Naturally the formulation of concrete objectives for the study was not possible either. This evolved as the study progressed in stages. It was however felt that the mfc should collect its own field data and get first hand information about the health status of the disaster victims.

A few mfc members had visited Bhopal in mid-February and had identified certain urgent areas for action (1).

The team for this epidemiological study was in Bhopal from 15 to 25 March 1985. It consisted of a voluntary group of clinicians, doctors working in community health projects and health activists from different parts of India. During the stay and subsequently as the collected data was being analysed, it was realised that two medical theories to explain the continuing symptoms were competing to gain supremacy :

i) *The 'pulmonary' theory* which believed that in view of the available information about the effects of MIC, only extensive lung damage (leading to diffused pulmonary fibrosis) and direct injury to corneas of eyes could be expected.

ii) *The 'enlarged cyanogen pool' theory* which believed that the effect of the released gases on the patients was to increase the cyanogenic pool inside their bodies leading to chronic cyanide-like poisoning.

Both these theories are explained further in the text. It is important to realise, however, that this was not a purely academic controversy but a very serious problem having a direct and immediate bearing on the lives of the people. The controversy had resulted in the adherents of the pulmonary fibrosis theory (who dominate the medical establishment in Bhopal) steadfastly refusing to treat the gas victims on a mass-scale with sodium thiosulfate which had been advanced as an antidote by the ICMR on the basis of its research findings. The net outcome of this unseemly controversy was that the suffering of the people was continuing without any relief in sight.

A study undertaken in a situation where two proponents of opposing theories are busy in a controversy cannot ignore these theories. We did not. In fact we consciously kept this controversy in mind and analysed our findings accordingly. Needless to add that the study does not and cannot aim to provide decisive arguments to resolve the controversy fully.

However the critical analysis does not remain narrowly confined to the merits and demerits of the contending theories only. It goes much beyond that. The inherent force of the logic of the criticism impinges upon the much wider issues of weaknesses in methodology, perspective, orientation and setting of objectives of medical research as it has been carried on in Bhopal. The serious gaps in the very fabric of research efforts have direct and vital connection not only with the urgent issue of relief from suffering, damages and compensation to the victims of the poison gas, but also with the issue of fixing the responsibilities on all those who have perpetuated the suffering of thousands of people of Bhopal.

We outline a series of conclusions and recommendations for urgent consideration by all concerned.

A summary of this report is also being released in English for wider circulation and a lay version in Hindi for the gas affected people in Bhopal.

If, through this modest effort we have moved towards the establishment of a 'people oriented science' and endorsed the people's 'right to know', we would have felt that our efforts were more than worthwhile.

- medico friend circle

Justice is but truth in action and we cannot hope to attain justice until we have the proper respect for truth.

—Anon

CHAPTER 2

OBJECTIVES OF THE STUDY

The Indian Council of Medical Research (ICMR) has initiated over 22 research projects to study the sub-acute, chronic and late effects of the Bhopal gas disaster. The objectives of the medico friend circle (mfc) intervention in Bhopal was not to duplicate the efforts of ICMR. We neither have the resources nor the access to technical supports that are required for such efforts; nor for that matter the mandate. We believe that the primary role of organising research linked to relief and rehabilitation efforts lies with the governmental and national institutions that have been established with the tax payers' money.

In January 1985 when we first decided to undertake this study, there was hardly any official information available on the health situation of the gas victims of Bhopal. The clamp down on information was unmistakable. From whatever little information we could obtain, it was clear that people in large numbers were reporting symptoms like shortness of breath, cough, excess lacrimation, fatigue headache, loss of appetite, etc. This was a list of symptoms. Only symptoms, apparently unconnected to one another by underlying patho-physiological mechanisms, dominated the scene.

Naturally at a meeting in Bombay we first set the following series of objectives.

(i) Assessing current health status and medico-social problems (ii) Prioritizing in terms of magnitude and implication for rehabilitation (iii) Identifying health problems that required health education efforts (iv) Studying existing plan of relief, research and rehabilitation services and (v) Studying people's perception of these services.

Later on, when the study was in progress in Bhopal, we came across more substantial information. The conflict of two medical theories came before us in sharp focus and the far reaching implications of this conflict for relief, rehabilitation, compensation etc. were tentatively grasped in those days. The objective was slowly evolving and finally came to be a thorough-going critique of the two medical theories and the implications flowing from them. Our initial fact finding, appraisal of information and situation analysis, led us to identify a series of issues of concern: (i) secrecy on any type of data/information on the disaster; (ii) secrecy of ICMR research study plans; (iii) absence of open scientific debate on research findings, (iv) the vertical, clinical and organ centred nature of research projects; (v) the absence of encouragement to non governmental initiatives; (vi) the adhoc and populist approach to relief and rehabilitation; (vii) the absence of authentic scientific and research based information for the medical teams providing services; (viii) the absence of demystified but authentic information to the disaster victims for their evolving movement/struggle for a more relevant relief and rehabilitation programme.

These concerns led to a reassessment of the Bombay objectives and a series of new objectives emerged to best meet the emerging situation. These were-

(i) To assess the current health status and related problems of the people on a sound epidemiological/ community basis;

(ii) To assess the findings in the light of the medical controversy between 'exclusive pulmonary pathology' vs. an 'enlarged cyanogenic pool' leading/ to a chronic cyanide like poisoning:

(iii) To evolve a critique of the ongoing research and medical relief programme;

(iv) To identify factors that have important implications for the relief, rehabilitation strategy (including claims for compensation);

(v) To assess the people's perception of the ongoing health care services;

(vi) To make suggestions for a more meaningful relief/research/rehabilitation policy.

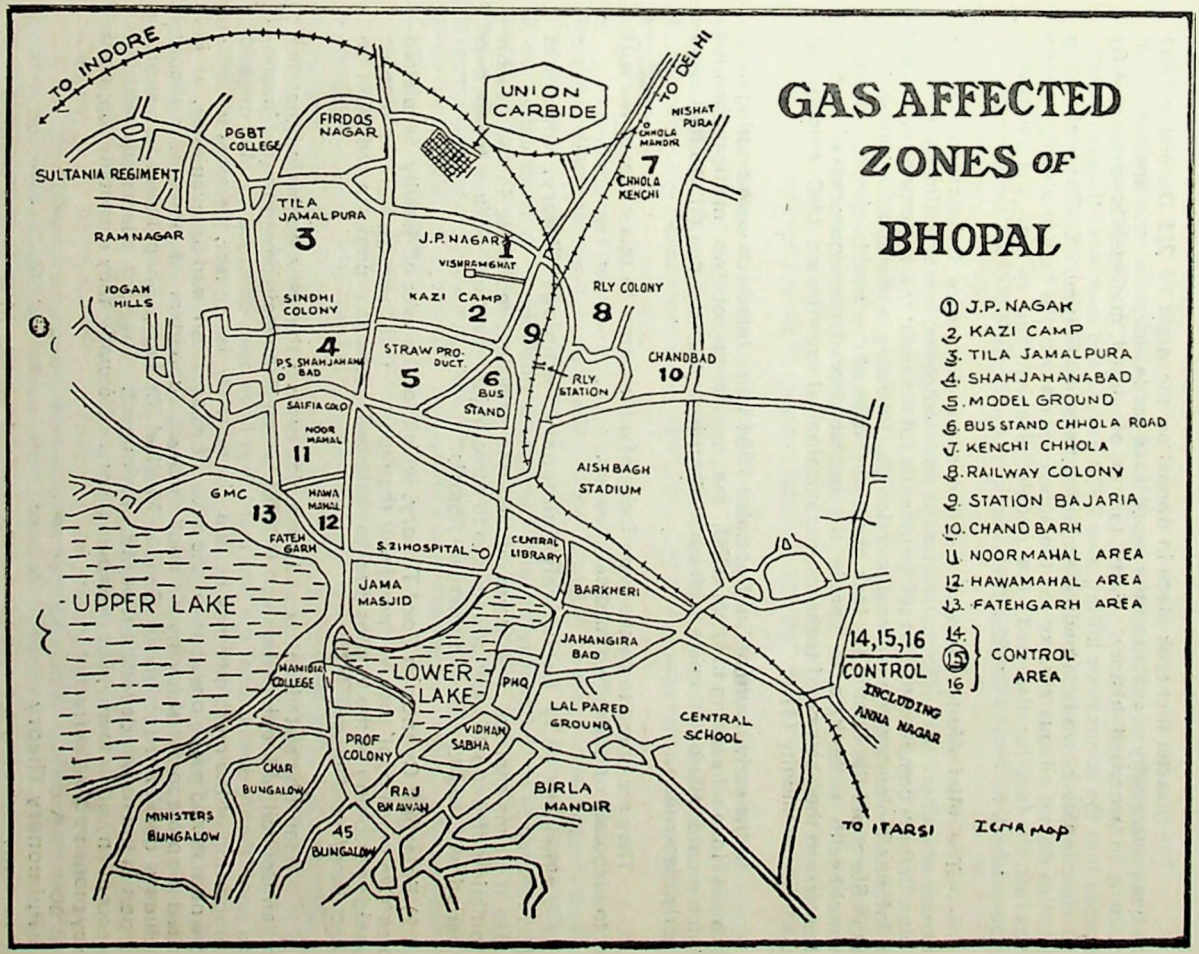
The health problem situation as it evolved in Bhopal which helped give a final shape to the objective, has another interesting aspect which bears on methodology of the study.

During and after the study many have commented that our reliance on symptoms is somewhat unsatisfactory, that they are subjective and therefore we are on shaky ground and that more objective data like bio-chemical measurements, X-rays etc. as were done by other groups (e.g. the Nagrik study) is missing in our study, rendering it less solid. This faith and attachment to laboratory tests, X-rays and other types of 'objective' tests is interesting but difficult to understand.

When predominance of a broad range of symptoms was the only important fact known and even after the fact of 'enlarged cyanogen pool' came to be known, what could be the biochemical-pathological tests that could be done in a sample population so as to make our study more objective and less shaky? The only biochemical tests of real value, suggested by the 'cyanogen pool' theory are augmented output of urinary thiocyanate following intravenous sodium thiosulfate and study of blood gases. Both these tests were of course, beyond our reach. However, that should not mean that studies at less sophisticated levels like ours, have no objectivity about them.

With regard to X-rays, it should be noted that the place of chest-radiography is extremely limited. Its only legitimate use is in the detailed follow-up of those whose pulmonary function studies have shown very significant lung diseases (19). Furthermore X-ray findings sometimes bear little relation to the patient's disability, loss of function or severity of other symptoms (10) The other test which is of real value is pulmonary function tests. The forced vital capacity (F.V.C.) and the forced expiratory volume in the first second (F.E.V. 1) are the simplest, most repeatable, valid and among the more discriminating tests reflecting mechanics of breathing. They have had most extensive trials during the past 25 years and regression equations for predicted normal performance are better documented than for any other respiratory test (10,19). We have in our study undertaken these tests.

Biochemical parameters, which are routinely studied in clinical settings where the problem situation is much more settled and clear-cut, cannot be easily and automatically used with a view to improve objectivity, in a situation like the Bhopal gas disaster. This is completely new and unknown territory in so far as little is known about MIC's effect on the body. To use such parameters would be like shooting in the dark. These 'solid' 'objective' tests themselves do not necessarily lend objectivity to any study in such an inherently difficult and ill-defined problem situation. In doing so we are only reinforcing and perpetuating the popular, mythical notions about scientific objectivity. To study symptoms is not necessarily to be subjective—but about this later.



STUDY AREAS - 1 & 15.

CHAPTER 3

BACKGROUND : TWO MEDICAL THEORIES

The disaster that took place in Bhopal on the night of 2/3 December 1984 has been universally accepted as the worst man-made industrial and environmental accident in recorded history. Forty tonnes of stored methyl-isocyanate (MIC) escaped into the atmosphere killing over 2500 people and over three thousand cattle and affecting over two lakh people according to official estimates. These shocking statistics do not adequately express the actual enormity of the human tragedy—of the lives lost, the families disrupted, the people disabled and ill and the thousands impoverished.

The relief efforts that were initiated soon after were handicapped by the absence of authoritative information on the released gases; the unwillingness of the Union Carbide company to part with authentic information; the absence of meaningful information among the relevant sanctioning, licensing and inspecting authorities in the State and the Centre; the lack of preparedness of the local bodies and governmental health authorities to handle the unprecedented consequences of such a disaster and the absence of technical or toxicological expertise on MIC among our scientific community (1).

In the early hours of 3rd December 1984 when hundreds were pouring in to Hamidia Hospital seeking medical relief, the beginnings of two medical theories which would later on compete with each other to occupy the central position were clearly discernible.

They are going to be the main focus of our report. In this chapter we will try to elaborate on these two medical theories.

They are (3.1) **Exclusively Pulmonary Pathology Theory,** which has been referred to as 'Pulmonary theory' throughout this report. It is so called because it claims that all the mortality and the prevalent morbidity in the gas hit population of Bhopal is exclusively due to direct injury to lung tissues which over a period will lead to diffuse pulmonary fibrosis.

((3.2) **Enlarged Cyanogen Pool Theory,** which for the sake of brevity is referred to as 'Cyanogen pool' theory' throughout the report. This theory postulates chronic cyanide poisoning of the victims due to enlarged cyanogen pool, in addition to direct lung/eye damage.

It must be stated clearly and unambiguously at the very beginning that the Indian Council of Medical Research (ICMR) which is the main protagonist of 'cyanogen pool' theory does except the fact that lungs have been damaged by MIC gas and a proportion of the morbidity may be due to that. It is, in fact, therefore the proponent of mixed pathology, but for the sake of discussion and convenience, it is called the protagonist of 'cyanogen pool' theory. Supporters of pulmonary theory include a dominant faction in Gandhi Medical College, Bhopal and has strong support in the health department of MP Government. They are adamantly refusing to accept any other theory, but their own theory. Naturally they are totally opposed to cyanogen polo theory.

3.1 Pulmonary Theory

According to this theory, isocyanates, of which MIC is one member, are

toxic, irritant gases that directly damage the tissues they come in contact with-lungs and corneas of eyes. The acute and long lasting pathological effects therefore are to be seen only in lungs and eyes, and the effects of hypoxia secondary to lung damage.

A small proportion of (about 5-10%) persons exposed to these substances also develop sensitization (2,5).

The effects of isocyanates even in high doses on the gastrointestinal tract is minimal (4).

It can induce blindness or visual impairment depending on the degree and location of scarring (2,3).

Among the isocyanates toluene di-isocyanate (TDI) has been shown to produce Central Nervous System (CNS) damage, manifested as loss of memory, diminished mental capacity, persistent headache, personality changes, irritability, depression etc (6) But any such effect by MIC on CNS has been dismissed as anecdotal "because MIC is such a severe primary irritant it would be apt to produce such a severe degree of irritation that death would occur before sufficient absorption of the compound could occur to produce systemic effects" (6).

This brings us to the central point of the theory, which is to explain why MIC exposure must produce damage to only lungs and corneas excluding all other organ systems. Why for instance MIC, an isocyanate, cannot have long lasting CNS effects whereas another isocyanate, TDI, can have long lasting effect on brain function?

Among the three isocyanates used in industry MIC is much more reactive than the other two e.g. TDI and MDI (Methyl Di-isocyanate). It has been argued that *'MIC is so readily decomposed by water, the chances are "very very remote" that this iso-cyanate could enter the blood stream, be whisked to internal organs and produce damage there, by reacting with target proteins'*. It is further argued that *'for the same reason MIC lacks the hardiness to be a carcinogen. Molecules of the compound would have to penetrate the cell wall and reach the DNA to do their genetic dirty work. It is virtually unthinkable that molecules of MIC could survive such a cellular journey' (2,9).*

This is the point : the high reactivity of MIC molecule renders it nonspecific and therefore it is bound to damage only those organs which come into direct contact with it—lungs, eyes and skin. The skin may however escape because MIC fumes may not penetrate the skin (3). The logical corollary of it is that long term problems in survivors can be due to extensive lung damage and corneal damage only.

Mr. W. Anderson, Chairman of Union Carbide Corporation, U. S. felt so confident that in a letter of 3rd January 1985 (exactly one month after the disaster) he wrote to an activist group which is monitoring the Bhopal Disaster to say that *'those injured by Methyl Isocyanate (MIC) are rapidly recovering and display little lasting effects . . . . . , for example, no case of blindness' (11).*

The pulmonary theory therefore, must reject any other explanation for the presence of wide ranging symptoms in the community and also the treatment based on alternative explanations.

For the same reason **some U. S. Scientists have characterised such reports of Cyanide Poisoning of the exposed population 'highly questionable' and 'probably spurious'. They have further argued that there is no known metabolic pathway that converts isocyanate into cyanide (2).**

The clash of theories extends to the whole range of health problems in Bhopal.

Thus according to the *'pulmonary theory'* the large number of deaths in the early hours of the morning of 3rd December 1984 were due to carbon monoxide poisoning and to others the deaths were due to cyanide poisoning. We have no definite information regarding the nature and quantity of dangerous gases that were present in the atmosphere after the massive gas leak. However it is known that the thermal decomposition of methyl Isocyanate can lead to the production of a variety of toxic substances including Carbon monoxide (CO) and Hydrogen Cyanide (4). The temperature of toxic fumes gushing out of the tank was at least 120 degrees centigrade (12).

An investigation was undertaken by the ICMR at a very early stage to sort out this controversy. Particular attention was paid to find out clear evidence of carbon monoxide and/or cyanide. A large number of control blood samples and also samples of blood already preserved in the deep freeze in the Medico Legal Institute and fresh samples from cases who subsequently died were examined for evidence of carbon monoxide poisoning (carboxyhaemoglobin) or cyanide poisoning (cyanomethemoglobin) by spectrophotometric analysis (14). In none of the samples was there evidence of either.

In contrast to this, a study of 113 MIC affected people who themselves reported to K.E.M. Hospital, Bombay showed carboxyhaemoglobin (COHb) at a concentration of more than 2% in 93% of cases. (The normal levels of COHb in blood are 0.5 - 0.8 %. In smokers the levels could be as high as 15%, the average being being 5%) (13). This sample however is not a representative sample and the control is lacking. Moreover age/sex structure and smoking status are not given (8). Besides, the effects of COHb levels less then 5% are controversial. COHb levels of 20%, decrease tissue oxygenation and affect performance (10).

3.2 Enlarged Cyanogen Pool Theory

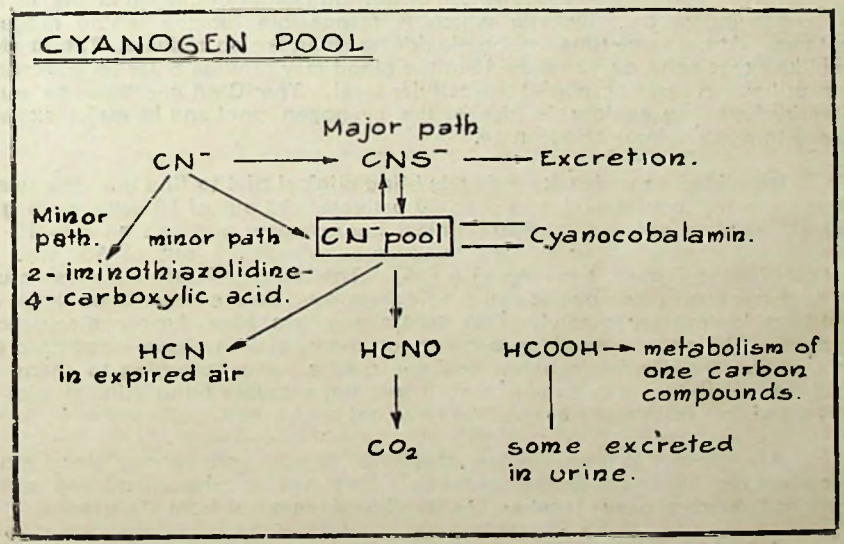
One of the most important developments of the complex findings among Bhopal disaster victims has been the evidence favouring what may be termed an 'Enlarged Cyanogen Pool' theory. Professor H. Chandra of Medico Legal Institute of Gandhi Medical College, Bhopal noticed in the early hours of 3rd December when the first autopsies were being performed that even the venous blood of dead bodies was cherry red in colour (so called arterialization of venous blood). All the internal organs, lungs, intestines, kidneys, brain, muscles, etc. were bright red in colour. This led him to suspect that victims could have succumbed to cyanide poisoning (14,15).

A visiting German clinical toxicologist Dr. Max Daunderer is reported to have detected cyanide in the affected patients (14,15,17) Unfortunately his findings could not be repeated because of technical and methodological problems (14,15). ICMR set out to 'identify the presence of either the original products'. The objective was to obtain a better understanding of the probable detoxification mechanisms which would help in the prompt use of an antidote to remove toxic substance still circulating in the body (14).

As has been pointed out in 3.1 above, attempts to establish the presence of either carboxyhaemoglobin or cyanomethemoglobin in the blood failed. However all the samples of all victims showed twin bands of oxyhaemoglobin(14) which is an indication of a change in the nature of the haemoglobin molecule.

Special note must be taken here that from as early as the first week of the disaster, the ICMR approach to the problem pointedly ignored the theoretical notion of the MIC molecule being too reactive to reach the blood stream and causing damage to the internal organs.

Following a rapid study of available literature by Dr. Sriramachari it was felt that the mechanisms of conjugation of isocyanate should be investigated vigorously. The equivocal results in the increase of blood urea in fresh autopsy tissue samples as well as qualitative reports of the presence of cyanide in tissue led to the hypothesis that either due to inhalation of hydrogen cyanide from the contaminant or cyanide radicals released by the breakdown of MIC within the body, there was every likelihood of either acute cyanide or chronic cyanide poison operating (14). This idea was reinforced by literature scan where in there is a reference **to the cyanide pool and its major excretory pathway through urinary thiocyanate (14)**



As shown in the diagram above, there is a cyanogen pool in the body which normally generates extremely small amounts of cyanide radicals in the course of normal metabolic processes of the body. These cyanide radicals are easily removed from the body by a process of detoxification which converts the cyanide radicals into relatively harmless thiocyanates which are excreted as urinary thiocyanates. This detoxification process is controlled by the enzyme called rhodanase in the liver.

The process of detoxification by the rhodanase system can be accelerated by sodium thiosulfate if given in large amounts. **This provides the rationale for injection of sodium thiosulfate for the treatment of cyanide poisoning. Also the amount of urinary thiocyanate excreted in the urine following injection sodium thiosulfate gives an indirect clue of the size of cyanogen pool in the body And this provides the rationale for sodium thiosulfate as an epidemiological tool of investigation of the hypothesis of 'enlarged cyanogen pool' in the MIC exposed population of Bhopal** to which we will return in the Chapter 6.

This pool of cyanogen is proposed to have been enlarged in the MIC exposed population of Bhopal. According to the theory small quantities of cyanide, but much larger than that which would be normally produced in the body, is continuously contributed to the cyanogen pool of the gas victims from MIC molecules which are attached to alfa chains of haemoglobin molecules - a process that is called carbamylation of haemoglobin. Cyanide blocks the activity of a large number of enzymes but the most important from the point of view of its effects is the enzyme called cytochrome oxidase in all the cells which controls the oxygen utilisation of the cells. This leads to under-utilisation or non-utilisation of oxygen at the cellular level producing chronic hypoxia which is responsible for the whole range of symptoms. At the same time carbon dioxide transport is also reduced. The study of gases like oxygen and carbon dioxide in the blood may provide clues to disturbance of gas utilisation and transport at the cellular level. The ICMR continued to pursue its inquiry further to explore the idea of the cyanogen pool and its major excretory pathway through urinary thiocyanate.

It decided to undertake a double blind clinical trial to find out the usefulness of sodium thiosulfate injections on 30 patients. 10 out of 19 who were given sodium thiosulfate showed marked clinical improvement and had an 8 to 10 fold increase in the excretion of urinary thiocyante, whereas 1 out of 15 who got injection glucose showed such increase (14). The full details of this most crucial trial have not been made public and the findings have been contested by those who uphold the 'pulmonary theory'. This controversy has been further discussed in Chapter 6. The opponents of 'cyanogen pool' theory claim to have conducted their own study with sodium thiosulfate and the results were according to them, discouraging. However it is known that it was not a double blind clinical trial like ICMR's and that full details of this trial have not been made public either !

Alongside this investigation, studies of arterial and venous blood oxygen and carbon dioxide levels were undertaken. This was to understand the state of oxygen utilisation at tissue level and carbondioxide removal from the tissues.

Following are the salient findings of the investigation.

a) Level of oxygen in arterial blood was lower than normal (14)

b) Similarly level of carbon dioxide in the arterial blood was also lower than normal (14)

c) Inspite of raised haemoglobin levels its oxygen carrying capacity was lowered. There is a probability of some compensatory mechanism, operating such as indicated by elevated levels of 2-3 Diphosphoglycerate (2-3 DPG) in the blood which is one of the mechanisms to improve the oxygen utilisation by the tissues (14)

d) Following the treatment with sodium thiosulfate the carbon dioxide level in venous blood increased, with improved clinical condition. This preliminary observation tends to indicate that following administration of sodium thiosulfate, patients appear to better utilise the oxygen. The higher levels of carbon dioxide in the venous blood probably means that venous carbon dioxide is being carried in solution. This could be due to some alteration in the haemoglobin molecule, possibly by mechanisms such as carbamylation of end-terminal amino groups (14) .

All these findings such as increased haemoglobin concentration, twin bands of oxyhaemoglobin, more than doubled normal values of 2-3 DPG in the blood and clinical improvement, augmented output of urinary thiocyanate and rise in carbon dioxide level in venous blood following sodium thiosulfate injections are unexpected but highly suggestive.

These findings strongly suggested that tissue utilisation of oxygen in gas victims is problematic. This is not a simple function of reduced diffusion—perfusion ratio leading to anoxia as one would expect in exclusive pulmonary damage.

The pathology is not only in the lungs, probably it is at a cellular level in all the vital organs. Logically speaking it is not imperative for the theory to chase only MIC molecule in the cellular processes. There may be other molecules derived from MIC or other toxic gases which contribute to the cyanogen pool. The cyanogen pool theory may stand or fall the critical tests but these findings if true are in need of explanation.

CHAPTER 4

MATERIALS AND METHODS

4.1 Sample Population

Two bastis (slum areas) were selected for the study: (i) JP Nagar, which was the worst affected, is situated right in front of the Union Carbide factory; (ii) Anna Nagar, which is about 10 km. south of the factory was selected as a control (see map). It is important to clarify here that no area in Bhopal which has similar bastis was unexposed to MIC at the time of the disaster and hence Anna Nagar was also exposed. However, it was one of the least affected areas. In the absence of any available information regarding the quantum of gas exposure of various communities differences in postexposure mortality can be taken as a criterion of difference in gas exposure. Our assumption, therefore, in selecting Anna Nagar as the least affected was based on the available mortality rates from the Department of Information and Publicity, Government of Madhya Pradesh - JP Nagar 2.34% and Anna Nagar 0.32%. This assumption was further corroborated by our study-finding of a difference in mortality between JP Nagar (36.6/1000) and Anna Nagar (7.9/1000), in the three month period between MIC gas exposure and our study. Another significant finding which justified this selection of samples was the fact that 45 persons (30%) out of our sample in JP Nagar had been hospitalised after the gas exposure whereas the figure for Anna Nagar was one person (0.72%), a clear indication of the differential exposure.

Both these bastis were more or less comparable with respect to housing, sanitation and economic characteristics though there were some socio-cultural differences among the two areas, in that the inhabitants of Anna Nagar were predominantly migrant labour from the south who were, however, resident in Bhopal for many years.

We decided on a sample size of about 180 persons of both sexes of more than 10 years age for each basti (This was based on the assumption that significant morbidity would be atleast 15% in JP Nagar and 5% in Anna Nagar. We wished to have a 90% chance of finding this difference with significance level of 5% in a two tailed test i. e. $2\alpha = 5\%$ and $\beta = 90\%$). It needs to be emphasised here that the assumptions on which the sample size was computed, are quite stringent. For our purpose sample size is more than adequate. Since random selection of individual persons was not possible, we decided to select at random 60 families from each basti to yield the desired number of persons. Random selection of families in both bastis was fortunately possible because the ICMR had already provided a number plate for each household. This provided the much needed sampling frame from which random sampling of families was done with the help of random number tables.

Children below 10 years were excluded from our sample because of the fact that their reporting of symptoms and pulmonary function tests would be unreliable.

4.2 Methods

As will be noted by the readers, history-taking has been our most important method of study. Methodological issues arising in respect of this method have been discussed in Chapter 2—'Objectives of the study' and below in the section of 'Morbidity Analysis'. The following were undertaken during the study.

4.2.1 History-taking and physical examination of each individual

A detailed proforma was designed for the study which was to be administred to each eligible member of the selected families (Appendixl). It included the following sections.

Section I : This included the following information about each household: family composition; deaths or missing members since the gas leak; occupation; income; history of smoking or chronic respiratory diseases (TB, asthma and chronic bronchitis) of each member. Details of loans taken by the family and compensation received were also elicited.

Section II : This was to be filled for each individual in the household included in the sample. It included details of occupation and income; change in income due to illness/disability following gas leak; certain details about exposure and safety measures attempted; whether hospitalised after exposure and history of smoking and chronic respiratory illnesses (TB, asthma and chronic bronchitis).

Section III : Every individual included in the sample was subjected to a systematic enquiry of 26 symptoms. The patients own description of these symptoms were listened to avoiding much direct questioning.

A general physical examination was also done including (i) height and weight (ii) and (iii) pulse and respiratory rates for full one minute in resting position after lapse of considerable time to ensure relaxation (iv) eye examination including cornea, lens, pupillary reflexes, distant vision and near vision (v) general signs like oedema, jaundice, cyanosis (vi) examination of skin; (vi.) respiratory system; (viii) cardiovascular system; (ix) central nervous system; (x) alimentary system.

The parameters for each system are shown in Appendix I.

Section IV : This was for each woman belonging to the reproductive age group included in the sample. It included menstrual history; history of gynaecological complaints before and after gas leak; pregnancy and its outcome; if a nursing mother then details of lactation before and after exposure.

4 2. 2 Pulmonary Function Tests (PFTs) which included Forced Expiratory Volume in 1st second (FEVI) and Forced Vital Capacity (FVC) for each individual. PFTs were recorded by Morgan's electronic spirometer set as BTPS. Three readings were recorded and the highest reading was taken for analysis.

For the interpretation of PFTs, height of each individual was measured by a straight aluminium rod on which a metal measuring tape was fixed. Weight was measured by standardised bathroom scales. The sample size of PFTs was further extended by additional observations on other families selected at random in both bastis. PFTs were performed by a doctor who had adequate experience of using the spirometer under field conditions.

4.2.3 Haemoglobin estimation using Sahli's haemoglobinometer was done on a random sample of the two bastis.

4.2.3 An enquiry into the **people's perceptions** of the existing services was done

by administering a questionnaire (section vi) to one member of each family included in the sample. These included questions recording availability and accessibility of services, quality of service, type of treatment given, attitude of examining doctor, cost of treatment, and nature of doctor-patient communication.

4.3 Building rapport with the people

The mfc team arrived in Bhopal to undertake the study in the third week of March 1985 (15th - 25th) . three and a half months after the tragedy. Numerous teams of investigators and relief workers both governmental and non-governmental had visited the selected bastis, made enquiries, offered or promised relief, raised expectations about compensation and assistance.

For the mfc team to ensure, therefore, that it would still be able to get reliable, authentic and relevant information it was necessary to counter this pre-conditioning of the basti dwellers and establish a meaningful rapport, free of suspicion, of false expectations and a sense of dependency. We therefore, employed the following strategy :

(a) Two days before the study, while selecting the samples the Coordinator and a team member visited the selected bastis and had informal discussions with some of the people explaining the objective of our study and the possible outcome;

(b) A hand-out prepared in Hindi was freely distributed among the basti dwellers. It clarified the role of the mfc, explained about the need for a sample and mentioned the possible follow up action. It specifically clarified that we were not providers of service but were facilitating a more relevant plan of serivces (Appendix II).

(c) During the actual survey, time was spent with each family answering their numerous enquiries and listening patiently to their stories. Occasionally when non-sample individuals/families approached the team members they were also listened to and occasionally given an examination;

(d) A summary of findings was made and handed over to each person in the sample; because we believed that it was a right of the people to get a record of the findings.

(e) In all our contacts with the people, it was very clearly stated that though the team was a medical one, it was not going to provide any treatment nor be involved with compensation claims. However, wherever it was necessary a prescription was given though this was rather occasional;

(f) A commitment was also made that the salient findings of the study and our recommendations would be made available to the people of the affected bastis to help them demand their rights to meaningful health services.

This methodology of informal, frank and participatory communication had its own rich dividends. The basti dwellers in both Anna Nagar and JP Nagar welcomed us into their homes warmly and took us into confidence. They appreciated our 'listening' attitude and this generated a lot of cooperation and support to our efforts. A major point of frustration for many of them was that though they had received treatment from government and other services, they had felt that the doctors were not taking them seriously and were summary in their approach. This affected the credibility of the existing services.

Our decision to concentrate very consciously on rapport building ensured that there was not one refusal among those who were present at the time of our visits. Moreover although several health surveys are supposed to have been done in these bastis, we found that in hardly any family, we had selected in our sample was there any health survey done. There was, therefore, no question of families being flooded with same types of questions and getting conditioned, consciously or unconsciously, to answer in a particular way or pattern.

4.4 Plan of Analysis

The plan of analysis of the data collected by us was as follows:

(i) All parameters in history, symptomatology and findings of clinical examination and lung function tests have been quantified and the percentage in each of the two bastis have been compared;

(ii) Relevant statistical tests have been applied to determine whether the differences, if any, are statistically significant;

(iii) Both the theories in the current medical controversy i.e. the pulmonary fibrosis theory and the 'cyanogen pool' theory have been kept in mind, consciously during the analysis to raise critical questions about both these theories from our findings;

(iv) Basically the important problem areas have been identified. There has been no attempt to group symptoms into specific diagnostic categories and both signs and symptoms have been taken into account in the analysis.

He is unwise who acts without investigation.

—**Charaka Samhita**

CHAPTER 5

OBSERVATIONS AND RESULTS

5.1 Non-responders: some observations

In JP Nagar in the 60 families selected there were 208 eligible persons whereas in Anna Nagar, the corresponding figure was 163.

In JP Nagar, 60 out of 208 individuals could not be interviewed and examined, giving a non-response rate of 29%. The corresponding figure for Anna Nagar is 15% (25 out of 163).

Several home visits were made by the survey teams in both the bastis to reduce non-response rates.

We feel that the given non-response rate in JP Nagar and Anna Nagar will not have a significant effect in the differences in rates of serious morbidities. Because, first, the age and sex structure of both responders and non-responders in both bastis is more or less similar. Secondly there was not one case where a person was at home but refused to cooperate. Had there been many such refusals amongst non-responders "the results would have been biased in unpredictable manner".

In JP Nagar majority of non-responders (about 60%) were out of town mainly for the reasons of treatment or fear of another gas leak. Twenty five per cent of them were out for work. At Anna Nagar about 50% were out of town for the purpose of social visits whereas 25% were out for work.

There have been large epidemiological studies where non-responders have been as large as 30%. This did not necessarily vitiate its results (22).

In the case of non-responders, if we are blind with respect to both exposure and outcome then the difficulty increases (22). In JP Nagar we have no information about the outcome in non-responders but we have recorded information that about 50% of them (28/60) were exposed to gas on 3rd December, in the remaining half many may have been exposed but we have failed to record definite information. No one among the non-responders in Anna Nagar was heavily exposed to MIC gas. Thus with regard to exposure status we are not completely blind.

If we make an assumption (though it is unlikely in view of available history of exposure in at least 50% of non-responders) that all the non-responders in JP Nager and Anna Nagar were normal, this will have an effect of narrowing down the differences in rates of morbidities between the two bastis. Even then the difference in rates of all serious symptoms between JP Nagar and Anna Nagar except for dry cough, lacrimation, breathlessness at rest and impotence remain statistically highly significant.

The reduction in sample size due to non-response rate has also not effected the outcome at all, because much greater differences in the rates of morbidity than had been expected (or assumed) between the two communities meant that our purpose of finding significant differences (if there was any) would have been served well even by much smaller size of the sample than the ones we studied.

5. 2 Comparison of samples of J P Nagar and Anna Nagar

Tables 1–A and 1·B show that both these sample populations are comparable with reference to age, sex structure, history of smoking habits and chronic diseases. Table 1-C shows that occupations and income levels are also comparable though the J P Nagar population was probably socio-economically better off than the Anna Nagar population. This income difference cannot however affect the observed differences in morbidities between the two samples. Table 2 shows that body surface areas (M^2) calculated from height and weight records are also comparable in the two samples. This is particularly relevant in the context of pulmonary function tests.

Comparisons of some of the important characteristics of J P Nagar and Anna Nagar populations (study/control populations)

Table 1 A

Age-Sex Structure

Age	Sex	J P Nagar % n = 148	Anna Nagar % n = 138
11-15 years	M	8.10	10.14
	F	9.46	4.35
16-45 years	M	35.81	34.78
	F	33.78	31.88
46 +	M	6.63	10.14
	F	6.75	8.70

Table 1 B

History of smoking and chronic diseases

		J P Nagar % (n = 148)	Anna Nagar % (n = 138)
Smoking (a)	+	22.75	25.0
	—	77.24	75.0
Chronic diseases (b)	+	9.58	10.37
	—	90.41	89.62

(a) a smoker is one who has smoked at least one cigarette per day for at least one year in a life time.

(b) chronic diseases specifically included asthma, chronic bronchitis, tuberculosis and others.

Table 1 C

Occupation and income levels

Occupation	J P Nagar % n = 148	Anna Nagar % n = 138
Unskilled	18.91	27.73
Skilled	7.43	8.73
Self-employed	13.51	15.32
Service	14.18	10.21
House work	29.72	24.08
Others	16.21	13.36
Per capita income per month before gas exposure		
Less than Rs. 50.00	4.68	4.58
Rs. 51-75	10.93	22.93
Rs. 76-100	16.40	21.10
Rs. 101-125	14.84	13.76
Rs. 126 and above	53.12	37.61

5.3 Socio-economic profile in the bastis

5.3.1 Occupational structure

The residents of both JP Nagar and Anna Nagar were long term residents of these bastis. Residents of JP Nagar were predominantly Muslims and Harijans with a wide range of occupations that included daily wage labour, construction workers, beedi rollers, cobblers, railway and factory employees, self employed artisans and others. Almost 1/5th (19%) of the working population in JP Nagar was unskilled.

Residents of Anna Nagar were predominantly Tamils and Maharashtrians and had a similar range of occupatian apart from a large number of potters. The percentage of unskilled workers was 28%.

The percentage of skilled persons in both samples was less than 10%. The category 'others' in the table is mainly represented by students.

5.3.2 Income levels and change in income since gas exposure

The income levels of both the samples are shown in Table 1-C. JP Nagar residents are generally of higher income levels as compared to Anna Nagar, e.g. before the disaster 68% of the families in JP Nagar had an income more than Rs. 100.00/ capita/month whereas the corresponding figure in Anna Nagar was 51%.

After the disaster, in JP Nagar 65% (42 out of 64) of the working persons experienced a drop in income ranging from 20% to 100% with a median of 50% drop in income (Fig. 1)

In contrast, in Anna Nagar only 9% (6 out of 64) reported a drop in income after the disaster. The extent of the drop in income was in the range of 20% to 55% (Fig.1).

Two individuals in JP Nagar showed an increased income after the gas disaster being exceptions rather than the rule.

(a) one person who was a loco-daily wage earner and got a job in the loco-loading department after the event with an increased scale of pay;

(b) one woman (housewife) who started brick loading after the disaster as her husband was not able to work after the disaster. Since our focus was on individual income rather than family income such an instance of increase is misleading. In actual fact with the husband being unable to work the family income had not been increased.

5.3.3 Compensation received and loans taken

During the acute phase of the crisis the only source of income if at all was the compensation received by families (only those who had deaths in the family) and loans taken from money lenders and others locally.

Some of our findings were:

In J P Nagar

Compensation of Rs.10,000.00 was given to 8 persons (out of 26 reported deaths). One non-respondent family had 5 deaths and 1 child survivor of 8 years in an orphanage. We could not elicit compensation details in this case.

Compensation was also given to other families who did not have a death. In our sample 2 persons got below Rs. 500.00; 3 persons between Rs. 500-1000, 4 persons between Rs.1000-2000 and 1 person between Rs. 2000-3000.

Table 1 C

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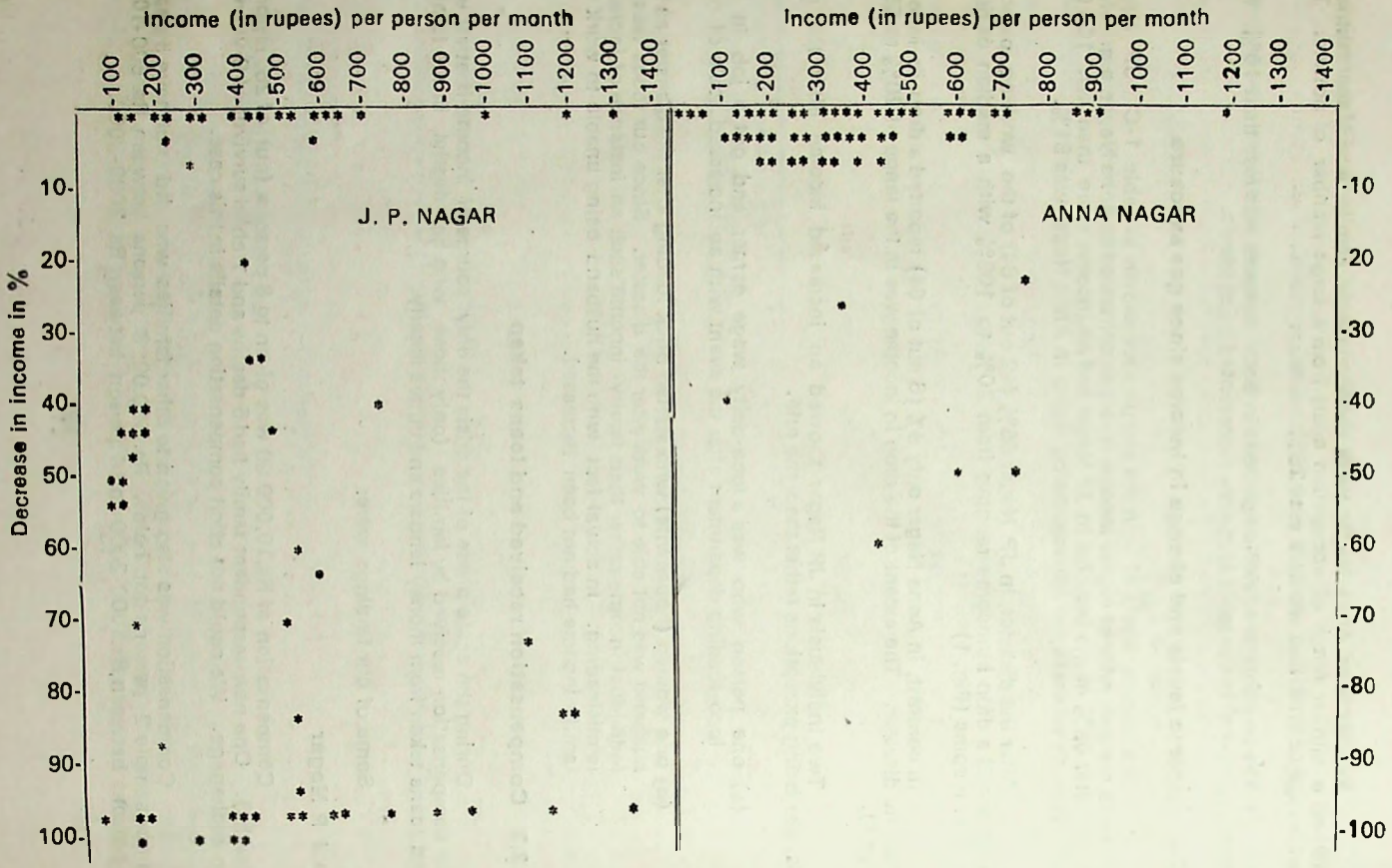
Figure 1. **Percentage change in income of individuals of both communities after gas exposure**



Twenty families in which there were no deaths and to whom no compensation was given had to take loans for medical treatment and for the migration during 'operation faith'. Many of them put their ornaments, vessels etc. on mortgage.

In Anna Nagar

Seventeen families who did not have a death in the family had to take loans. Most of them specifically mentioned that this was during *'operation faith'* when they went outside Bhopal for a while.

5.4 Morbidity Analysis

5.4.1 General comments

Before presenting the analysis of morbidity, two issues must be sorted out.

One, it must be stressed again that there is no population which matches JP Nagar socio-economically or in respect to housing and sanitation which was not exposed to the toxic gases on 3rd December, 1984. A control population selected like Anna Nagar is not strictly speaking a 'non-exposed' population as it should be but serves as a control population by virtue of being minimally exposed in comparison to JP Nagar. This also implies that even in our control population one would expect to observe some of the disabilities or debilitating morbidities in a higher proportion of the population than would be the case in an unexposed control area. Actually this is what we did observe and the Anna Nagar sample had definitely a larger number of serious symptoms in a sizeable proportion of persons studied (Tables 3-A to 3-C)

This is something which is quite unexpected and in fact narrows down the differences in rates of symptoms observed between the two populations. The health impact of the toxic gases on the exposed population is, therefore, much greater than what our study reveals.

Seen in this background alone can one appreciate the devastating impact on the health of highly exposed populations. Because in spite of the dampening effect on the differences in rates explained earlier, the rates of many serious symptoms (indicating widespread underlying damage to the physical and mental health of the victims of the gas disaster) in JP Nagar are higher than Anna Nagar with an extremely high level of significance (Table -3-A and 3-B).

Two, the dependence of the study on symptoms may be felt to be problematic by many, since it is 'subjective' and therefore less dependable. As discussed in Chapter 2 the problem situation as it was unfolding was such that one had few clues as to the pathophysiological disturbances taking place in the bodies of the gas victims. The only loud and clear clue was the people complaining of symptoms. What biochemical pathological parameters could be included in the study to enhance the objectivity of the study? None, except one as we have tried to argue above.

We acknowledge freely the problems of relying on symptoms reported by the individuals. *We would, however, like to draw attention to the fact that even in more understood problem situations like epidemiological studies of chronic bronchitis, emphysema, angina pectoris also, the most reliable tool of epidemiological study is recognised to be the questionnaire. Of course, these tools as developed by Medical Research Council (U.K.) and American Thoracic Society (U.S.A.) have been standardised to varying extents. Similarly, the epidemiological tool in the*

study of psychiatric disorders is also a questionnaire. It is not necessarily true that since symptoms are reported by the individuals, they are subjective and hence less reliable than biochemical measurements. The point is not whether we are using so called subjective or objective measurements, the point is whether we are employing appropriate methods and tools to answer clearly the critical questions we are raising in a given problem situation.

True, an important limitation of this study is non-standardization of the questionnaire i.e. ability of the questions to elicit the same answers on two or more occasions (reliability) and the ability of the questions to measure what was intended (validity). Due to limitations of time this was not possible.

However the varied symptomatology presented by the subjects of the study were not mentioned by them casually but given in graphic detail; words and examples used by the patients while describing their symptoms clearly showed the gravity of the symptom as well as its effect on the person's day to day work. The different manner in which the symptom was described also showed that the person was informing us of a problem based on his/her own experience and not just vague hearsay expressions. This is particularly important since in the absence of signs in the same proportion as symptoms, doctors attending on these people in busy government clinics were often passing off the symptoms reported, as compensation 'malingering' or 'not of clinical significance'. We have every reason to believe that these symptoms were real expressions of physical and mental ill health and many should be accorded the same significance as the use of patterns of cough with or without expectoration in the diagnosis of chronic bronchitis or the use of anginal history in the diagnosis of Ischaemic Heart Disease.

The commonest symptom reported was breathlessness on usual exertion and the specific descriptions recorded were : (1) while excessive talking; (2) on brisk walking; (3) doing house-hold work in a hurry; (4) fetching water and firewood; (5) cannot go till the market; (6) little walking – say 100 yards; (7) while coughing; (8) while riding a bicycle etc.

5.4.2 Symptomatology and signs - a comparison

Tables 3-A - 3-C show the difference in rates of the 26 symptoms that had been enquired into in both the sample populations. It must be emphasised that *a symptom was recorded as positive only if it was present at the time of the study.* Five symptoms were not significantly different. These were blood in sputum, fever, jaundice, blood in vomit, stool or malena and vomiting.

Six symptoms were *significantly different.* These were dry cough, breathlessness at rest, lacrimation, skin problems, bleeding tendency and impotence.

Fifteen symptoms were *highly significantly different.* These were cough with expectoration, breathlessness on usual exertion, chest pain/tightness, blurred vision/photophobia, headache, weakness in extremities, muscleache, fatigue, loss of memory, tingling/numbness, nausea, abdominal pain, flatulence and anxiety/depression. Moreover critical symptoms like breathlessness on usual exertion, lacrimation, pain/tightness in chest, blurred vision, weakness in extremities, fatigue, loss of memory, tingling/numbness, anorexia, nausea, flatulence and anxiety/depression were not reported in a monosyllable 'yes' but described in such graphic detail that their presence could not be doubted.

5.4.3 Clustering

It was obvious from the study findings that most of the persons in JP Nagar had more than one symptom present. To further study the pattern of clustering of symptoms, we grouped the symptoms according to the system they naturally belong to. Some overlap in such grouping is inevitable but it does reveal the overall pattern e.g. an important symptom like breathlessness on usual exertion which is reported with highest frequency does not squarely belong to one system like cardiovascular or respiratory system alone. Both these systems can with equal legitimacy lay claim to this most frequent and crucial symptom and this is particularly important since we are examining critically two dominant medical theories in this study–'cyanogen pool' theory and 'pulmonary theory.'

All the symptoms were grouped together system wise as follows :

(a) Pulmonary system (P)

The grouping of symptoms suggesting diffuse pulmonary fibrosis is based on Harrison's Principles of Internal Medicine 10th edition, 1983 (Chapter 280, P.1567). They include breathlessness at rest and on accustomed exertion, dry cough and cough with expectoration, weakness in extremities and pain/tightness in the chest. To be included in this group the combination of symptoms had to have cough with or without expectoration and dyspnoea at rest or usual exertion.

(b) Gastro-intestinal system (GI)

They included anorexia, nausea, vomiting, abdominal pain and flatulence.

Table 2

Comparison between body surface area (M^2) in JP Nagar and Anna Nagar according to age-sex (figures in brackets show S .D)

Body surface area (mean) in Sq M^2		J P Nagar n= 136	Anna Nagar n = 137
11-15 years	M	1.23 (0.14)	1.22 (0.19)
	F	1.22 (0.12)	1.15 (0.13)
15–45 years	M	1.49 (0.09)	1.51 (0.12)
	F	1.37 (0.11)	1.35 (0.12)
45-60 years	M	1.50 (0.14)	1.53 (0.09)
	F	1.37 (0.09)	1.41 (0.22)
61 +years	M	1.35 (0.04)	1.38 (0.15)
	F	1.32 (0.06)	1.28 (0.05)

Note: The differences in mean BSA's were tested by 't' test -- all the differences were statistically non-significant (NS)

Table : 3 A

Comparison of Symptoms reported by individuals in J.P. Nagar and Anna Nagar. (Expressed in percentage. Numbers of cases are shown in brackets.)

Sl. No.	Symptoms	J.P. Nagar %	A. Nagar %	P. Value* (a)
1.	Dry Cough	27.70 (41)	14.49 (20)	P < 0.01
2.	Cough with Expectoration	47.29 (70)	23.91 (33)	< 0.001
3.	Breathlessness at rest	10.13 (15)	2.89 (04)	< 0.025
4.	Breathlessness on usual exertion	87.16 (129)	35.50 (49)	<< 0.001
5.	Chest pain/tightness	50.0 (74)	26.08 (36)	<< 0.001
6.	Weakness in Extremities	65.54 (97)	36.95 (51)	<< 0.001
7.	Fatigue	81.08 (120)	39.85 (55)	<< 0.001
8.	Anorexia	66.21 (98)	28.26 (39)	<< 0.001
9.	Nausea	58.10 (86)	16.66 (23)	<< 0.001
10.	Abdominal pain	53.37 (79)	25.39 (35)	<< 0.001
11.	Flatulence	68.91 (102)	25.36 (35)	<< 0.001
12.	Lacrimation	58.78 (87)	42.62 (58)	<< 0. 01
13.	Blurred vision/photophobia	77.02 (141)	33.40 (53)	<< 0.001
14.	Loss of memory for recent events	45.27 (67)	11.59 (16)	<< 0.001
15.	Tingling/numbness	54.72 (81)	20.28 (28)	<< 0.001

*(a) P Values were calculated by X^2 method.

Table : 3 B

Comparison of Symptoms reported by individuals in J.P.Nagar and Anna Nagar. (Expressed in percentage. Numbers of cases are shown in brackets.) **(Symptoms significantly different but not analysed further)**

Sl. No.	Symptoms	J. P. Nagar %	A. Nagar %	P. Value *(a)
1.	Skin problems	29.05 (43)	11.59 (16)	< 0.01
2.	Bleeding tendency	9.45 (14)	2.89 (04)	< 0.025
3.	Headache	66.89 (99)	42.02 (58)	<< 0.001
4.	Muscle ache	72.97 (108)	36.23 (50)	<< 0.001
5.	Impotence	8.10 (12)	0.72 (01)	< .05
6.	Anxiety/Depression	43.92 (65)	10.14 (14)	<< 0.001

Table : 3 C

Comparison of Symptoms reported by individuals in J.P Nagar and Anna Nagar (Expressed in percentage. Numbers of cases are shown in brackets.)
(Symptoms - Non-significant)

Sl. No.	Symptoms	J. P. Nagar %	A. Nagar %	P. value* (a)
1.	Blood in Sputum	10.13 (15)	7.24 (10)	N.S.
2.	Fever	27.70 (41)	28.98 (40)	N.S.
3.	Jaundice	0.67 (01)	00	N.S.
4.	Blood in vomit/stool/malena	12.16 (18)	10.14 (14)	N.S.
5.	Vomiting	11.48 (17)	5.79 (08)	N.S.

*(a) P Values were calculated by X^2 method.

(c) Eye Symptoms

They included blurring of vision and or lacrimation.

(d) Central Nervous System (CNS)

Disturbance or loss of memory and tingling and numbness.

The following symptoms were not included in this classification: impotence, anxiety/depression, headache, muscleache, bleeding tendency, skin problems,

Table 3-D shows the incidence of the combination of these symptom complexes. Some very interesting facts emerge.

As large as 63.5% (94/148) persons reported all the important symptoms. Only 2.7% (4/148) have symptoms which are exclusively pulmonary. Atleast 35.14% of persons do not have any pulmonary symptoms.

Table 3-E further explores the group of patients without pulmonary symptoms and we found the following significant facts:

About 21% persons have GI symptoms without pulmonary symptoms.

About 22% persons have eye symptoms without pulmonary symptoms.

About 15% persons have CNS symptoms without pulmonary symptoms.

In the last three categories symptoms of other systems may or may not have been present.

An important further point of comparison between JP Nagar and Anna Nagar with reference to this grouping of symotoms is that **every person in JP Nagar reported atleast one serious symptom but quite a few in Anna Nagar did not report any serious symptom.**

Table: 3 D

Symptoms

Symptom groups	No /Total	%
P + G. I. + Eye + CNS	92/148	62.16
P (Pulmonary only)	4/148	2.7
P - NIL (ie G.I./CNS/Eye)	52/148	35.14

(For symptoms included in grouping please refer 4.4.3)

Table : 3 E

Symptom Complexes excluding Pulmonary System

Symptom Groups	No./Total	%
G.I. (with or without eye/CNS)	31/148	20.94
Eye (with or without GI/CNS)	32/148	21.62
CNS (with or without GI/Eye)	23/148	15.54

Table : 4

Patterns of disturbance of vision in 10—45 yrs of population in J.P. Nagar and A. Nagar (Figures in brackets indicate actual number)

		J.P. Nagar %	Anna Nagar %
Blurring of vision	(1)	74.24 (98/132) (a)	28.57 (34/117)
Abnormal distant vision	(2)	42.0 (65/141) (a)	21.88 (21/96)
Abnormal near vision	(3)	17.55 (20/114) (b)	8.74 (9/103)
Corneal Opacity	(4)	4.7 (7/148) (b)	2.8 (4/138)

NOTE :—

1. Includes Photophobia.
2. Normal vision 6/9 — Distant Vision tested by means of Snellen's chart
3. By means of near vision chart
4. In J.P. Nagar and Anna Nagar each there are two central opacities.

(a) tested by X^2 d.f.1 $P < 0.001$

(b) tested by X^2 d.f.1 P - Non-significant

5.4.4 Disturbances of vision

Table 4 shows percentage disturbance of vision of the age group 10-45 years of population in both communities. Persons above 45 years of age have been excluded because of the higher rates of cataract in this population which would contribute to disturbance in vision.

Significantly higher percentage of individuals complained of blurring of vision in JP Nagar rather than in Anna Nagar. As large as 42% in JP Nagar had abnormal distant vision compared to 22% in Anna Nagar. The difference is highly significant statistically. As to the abnormalities in near vision the differences between the two populations are of some significance (but this difference misses 5% level of significance very narrowly : X^2 d.f.1 3.62).

The difference in the rate of corneal opacities between the two communities irrespective of their position on the cornea is not significant statistically (see Note 4 to table 4). However individual case histories had recorded that new corneal opacities had emerged after the gas leak in both JP Nagar and Anna Nagar.

Abnormalities of distan tvision, although large, cannot fully explain the extent of blurring of vision in JP Nagar. Moreover significantly larger proportion of abnormal distant vision in JP Nagar is itself in need of explanation. It is relevant at this stage to point out that examination of eyes by trained ophthalmologists undertaken by other teams have so far failed to identify abnormalities in the anterior and posterior chambers of the eyes to any significant extent (14).

The combination of these findings is unexpected but significant. The experts had predicted that there will be no problems of vision of such magnitude and whatever residual problems of vision there would be, that would be because of corneal opacities.

5.4.5 Pulse/Respiration Rate/Hemoglobin Concentration

Tables 5-A, 5-B and 5-C show the comparisons of resting mean pulse rates, resting mean respiratory rates and mean hemoglobin concentrations, respectively between the two samples and in both sexes.

Mean pulse rates and mean respiratory rates in both sexes in both JP Nagar and Anna Nagar are not different statistically. However, mean hemoglobin concentration in both males and females is significantly higher in JP Nagar than in Anna Nagar.

The higher concentration of hemoglobin is probably masking resting tachycardia and resting tachypnoea in JP Nagar but the degree of tachypnoea and tachycardia masked is not likely to be very high.

5.4.6 Other clinical findings

Clinical examination of all individuals in the sample showed the following:

(i) 9.4% (14/148) individuals in JP Nagar had *rales and rhonchi in the chest* as against 2.1% (3/148) in Anna Nagar. The difference is significant statistically ($P < 0.026$). Significantly higher rates of rales-rhonchi in JP Nagar may well be due to increased sensitization of the bronchial tree following

MIC exposure, but the rate is too small to account for the much higher rate of breathlessness on exertion;

(ii) We identified no case of *cyanosis*, a significant negative finding in view of the fact that 87% of the individuals in JP Nagar have breathlessness on exertion, have increased concentration of hemoglobin and that extensive pulmonary damage is expected to have occurred.

(iii) There was one case of oedema of leg, one case of hemiplegia (long term history) and one case of palpable hepatomegaly.

(iv) There was one case of jaundice and no splenomegaly;

(v) No significant findings in cardio-vascular system or central nervous system.

5.4.7 Effects on the Reproductive System Of Women

5.4.7.1 Gynaecological problems

The comparisons of symptomatology in this group of symptoms has been done in two stages :

(i) comparison between symptoms in women of JP Nagar before and after the gas leak (in the same women);

(ii) comparison between symptoms in women of JP Nagar and Anna Nagar after the gas leak (between samples).

Tables 6-A, 6-B, 6-C, 6-D and 6-E show the comparison of mean menstrual cycle lengths, percentage distribution of flow types, percentage distribution of colour and percentage distribution of dysmenorrhoea and leucorrhoea.

The salient findings are that women of reproductive age group in JP Nagar have significantly shortened length of menstrual cycles after the exposure to the gas compared to the lengths of cycles in the same group of women before the gas leak and lengths of cycles of women in Anna Nagar after the gas leak. Significantly more number of women in JP Nagar also had abnormalities of menstrual flow—scanty, or heavy and blackish discharge (Tables 6-A - 6-C), dysmenorrhoea (Table 6-D), and leucorrhoea (Table 6-E), after the gas exposure when compared to the internal/external control mentioned above.

It may be argued that increased rates of leucorrhoea in JP Nagar after the gas exposure may be because of break-down in sanitary conditions due to the disaster. The disaster obviously did not lead to physical destruction of the housings and whatever sanitation that there was, people did not flee to refugee camps where sanitory breakdown may be nearly total. Therefore this argument of sanitation is not really applicable to the study.

5.4.7.2 Pregnancies and their outcome

Four women in JP Nagar and five women in Anna Nagar were pregnant at the time of our study. There was one abortion in Anna Nagar and none in J P Nagar. There was no instance of still birth. The numbers in the sample are too small to

Table : 5 A

Mean pulse rate/minute (S.D.) in males & females of J.P. Nagar and Anna Nagar. *

	J.P. NAGAR	ANNA NAGAR
Male	77.13 (11.28) n = 67	77.94 (10.68) n = 73
Female	85.73 (13.21) n = 78	85 05 (11.20) n =59
Total	81.70 (13.20) n = 145	80.4 (13.0) n =132

* All the differences in mean pulse rates were tested stastically by 't' test and found to be non-significant.

Table : 5 B

Mean Respiration Rate/minute (S.D.) in males & females of J. P Nagar and Anna Nagar.*

	J.P.NAGAR	ANNA NAGAR
Male	21.73 (3.98) n= 69	21.21 (3.84) n=74
Female	21.84 (4.93) n=70	20.92 (3.70) n=56
Total	21.87 (4.51) n=139	21.09 (3.77) n=130

* All the differences in mean respiration rates were tested stastically by 't' test and found to be non-significant.

Table : 5 C

Mean blood Haemoglobin in gm.% in J.P. Nagar & Anna Nagar. (The figures in brackets are S.Ds of means. n = sample size.)

	J.P. NAGAR	ANNA NAGAR
Male	14.68 (1.79) n = 11 (a)	12.70 (1.35) n = 17
Female	12.7 (1.46) n = 20 (b)	10.79 (1.34) n = 18

(a) $t_{d.f26} = 3.18$ - P < 0.01
(b) $t_{d.f36} = 4.20$ - P < 0.001

Table : 6 A

Mean Menstrual cycle length in days in J.P. Nagar and Anna Nagar after and before gas exposure. (Figures in brackets indicate S.D. in days.)

J.P. NAGAR		ANNA NAGAR	
Before	After	Before	After
32.32	25.59	35.41	36.10
(13.51)	(12.04)	(20.09)	(19.89)
n = 31	n = 31	n = 29	n = 29

$t_j = 2.06$
d.f. 60
P. < 0.05

$t_a = 0.131$
d.f. - 56
P > 0.8

$t_{j.a.}$

j.a. :- differences in mean menstrual cycles length in days between J. P. Nagar and Anna Nagar after the gas exposure.

$t_{j.a}$ - 2.46
d.f. - 58
P < 0.05

Table : 6 B

Percentage distribution of Flow in J.P. Nagar & Anna Nagar before and after the gas exposure. (Figures in brackets are number of cases)

	J. P. NAGAR			ANNA NAGAR		
	Scanty	Excess	Total	Scanty	Excess	Total
Before	5.5	11	100	2.6	18.4	100
	(2)	(4)	(36)	(1)	(7)	(38)
After	25.7	31.4	100	5.8	20.7	100
	(9)	(11)	(35)	(2)	(7)	(34)

$X^2 = 11.96$
d f. = 2.
$P < 0.01$

$X^2 < 1$
d.f. = 2.
$P > 0.50$

After the gas exposure
J. P. Nagar & Anna Nagar

$X^2 = 7.82$
d. f. = 2.
$P < 0.025$

Table : 6 C

Percentage distribution of colour of menstrual flow in J. P. Nagar and Anna Nagar before and after the gas exposure. (Figures in brackets are No. of cases)

	J. P. NAGAR		ANNA NAGAR	
	Black	Total	Black	Total
Before	5.8	100	0	100
	(2)	(34)	(0)	(37)
After	46 8	100	8 8	100
	(15)	(32)	(3)	(34)

$X^2 = 14.46$
d.f = 1
$P < 0.001$

$X^2 = 3.41$
d.f. = 1
P - N.S.

After the gas exposure J.P. Nagar & Anna Nagar

$X^2 = 12.03$
d.f. = 1
$P < 0.001$

Table : 6 D

Percentage distribution of Dysmenorrhoea in J. P.Nagar and Anna Nagar before and after the gas exposure. (Figures in brackets are number of cases.)

	J. P. NAGAR		ANNA NAGAR	
	+ve	Total	+ve	Total
Before	28.5 (10)	100 (35)	48.7 (19)	100 (39)
After	65.6 (21)	100 (32)	39 (14)	100 (36)

$X^2 = 9.21$
d.f. = 1
$P < 0.01$

$X = 0.71$
d.f. = 1
P - N.S.

After the gas exposure
J. P. Nagar & Anna Nagar

$X^2 = 4.89$
d.f. = 1
$P < 0.05$

Table : 6 E

Percentage distribution of Leucorrhoea in J. P. Nagar and Anna Nagar— before and after the gas exposure (Figures in brackets are number of cases.)

	J. P. NAGAR			ANNA NAGAR		
	Non-Specific Leu.	Specific Leu.	Total	Non-Specific Leu.	Specific Leu.	Total
Before	15.5 (7)	0 (0)	100 (45)	16.6 (7)	14.3 (6)	100 (42)
After	22.2 (10)	35.5 (16)	100 (45)	14.6 (6)	14.6 (6)	100 (41)

$X^2 = 22.5$
d.f. = 2.
$P < 0.001$

$X^2 = 1$
d.f. = 2
P—N.S.

After the gas exposure
J. P. Nagar & Anna Nagar

$X^2 = 7.455$
d.f. = 2.
$P < 0.025$.

reveal any significant changes. Moreover the foetuses which are likely to have been damaged about three months ago at the time of the gas leak are now in the second trimester and therefore, it will be a few more weeks before the adverse impact on pregnancies will be correctly estimatable.

5.4.7.3 Lactation

50% of nursing mothers in JP Nagar reported lactation failure or decrease in output as compared to 11% (1/9) of mothers in Anna Nagar.

5.4.8 Effects on Reproductive System : Of men

Impotence: Table 3-B shows that the percentage of men reporting symptoms of impotence was 8.1% (12/148) in JP Nagar and 0.72% (1/138) in Anna Nagar (significance of difference $P < 0.05$).

5.4.9 Pulmonary Function Tests

Table 7 shows the comparison between the sampled subjects of JP Nagar and Anna Nagar on two parameters of lung function measured in the study - Forced Expiratory Volume in the 1st second (FEV1) and Forced Expiratory Capacity (FVC).

The difference between JP Nagar and Anna Nagar are statistically significant in both sexes in the age groups of 15-45 and 46-60 years. The difference in other age/sex categories are however, not statistically significant. This may be due to smaller number of observations in these categories. The mean values in all these categories and the FEV1/FVC ratio in all categories are diminished in JP Nagar in comparison to Anna Nagar.

The pattern in the age groups 15-44 and 45-60 shows a restrictive type of pulmonary function, while in the over 61's the pattern is mainly obstructive.

5.4.10 Anxiety/Depression

From our field level interviews in which we spent much time listening to the people's experiences we identified syndromes of anxiety and or depression in 43.92% of the subjects (65/148) in JP Nagar and 10.14% of subjects (14/138) in Anna Nagar. This difference is statistically significant.

From the sharing of experiences we gathered that there was much fear, apprehension, anxiety symptoms, gas-phobia, fear of the restarting of the factory operations and frank depression. In some cases there was some degree of mental confusion.

5.4.11 Impairment of Memory

Many people described a definite change in their memory for recent events. They narrated different examples of situations in which their memory seemed to fail causing them much worry: e. g. (i) forgetting where something has been kept; (ii) forgetting whether a meal has been taken or not; (iii) forgetting whether salt has been added to the 'dal' or not; (iv) forgetting the names of the children; (v) forgetting the day or time; (vi) after coming out of the house forgetting for what purpose one came out; (vii) students complained that they could not remember lessons or poems learnt before the episode.

Table : 7

Distribution of Mean values of Body Surface Area (M^2), FEV (Litre.), FVC (Litre) ., FEV/FVC% in different age-sex groups. in J. P. Nagar and Anna Nagar. (a) * (Figures in brackets are S.Ds) n = number of persons in each cell. P = P value.

Age-Sex	BSA (M^2)		FEV (Lit)		FVC (Lit.)		FEV,/FVC %	
in yrs.	J.P	A.N.	J.P	A.N.	J.P.	A.N.	J.P.	A.N
10-14								
M	1.23 (0.14) n=4	1.22 (0.19) n=4	1.59 (0.74) P=NS	1.93 (0.48)	1.72 (0.77) P=N.S.	2.20 (0.51)	87.05	87.8
F	1.22 (0.12) n=3	1.15 (0.13) n=6	1.76 (0.84) P=NS	1.77 (0.33)	2.07 (0 88) P=N.S.	2.10 (0.40)	84.3	84.2
15-44								
M	1.49 (0.09) n=45	1.51 (0.12) n=55	2.04 (0.47) P <).001	2.66 (0.51)	2.39 (0.47) P <0.001	2.99 (0.55)	79.1	88.9
F	1 37 (0.11) n=56	1.35 (0.12) n=52	1.64 (0.44) P <0.001	2.25 (2.42)	1.97 (0.38) P <0.001	2.54 (0.43)	76.3	88.6
45-60								
M	1.50 (0.14) n=12	1.53 (0.09) n=6	1.88 (0.53) P <0.05	2.26 (0.19)	2.20 (0.43) P <0.05	2.54 (0.24)	85.3	88.9
F	1.37 (0.09) n=11	1.41 (0.22) n=7	1.51 (0 48) P <0.01	2.13 (0.18)	1.86 0.58) (P <0.01	2.48 (0.21)	79.8	85.9
61 +								
M	1.35 (0.04) n=2	1 38 (0.15) n=4	0.94 (0.39) P <0:02)	1.91 (0.15)	1.83 (0.35) P=N.S.	2.17 (0.16)	61.8	88.0
F	1.32 (0.06) n=3	1.28 (0.05) n=3	1,39 (0.31) P <0.05	1.90 (0.07)	1.96 (0.31) P=N.S.	2.13 (0.15)	63.4	86.2

(a)* All the differences in Mean Values between J.P. Nagar & Anna Nagar in each age-sex category were tested by 't' test.

Table : 8

Exposure History and safety Measures

Where at the time of leak	J P Nagar				Anna Nagar			
	Wet towel	Blanket	Ran out	Nil	Wet towel	Blanket	Ran out	Nil
In the Basti	5	7	124	8	9	6	64	52
Out of home (in Bhopal)	1	-	1	2	-	-	2	5
Out of Bhopal	-	-	-	10	-	-	-	11
	Total No. 158				Total No. 148			

Note: Nil means remained in the house without safety measure.

Table : 9

Number of attacks (respiratory infections) in one month preceding the study

Age	JP Nagar			Anna Nagar		
	One attack	Often	Nil	One attack	Often	Nil
10-15 yrs	3	13	15	4	1	16
16-45	15	46	35	24	7	68
46 +	3	14	4	4	4	11
	21	73	54	32	12	95

In statistical terms 67/148 subjects in JP Nagar (45.27%) and 16/138 subjects in Anna Nagar (11.59%) complained of this symptom. The difference is highly significant.

Miscellaneous observations

5.4.12 School Performance of Children

A discussion with one of the school teachers in the affected area revealed that the school attendance had fallen because many families had moved away, many pupils had died or become too ill to continue. Of those who returned to school, the teachers felt that there appears to be no visible physical effect but they are not as 'active' as they used to be. They do not go out to play that often. They are not restless when they have to sit for long periods in class as they used to be. Some of them have developed a disinterest in school work. Even though all had not lost their immediate kith and kin, many had seen their friends and cousins die and were affected by this.

Many members of the team themselves observed this general listlessness or apathy of the children, and many were dyspnoeic as well. The visual impressions of these problems between JP Nagar and Anna Nagar was distinctly different, the impression in Anna Nagar being similar to what one expects in an average slum area - lots of children playing around, inquisitive, running about, active.

5.4.13 Effect on immunity/resistance

We enquired about the experience of respiratory infections in the study and control population in terms of number of attacks in the one month preceding the study. Table 9 shows this finding. 73/148 in JP Nagar had many attacks of respiratory infections while only 12/138 in Anna Nagar gave this history. In JP Nagar this was often described as a continuous respiratory problem. This is an important supportive finding but cannot be taken directly to mean a state of lowered resistance to infection resulting in frequent upper respiratory infections but is strongly indicative of it.

5.4.14 Enquiry into exposure and safety measures employed

Table 8 shows where the people in our sample were at the time of the incident and whether they employed any safety measures (wet towel, blanket, running out) to protect themselves against the gas leak.

The fact that many ran out and few used a wet towel is a good indication of the lack of awareness or safety education of the residents of the bastis. Most of them had no idea about the hazardous nature of the plant operation nor about measures to protect oneself in the event of a gas leak. Even those who used a wet towel used it by instinct rather than due to an awareness of precautionary messages.

Concern for man himself and his safety must always form the chief interest of all technical endeavours. Never forget this in the midst of your diagrams and equations.

Albert Einstein

CHAPTER 6

DISCUSSION

The present study is a community based, case/control study in randomly selected samples of families. It provides a much more authentic picture of the state of health of the gas affected communities than one can get from studies conducted on inpatient/outpatient populations of the hospital, which is the chief characteristic of the studies undertaken by the protagonists of the two medical theories. Self selection in hospital based studies necessarily occurs which distorts the community perspective. These efforts may give some understanding of the quality of the problem, but give little information on the actual pattern and quantum of morbidities prevalent in the community. There is no substitute for community based epidemiological studies. Our study has the merit of shifting the focus from the health problems of hospital based patients to the health problems in the community outside the hospital and dispensaries.

It is not too difficult to understand why the health establishment of Bhopal including the dominant faction in the medical college of Bhopal did not attempt such community based epidemiological studies.

However it is not easy to understand why the ICMR after having broken fresh ground and hit upon a potent and fertile hypothesis of 'enlarged cyanogen pool' theory did not go all out for community based epidemiological studies to exploit its full potentials.

But before we go into such intriguing and intricate problems let us first examine the role of chronic diseases and smoking in producing the morbidity and mortality in the Bhopal gas victims, and then critically assess the claims of 'pulmonary theory' in the light of our findings and available information.

6.1 Role of chronic diseases and smoking

Many have argued that a significant proportion of the mortality and residual morbidity is reflective of the base line ill health including a higher prevalence of chronic diseases like tuberculosis and higher smoking rates.

Our findings do not lend support to such speculation. Out of 26 persons who died in our sample study of JP Nager after the gas exposure, one was reported to have been a smoker and none to have had any chronic diseases.

The age/sex breakdown of the dead in JP Nagar are as follows

Age in years	0-1	2-5	6-15	16-45	45+
Male	1	4	2	5	—
Female	2	3	2	5	/

Among these only one 45 year old male was a smoker. Women in JP Nagar generally didn't smoke. Among the dead there were 13 women, 7 males under 15 and 4 males between 16-45 who did not smoke.

The findings of the morbidity survey are also significant. A quarter of the sample in both the communities — JP Nagar and Anna Nagar—were smokers and yet most of the serious symptoms are significantly higher in JP Nagar than in Anna Nagar. Moreover the given smoking rates in JP Nagar cannot fully explain the much higher symptom rates in JP Nagar. A similar argument would apply to the chronic diseases as well which in our survey specifically included history or tuberculosis, bronchitis and asthma. This was found to be around 10 percent in both communities and is much too small to explain the high rate of symptoms.

The question therefore we now come to is : How much do our study findings support or question either of the theories? or to put it differently, how much of our study findings can be explained by either of the theories.

6.2 Pulmonary theory : an assessment

Pulmonary theory's greatest strength is in its simplicity and plausibility.. The theory has a formidable backing of a range of western experts.

The adverse effects of isocyanates other than MIC, which are widely used in industry, have been extensively studied. These effects are mainly confined to lungs. Changes in the blood have never been implicated.

The probability of the MIC molecule's ability to enter the blood stream and reach other organs, thanks to its supposed high reactivity, has been rated extremely low indeed. Furthermore it has been argued that 'there is no known metabolic pathway that converts isocyanate into cyanide' (14).

Autopsy findings have consistently shown damage to the lung tissue, of course damage to the other organs has been shown too. Pulmonary function tests have consistently shown impairment of ventilatory functions. In so far as MIC causes direct damage to the corneas, impairment of vision is an expected finding.

The difference among the believers has been with regard to the type, extent and duration of damage.

Thus the American Public Health specialists maintain that eyes and lungs of a considerable proportion of the population will be greatly damaged. Sooner or later many victims will succumb to suffocating onslaughts of emphysema, asthma and pneumonia. Sizeable number of people could develop permanent blindness due to damage to the corneas. The damaged lung tissue of victims makes them much more vulnerable to common respiratory infections which could become fatal (9).

Then there are others who are much more optimistic about the extent and duration of damage. Thus as we have already quoted, Mr. W. Anderson, Chairman of Union Carbide, U. S. made a confident prediction as early as 3rd January 1985 that victims are rapidly recovering (11) .

These arguments favouring the 'pulmonary theory' are however general without specific reference to the actual situation in Bhopal where massive exposure to MIC gas has occured.

Let us now see how the 'pulmonary theory' stands up to critical examination in the light of facts brought out in Bhopal.

6.2.1 Deaths

The believers of the pulmonary theory have tenaciously held on to the idea that the very high death rate following the gas leak was due to Carbon Monoxide poisoning and not because of cyanide poisoning (besides pulmonary oedema).

As we have seen earlier, the ICMR studies have shown that blood samples of the dead stored in deep freeze and the blood samples of critically ill patients who subsequently died, showed no evidence of carboxy haemoglobin (carbon monoxide combined with haemoglobin) (14). The K.E.M. Hospital study on 113 self reporting MIC exposed persons cannot lend support to the theory of carbon monoxide poisoning either because of the reasons we have discussed in para 3.1, Chapter 3.

According to the theory one expects at least some of the post exposure deaths to be due to lung infections. In our study out of 26 deaths in JP Nagar 52 occured within 5 days of the gas leak because of the direct toxic effect of the gas.

6.2.2 Diseases - Disabilities

It is here however that the theory runs most into deep trouble. The pulmonary theory cannot explain the high rates of symptomatology even 3 months after exposure in a population which is not hospital bound. For instance it cannot explain fatigue(81%), blurring of vision (77%), muscle ache (73%), flatulence (68%), headache (67%), anorexia (66%), nausea (58%), excessive lacrimation (58%), tingling and numbness (54%), loss of memory (45%), and anxiety depression(43%). Even the most common and disturbing symptom like breathlessness on usual exertion (87%) cannot be fully explained by this. (Table 3A)

The simultaneous presence of all serious symptoms suggesting involvement of not only lungs but gastro-intestinal tract, brain and vision in as large as 62% of the sample population in JP Nagar cannot be explained by the pulmonary theory. (Table 3D). It is not the point whether all the above symptoms are part of the symptomatology of extensive pulmonary damage; the point is, are they all present simultaneously in such a large proportion of individuals who are not so ill as to be in the hospital? True, ventilatory capacities are diminished in JP Nagar significantly which supports the pulmonary theory, but even here the reduction is not large enough to explain such a high rate of breathlessness on exertion, weakness and fatigue. **It obviously cannot explain exclusively non pulmonary symptoms in as high as 15 to 21%** (Table 3E). Even if we grant that there is extensive lung damage in a large proportion of cases there should be commensurate clinical findings in those individuals. One naturally would expect high rates of respiration and pulse and cyanosis. None of these are found in our study (Table 5A and 5B).

This is an odd finding. One can of course argue that tachycardia and tachypnoea in JP Nagar is masked by rise in haemoglobin (Table 5-C) which is a result of hypoxia produced by extensive pulmonary fibrosis. But surely where extensive lung damage is supposed to have occured because of MIC exposure one expects 'suffocating onslaughts of emphysema, bronchitis, asthma', etc. (9) with attendent compromised gas exchange at alveolar level. This must lead to not only hypoxia (low oxygen level in the blood) but also to retention of carbon dioxide in the blood which in turn must lead to increased ventilatory efforts to wash out excess build up of carbon dioxide.

Besides, 'cyanogen pool' theory can explain haemoglobin rise without having to account for not much increase in pulse rate or respiratory rate.

Looking at visual disturbances also we see an interesting set of facts. The pulmonary theory explains and predicts visual impairments solely by virtue of direct injury to corneas which may result in opacities producing visual impairment (2,3). In JP Nagar only 7 out of 148 individuals have corneal opacities, of these only 2 are central opacities which matter. The rate in JP Nagar (4.7%) is not statistically significant when compared to the rate in Anna Nagar (2.8%). This extremely low rate of opacities can obviously not explain 74% of blurring of vision in JP Nagar which is statistically significantly higher than in Anna Nagar (Table 4). Carboxy haemoglobin levels of more than 5% in large numbers of individuals can explain this but there is no such evidence. The pulmonary theory cannot explain either the high abnormal rates of distant vision in JP Nagar (42%) which is highly significantly higher than that in Anna Nagar (22%) (Table 4). Finally the evidence from the effects seen on the reproductive system is significant. A significantly shortened menstrual cycle (Table 6-A), increased rate of dysmenorrhoea (Table 6-D), increased leucorrhoea after the disaster in the women (Table 6-E) and increased percentage of impotence in men of JP Nagar (Table 3 B) as compared to Anna Nagar cannot be explained by the pulmonary theory.

Very high rates of symptoms implicating all the important systems in the body call for a theory which can explain disturbances in all the systems by postulating a mechanism which must be operating in all the systems. 'Pulmonary theory' clearly lacks the theoretical mechanism with an integrative power to account for the wide range of symptoms in JP Nagar. 'Cyanogen pool theory' precisely achieves this at least tentatively.

6.3 'Enlarged cyanogen pool' theory : an assessment

By postulating chronic poisoning by cyanide which is slowly released from haemoglobin bound MIC, it suggests that at the cellular level in practically all the organs oxygen utilisation has been impaired. The bewildering and apparently unconnected wide range of symptoms can be explained with the help of this theory. Our findings per se pose no serious problems to this theory.

This is very interesting but then excess cyanide radicals in the body fluids have not been demonstrated. Its presence is inferred from increased levels of urinary thiocyanate following injection of sodium thiosulfate. This however is not its main handicap. Nor is the 'cyanogen pool' theory suffering from the handicap of uncompromising dogmatism which characterises 'the pulmonary theory'. From the very beginning, until now unlike 'the pulmonary theory' it does not claim to be the only theory which can explain everything in Bhopal. It readily accepts that at least a part of the human suffering may well be because of direct damage to the lung tissue and eyes by MIC gas. Its main problem lies in a different area.

Events postulated and substantiated very tenuously to be taking place at the cellular level cannot be directly connected to events occuring (symptoms) in a large proportion of individuals in the community. The chain of links that connects the two must be demonstrated at least tentatively. This has not been done. We therefore now turn to a critique of the 'cyanogen pool' theory.

There are two kinds of evidence both indirect, to suggest chronic cyanide poisoning, (1) Inadequate utilisation of oxygen and removal of carbon dioxide indicates a metabolic block at cellular level. There is also some evidence that carbon dioxide removal from tissues is increased after injection of sodium thiosulfate, (2) The clear rise in the urine output of thiocyanate following injection of sodium thiosulfate perhaps indicates an enlarged cyanogen pool.

However the data available on both the types of studies (changes in the blood gases and urinary thiocyanate following sodium thiosulfate) is very scanty and fragmentary, which makes informed and in depth examination of these studies almost impossible. *Furthermore these studies are done on hospitalised patients. To extend the findings and lessons of these studies to home based ambulatory persons as ICMR does is not acceptable on methodological grounds.*

We find ourselves not equipped enough to appraise more critically the meaning and interpretation of blood gas studies but we do offer our criticism of the way a potent tool of epidemiological research such as sodium thiosulfate has been used so far resulting in non-illumination of many critical areas of toxic effects on the human population.

In the double blind clinical trials carried out by ICMR and others on 30 hospitalised patients in Jan.-Feb.1985 two outcomes were observed, one, clinical improvement and two, urinary thiocyanate levels following sodium thiosulfate or glucose as placebo (14). The released information so far does not say clearly as to what was observed in the clinical outcome. However if we go by clinical criteria used in subsequent studies (not double blind trial) which are made public, we can make a reasonable guess as to what was probably observed, i.e. (i) weakness and breathlessness at rest and (ii) increase even after mild exertion (14). From our point of view these are only pulmonary symptoms constituting only a small proportion of all symptoms. They do not include non pulmonary symptoms like blurring of vision, nausea, anorexia, flatulence, fatigue, weakness, headache, etc. And yet the minutes of the ICMR meeting of 14-2-1985 (16) contained detailed guidelines for categories of patients to be given injection sodium thiosulfate which included patients suffering from acute and/or chronic symptoms relating to respiratory, gastrointestinal and neuromuscular systems following MIC gas exposure.

This is clearly far from satisfactory. There is no published evidence by ICMR which says that a significant proportion of non pulmonary symptoms are relieved also. We are therefore, bound to question the explanatory power of the 'cyanogen pool' theory to account for high rates of non pulmonary symptoms. Also ICMR data related to hospitalised patients, cannot say much about the community where large numbers of persons have wide ranging symptoms. Based on such a few and limited studies how can the cyanogen theory explain these symptoms in the community ?

Have there been community based trials focussing on the whole range of symptoms so that, even if indirect, evidence for existence of an enlarged cyanogen pool and its extent in the community may be established ? No.

This is not all. Significantly increased urinary output of thiocyanate in patients who are given sodium thiosulfate compared to those who are given only glucose is not a finding which is non problematic. This is so, because we do not know the effect of sodium thiosulfate on the urinary output of thiocyanate in a healthy population.

Going by whatever evidence ICMR has published so far, it is not adequate enough to explain the wide range of symptoms in a high proportion of the ambulatory population as revealed by our study.

This criticism clearly leads one to suggest that ICMR does not have adequate evidence to substantiate the 'Cyanogen pool' theory or if it has got it for some unknown reasons it has not made public full details 5 months after the disaster.

ICMR cannot make a claim that necessary information is being generated, for how can it then issue two press releases giving details of guidelines for thiosulfate therapy for the symptoms including non pulmonary symptoms ?

To summarise our arguments : On the night of 3rd December, between 100, 000 to 200, 000 persons in Bhopal got severely exposed to MIC gas (14,18,12). A vast majority of them are still complaining of serious, debilitating symptoms indicating involvement of many systems

According to the cyanogen pool theory each of these exposed persons has an enlarged cyanogen pool in his/her body leading to chronic cyanide poisoning. This whole population may be made up of different categories of people from the point of view of the state of the cyanogen pool in their bodies and its manifestations in the form of various symptoms.

There may be some who have been ill enough to be hospitalised, those who have attended OPD only and those who belong to neither group, but have serious symptoms nevertheless. Of course there may be various degrees of overlap here. Similarly there may be various categories of symptom complexes in each of the above described groups.

The idea is not to work out all possible permutations and combinations! But along the two axes of symptom complexes and degree of seriousness of symptoms a limited number of concrete epidemiological groupings/profiles may be present which can be and must be identified.

The whole point of our criticism is that out of all such existing epidemiological groupings who together make the total population of gas victims, the ICMR has chosen to study rigorouly only one tiny group: a seriously ill patients (hospitalised), whose pulmonary symptoms have been kept in focus. The rest have been ignored. They remain unidentified, unknown and the existence or otherwise of an enlarged cyanogen pool in these groups remain untested, although such a potent tool of epidemiological investigation as sodium thiosulfate is available all through out!

Our arguments must not be understood to mean that our aim is to reject the 'cyanogen pool' theory. The theory is to be rejected only when the arguments advanced in its support are found wanting, untenable. Here we are not criticising and rejecting the arguments which have been advanced in support of cyanogen pool theory. On the contrary we are complaining, bitterly, that the possible, sensible and comprehensive arguments in support of 'cyanogen pool' theory have not been advanced because they have not been developed. Without these arguments the cyanogen theory remains untested and weak. And this is because ICMR has not bothered to develop this theory and to build up the arguments by following relevant lines of research so clearly suggested by the theory and the nature of problem facing us.

This is the criticism of methodology, perspective, orientation and objectives of research strategy. This has helped more than anything else to put the theory under the shade before it was given a fair and rigorous trial. This is not a criticism of the theory per se. Many have expressed fears that by this criticism we might be forced to oppose the mass treatment of sodium thiosulfate. Far from it.

This fear arises in part from the fact that if gaps in evidence are highlighted then the theory may suffer and with that sodium thiosulfate therapy might be rejected and condemned. We do not agree. As we have tried to argue above, the

gaps in the evidence because of lack of efforts to build up evidence is not the same as negative evidence. The theory cannot be rejected before it is properly tested. The whole point is that the evidence can be and must be built up if the theory is sound and is to be properly tested.

There may be some hesitation on account of the fear—again not really sound that further trials may mean further delay in treatment and that it may not be ethical to carry out such trials.

Taking the second point first : It is not ethical not to give benefit of treatment to the remaining groups. It is perfectly ethical to give them treatment especially when we know that on the one hand there is a disturbing possibility of chronic cyanide poisoning in such a vast number of people, and on the other hand sodium thiosulfate is such a harmless drug.

Coming to the first point : Used as we are to a division and distance between research and action, we may not be quick enough to grasp that this division and distance is artificial and has no connection with the real world where efforts to understand and solve the problems almost simultaneously is possible !

The science of clinical trials has advanced so much that with the help of well established statistical methods like Sequential Analysis, a series of quick, short duration, rigorous trials in the relevant epidemiological groups described above can be easily mounted. From a minimum of data, reliable and valuable conclusions can be drawn. We do not have to wait for a long time for the results of clinical research to come through before the treatment is initiated.

It is also possible to initiate mass treatment on the one hand, since no ethical problems are involved and launch well planned, comprehensive programmes of research in the chosen epidemiological groups on the other hand so that the whole scientific case to support 'cyanogen pool' theory may be built up and the treatment is based on rational, scientific, foundations. Specific care should be taken that all who are getting treatment should have proper records showing identity of person, precise clinical description and outcomes.

These strange and inexplicable lapses of ICMR have other implications and far reaching consequences not only for establishing the case for the 'cyanogen pool' theory, and treatment and relief as we have seen above but also for compensation damages for the gas victims and for continuing relevant research programmes.

6.4 Magnitude of the problem : an issue of damage/compensation

We undertook this small and modest study within the severe limitations imposed by man, material and time constraints. The purpose of the study was to bring into focus the real issues of health that seemed to be out of focus.

To design and implement a much larger and more comprehensive series of epidemiological studies (i) to elucidate and substantiate the 'cyanogen pool' theory (ii) to help the suffering gas victims of Bhopal by way of medical relief (iii) to help them put up claims for damages and compensation against the Union Carbide, cannot be undertaken by us.

The issue of compensation/damages for Bhopal gas victims is now before the American courts. The crucial question is : How can medical evidence for tens of thousands of gas victims be presented in the court? Fortunately American courts

accept epidemiological evidence in such cases as the Bhopal disaster. A representative case from each of the relevant epidemiological groupings may be presented before the jury. Once the jury is satisfied, it can then be given statistics of other similar cases, based on proper epidemiological studies. The damage for all the identified victims may then be awarded (20).

A detailed working out of epidemiological profiles and listing of the gas affected population assigning each to one of the profiles is thus crucial to claim damages from Union Carbide.

Easily between 50 to 70% of the ambulatory population in the severely affected areas of Bhopal are still complaining of one or more serious symptoms implicating different body systems like the respiratory/gastro intestinal/ ocular and neuromuscular systems.

It has been estimated that about 100,000 to 200,000 people of Bhopal suffered serious exposure to MIC gas (14, 18, 21). Since we have excluded children below 10 years from our study who constitute about 30% of the total population we can give an estimate of suffering in 70,000 to 140,000 population. By most conservative estimates the number of persons still suffering is between 30,000 to 60,000 at the lower end. We stress again that even the upper estimate is a severely conservative estimate especially since it excludes children below 10 years who are suffering also. Practically nothing has been thought about them let alone anything being done for them thanks to the exclusive focus on the hospital population.

6.5 Thiosulfate controversy

It is obvious that differences in theory can also lead to difference in the treatment. But in Bhopal the differences about treatment have clearly gone beyond academic differences.

The believers in the pulmonary theory in the beginning treated the gas victims with bronchodilators, steroids, antibiotics, oxygen etc. This was the most obvious line of treatment at first. However, the symptoms continued unabated inspite of treatment.

Later it was known that cyanide poisoning was a strong possibility and many including doctors themselves availed of thiosulfate injections to obtain relief. ICMR issued guidelines for such treatment by 14th February 1985 based on the findings of a double blind clinical trial which is accepted as one of the most rigorous scientific methods of study.

Inspite of all this the medical establishment of Bhopal held back the treatment from the gas victims and continued to put obstacles in the way of implementation of this recommendation. Why ?

The minutes of the ICMR meeting of 14th February (16, Appendix-III) specifically mentions that all participants (which included members of the opposing medical lobby as well) agreed finally to the guidelines and a decision to convey the same to the health authorities in Bhopal as well as the Ministry of Health at the Centre (to ensure adequate supplies of sodium thiosulfate) was also recorded. These minutes were circulated to all the staff of the medical college recommending necessary action on 18th February 1985. Nothing came of it. Sodium thiosulfate is still not being given on a mass-scale to the gas victims. Besides this, a bogey of

supposed ill effects of treatment is being raised. The evidence produced is worse than flimsy (2 out of 200 patients treated with sodium thiosulfate developed rash and nausea-vomiting and 2 patients severely moribund died after sodium thiosulfate treatment!).

At a symposium on pulmonary function held in the Medical College at Bhopal on 24th March 1985, when a senior Professor was asked by the mfc team why sodium thiosulfate was not being more widely used, when seniors like him had given their consent to it earlier (Ref. appendix-III ICMR minutes - 14-2-85), the matter was brushed aside by a denunciation of ICMR and questioning the validity of the double blind study. This reaction was indeed strange since if he had not been satisfied with the results or methods of the trial, the dissent or objections should have been raised and minuted in the proceedings of the meeting and ICMR should have been required to release further details of the controversial trial.

On 3rd April 1985, Hindu, Madras carried a news report. Another senior Professor Emeritus of the Medical College, Bhopal was asked by press reporters why victims of the gas exposure were still not being given injection sodium thiosulfate. The reply recorded was even more surprising. 'How do you expect me to administer sodium thiosulfate to gas affected persons when I am not convinced about the need for it - simply because someone however eminent he is, has said it and patients are asking for it?'

Strange argument this! In invoking the doctors' right to choose the treatment one should not forget that this right is not arbitrary. The doctor is under obligation to take cognisance of well tested scientific facts. In this case it is not the opinion of the eminent person that is the issue. The issue is whether the opinion is based on a rigorous scientific trial and whether there exists equally strong arguments which contradicts the outcome of the trial. In the name of 'the doctors right to choose the treatment' a doctor cannot ignore existing scientific evidence. What is conveniently also glossed over is the fact that only a few months earlier most doctors had accepted meekly the dictates of the health department banning the use of sodium thiosulfate.

This is pathetic. Is there no one to pull up these 'eminent' people whose behaviour is both unethical and unscientific?

In our country we have a body of health professionals - the Indian Medical Association (I.M.A.). I.M.A. considers itself to be a custodian of health of the people. To fulfill this role it has also taken up the cause of merit in medical education. Thus not long ago it launched a tirade against introduction of village health workers in the health services in rural areas. 'How can these illiterate villagers be entrusted with such a sensitive and responsible task as diagnosis and treatment of ill persons?', it argued vehemently. Again, when it was a case of reserving a few seats in medical colleges for Scheduled Castes and Tribes, it promptly jumped into action raising a hue and cry, to defend the cause of merit, supporting the anti-reservation agitation which raised such untruthful slogans as 'people's health is in danger', 'save lives, abolish reservations'.

Now here in Bhopal, months after the disaster, months after the establishment of sodium thiosulfate as effective therapy, months later when thousands of gas victims are still complaining of debilitating symptoms forcing them to stay at home without jobs, without income what is I.M.A. doing to reprimand the medical estabishment in Bhopal which simply refuses to give a vital drug to the thousands? Nothing. Just looking the other way. A body which is so concerned about health

and lives of people should have decided a clear policy on the thiosulfate issue long ago. It did nothing of the sort.

Emboldened by such tacit approval the medical establishment in Bhopal continues to behave in a strange and arbitrary fashion throwing all pretences of being scientific overboard and continues to deny a vital drug to gas disaster victims.

Strangely the ICMR too has chosen not to release the details of the study and to allow this important trial to be subjected to wider and open scientific scrutiny especially when its scientific worth is being questioned. Does it realise that by not releasing this crucial information and critical data which could have helped solve the controversy it has become partly responsible for the continuing suffering of countless unknown, unfortunate gas disaster victims whose health may have been further damaged — damaged even irreversibly ?

6.6 Implications for research

Because of ICMR's ambivalence and lack of openness even 5 months after the disaster and even after being in possession of a potent tool (sodium thiosulfate) not only to treat but also to investigate further the disease pattern, ICMR has apparently made no progress in this vital area of research which demands our maximum attention. Whatever information ICMR has released (ICMR update 10-3-85) so far on the research it has sponsored is scanty and fragmentary.

It is a sad commentary on these research efforts that 5 months after the disaster with a mass of population continuing to complain of serious symptoms, no comprehensive picture of morbidity pattern in the community is put together either by ICMR or the medical establishment of Bhopal.

A very large proportion of the exposed population have more than one system's involvement. Intrinsic connections to all those disturbances must be clearly understood. Based on this insight, a community based, integrated comprehensive research programme should be mounted. Only this will reveal the true extent of suffering and its pattern and probable causes. Quite a few research studies sponsored by ICMR lack this integrated approach (Ref. ICMR update 10th March 1985 - Part II)

The approach of examining say 200 eyes, or 200 lungs and so on independent of one another lacks this integration. Strange as it may sound, but it seems to derive its rationale—unconsciously—from the pulmonary theory model, wherein the toxic gas directly hits the target organ (lung, eye etc.) to produce damage without any intrinsic connections—which is at the heart of the 'cyanogen pool' model!

The focus of research should become suffering in the community (and not only hospital based patients). Only when this happens, ICMR will mount well designed, clinical trials in the community using the potent tool of sodium thiosulfate, to work out epidemiological profiles existing in the gas affected community:

i) to find out who among the affected are relieved by it and who are not relieved and to what extent.

ii) to find out the pattern of improvement and extent of improvement in various groups of symptoms

iii) to find out what is the natural history of the range of serious symptoms

iv) and to work out patterns and degrees of disabilities

A small sub-sample of persons from each epidemiological category may be selected to study the blood gases. We stress again that a series of such studies must be done on the ambulatory populaton among which there may be 85,000 who carry a serious morbidity load.

Using the potent tool of sodium thiosulfate in this way ICMR will be able to establish not only the 'cyanogen pool' theory but also treatment schedules for the suffering population.

Only from such studies we will have detailed epidemiological profiles of those wno are going to recover with sodium thiosulfate and those who are not. We would then need a mass survey to identify all such persons so that proper and just damages may be claimed from the Union Carbide. It is obviously not enough that Union Carbide be asked to pay damages for those who are dead. It must also be made to pay those who have been disabled - physically, mentally and socially. Mr. W. Anderson, Chairman of Union Carbide should not get away with statements that 'all is well' with Bhopal.

Industrialisation is creating a high-risk environment for everyone. But experience shows that it is the poor who face the highest risks and dangers. They get the dirtiest, most hazardous of jobs and poverty forces them to live in the dirtiest environments. Yet few people pay any attention to their plight, and even fewer are prepared to do anything about it.

The state of India's Environment
— a citizen's report
Centre for Science and Environment

CHAPTER 7

RECOMMENDATIONS

Around 90,000 gas affected persons in Bhopal continue to suffer from such debilitating symptoms as breathlessness on exertion, fatigue, headache, disturbed vision, loss of memory, loss of appetite and more.

The physical and mental disability has meant loss of jobs and consequent loss of income for the survivors (Fig.1). 65% of working persons in JP Nagar have reported a drop in income as against 9% in Anna Nagar. In atleast half of the working population the rate in drop of income has been 50% or more. This is by any standard a picture of massive socio-economic disruption. The suffering - atleast part of it continues not because there is no remedy for it. Many, if not all, might have been relieved if prompt and adequate treatment with sodium thiosulfate – an antidote to cyanide poisoning was given to them.

This was not done, and it is still being withheld from them. We have tried to make a case in the last chapter that the problem of medical relief, rehabilitation and damage to the thousands of victims has been turned into a tangle due to the unseemly conflict between the two medical theories.

Although outwardly the conflict is theoretical, it has little to do with scientific rigor and debate. The supporters of the pulmonary theory have dogmatically stuck to their lame and indefensible theory and have successfully stalled mass treatment by sodium thiosulfate, thanks to the support they have in decision making and power centres.

The supporters of cyanogen pool theory on the other hand after having made a brilliant and bold breakthrough have chosen to lapse into a kind of inaction not following up the theory to its logical end by undertaking relevant epidemiological research, allowing the theory to remain vulnerable to attack.

Indian Medical Association, 'the custodian of peoples' health', is of course looking the other way and lending indirect, if not direct, support to the pulmonary theory.

The right atmosphere to make relevant, comprehensive and people oriented recommendations is of course not there. Even then we would like to make recommendations based on our understanding of the problem situation so that, individuals, groups, organisations and the gas victims may be helped, even if in a small measure in their struggle to get justice and a better deal from the Union Carbide and from the Government of M.P.

Of all recommendations we believe the most decisive and central is the research-cum-action programme which is in a way linked to all the major issues of medical relief, rehabilitation and compensation for damages.

The whole scheme of recommendations follows logically from it.

7.1 Community Based Epidemiological Research

7.1.1. The research endeavour must shift its focus from the present hospital or dispensary based seriously ill patient orientation to a family and community based

ambulatory patient orientation so that the quantity and quality of the problem can be clearly demarcated. Epidemiological profiles of ill health and disability in the community need to be urgently built up. Well designed clinical trials using sodium thiosulfate not only as a therapeutic tool but a potent epidemiological tool as well need to be initiated on ambulatory patients in the community - to find out who is and who is not relieved, extent of improvement and natural history of the range of serious symptoms (e.g. breathlessness on exertion, disturbed vision, fatigue etc.) This will enable it to test and substantiate the 'enlarged cyanogen pool' theory, to help it establish mass therapy with sodium thiosulfate on a firmer scientific base than is the case today and to help refine, modify and consolidate profiles of significant epidemiological groupings so that classification of the entire gas affected population becomes possible.

7.1.2 Since the possibility of chronic cyanide poisoning in Bhopal is very high an ongoing surveillance programme covering the total affected population should assess the risk to the unborn and newborn babies.

7.1.3 Health problems related to women's reproductive system should be continually monitored.

7.1.4 Quite a high proportion of gas victims are suffering from psycho-social stress. They must be properly rehabilitated.

7.1.5 In view of the possibility of lung damage it is necessary to have monitoring of pulmonary functions for a much longer time since the process of lung fibrosis is insidious and takes a long time to develop fully. Special care must be taken for those whose pulmonary symptoms show no improvement after sodium thiosulfate treatment. Similarly a special watch must be kept on visual disturbances since it is closely related to work performance.

7.1.6. An important but neglected dimension of the existing research endeavour is the lack of informed consent. This is a minimum medical ethic which even in the unprecedented situation of Bhopal is reasonable, relevant and possible. People must be informed about the test being done, their rationale and their informal/formal consent be taken. This is their right and is the only way that medical research becomes an instrument of human welfare and does not degenerate into an instrument of exploitation of human suffering for esoteric research and career advancement.

6.2 Mass Relief Programme

As we have discussed in Chapter 5, while the epidemiological studies are underway, mass treatment with sodium thiosulfate can begin.

Special care must be taken to maintain medical records of each individual containing a record of his/her symptoms, amount of sodium thiosulfate given and outcome recorded in terms of improvement/no improvement of symptoms and urinary thiocyanate excretion if measured. The records system must be modified in the light of new information emerging. A copy of the essential contents of the record must be given to each individual.

7.3 Listing of the victims : claims for compensation

A list of all gas victims, each assigned to one of the epidemiological groupings must be prepared. This is of vital importance for the claims of compensation for all the gas victims.

7.4 Health committees

The tasks described in 6.2 and 6.3 are huge ones. The Government machinery however big cannot accomplish these tasks. Involvement of voluntary groups working amongst people must become an integral part of the health service structure if these tasks have to be accomplished properly and in time. This will also ensure the people's right to know.

7.5 A communication strategy on health related issues

There is need to evolve urgently and immediately a continuing education strategy for medical personnel and a health education strategy for people exposed to the toxic gas as part of an overall community health approach to the disaster aftermath. A multi-pronged approach using different groups of people should be developed. The aim should be to translate existing knowledge and new knowledge derived from ongoing research effort into supportive intervention in the lives of the people. This will not only meet the people's need but also satisfy their right to information about their own health.

7.5.1 We recommend that all health personnel involved in relief/rehabilitation services should be continuously educated and kept informed through news letters, informal group meetings at regular intervals and other means and kept updated with latest research results and guidelines emerging out of these. For a start the content of this continuing education for health personnel must include

i) ICMR guidelines for sodium thiosulfate therapy and the scientific rationale for this line of treatment.

ii) Disaster induced psycho-social stress and methods of management-counselling and supportive psycho and chemotherapy.

iii) Possible risk to unborn foetus, need for surveillance of pregnant women, counselling about risk and helping couples with the decision to continue or to take the option for MTP.

iv) Family planning advice and need for contraception till detoxification is completed.

v) Role of Respiratory Physiotherapy.

vi) Low cost nutritious recipes for mothers whose babies have had to be weaned due to effects on lactation.

vii) Caution against overdrugging particularly steroids and antibiotics - their side effects and rationale for use.

viii) Need for open-minded surveillance of affected population especially high-risk groups to identify emerging chronic and long term effects.

ix) Importance of family based records and improving doctor-patient communication of findings and treatment.

7. 5. 2 We recommend that a dynamic, creative, non-formal health education of the affected community must also be initiated including open group meetings, posters and pamphlets with demystified health messages and audio-visuals. The health messages must be built around the life style, culture and the existing socio-economic situation of the people to have any impact or relevance. These should include most of the areas outlined in 7.5.1 (above) This is particularly relevant since the disaster aftermath has led to a socio-economic crisis in the life of the victims.

APPENDIX I

BHOPAL STUDY PROFORMA

Medico-friends circle, 17-25 March, 1985

SECTION I : INFORMATION REGARDING HOUSEHOLD

1. House Number : .....
2. Area/Basti : .....
3. Head of household : .....
4. Religion : .....
5. Type of cooking fuel used (tick whatever is used)
   - i) Firewood ☐
   - ii) Cowdung cake ☐
   - iii) Saw-dust ☐
   - iv) Coal ☐
   - (v) Kerosene ☐
   - (vi) LPG Gas ☐
   - (vii) Other (specify) .....

6. Composition of family: (start with household head – Do not include members who are dead or missing since Gas leak)

No.	Name	Age	Sex
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

	Before	After
Loan		
Compensation		

7. Information regarding family members dead or missing since gas leak (include all deaths after 3.12.1984)

No.	Name	Age	Sex	Date of death or missing *	Cause	Occupation	Smoking status	Chronic lung disease prior to 3/12/84	History of serious illness prior to 3/12/84	Staying in this basti since when	Was he/she present here during gas leak
1.											
2.											
3.											
4.											
5.											
6.											

* Specify whether dead or missing : M = missing
D = dead

Name of Investigator.....

Date .....

SECTION II : FOR INDIVIDUAL MEMBERS OF HOUSEHOLD

1. House No. : .....
2. Area/Basti : .....
3. Head of household : .....
4. Name of individual : .....
5. Staying in this basti since when (month & year) : .....
6. a) Occupation/job/ vocation (Before gas leak) ; .....
   b) Since when (years, months) : .....
   c) Has gas leak affected your job? (specify) : .....
   d) What is your present occupation : .....
7. Income data :

	Per day	Regular/ irregular	Per month
Before gas leak			
After gas leak			

8. Where were you during the gas leak :.....
9. Did you use any safety measures? How did you protect yourself? (water towel, direction of running with respect to UCIL, doors closed, open, etc.)
10. Smoking status;

Current	Past	Nonsmoker

11. Hospitalization for gas effect?
    When?
    For how long?

12. Chronic illnesses? Yes/No

Particulars	Chronic illness other than respiratory	Chronic respiratory illnesses				
		Asthma	TB	Bronchitis	Lung cancer	Other (specify)
Duration						

13. Number of episodes of the following in the past 3 months:

Disease	No. of attacks	Duration
1. Common cold		
2. Cough		
3. Fever		

Name of Investigator: _____

Date : _____

SECTION III : : EXAMINATION DETAILS

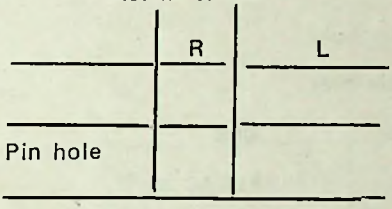
1. House No. : .....
2. Area/basti : .....
3. Head of household : .....
4. Name of individual : .....
5. Examination details: Age:

Symptoms	No.	Yes (Specify)	If yes, duration
1. Dry cough			
2. Cough with expectoration			
3. Blood in sputum (haemoptysis)			
4. Breathlessness at rest			
5. Breathlessness on accustomed exertion			
6. Lacrimation			
7. Fever			
8. Chest pain or tightness			
9. Skin problems (itching, burning, infection)			
10. Jaundice and its symptoms			
11. Blood in stool or vomit/malena			
12. Bleeding tendency			
13. Blurred vision and photophobia			
14. Headache			
15. Weakness in extremities			
16. Muscle aches			
17. Fatigue			
18. Loss of memory (amnesia) recent			
19. Tingling, numbness			
20. Anorexia			
21. Nausea			
22. Vomiting			
23. Pain in abdomen/burning			
24. Flatulence/heaviness			
25. Impotence			

6. General examination:
   i. Height cms
   ii. Weight kgs
   iii. Pulse rate
   iv. Respiratory rate

7. Eye examination:
   i. Cornea
   ii. Acuity of vision
   iii. Pupillary reflexes
   iv. Lens

Distant vision



Near vision

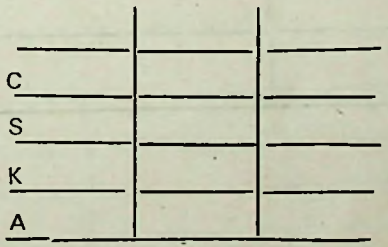
N8 — R PR NR

8. Jaundice (sclera)
9. Cyanosis
10. Skin examination
11. Oedema

12. Respiratory system:
    i. shift of mediastinum
    ii. air entry
    iii. foreign sounds

13. CVS

14. CNS
    i. Muscle power
    ii. Wasting
    iii. Plantar
    v. Knee



15. Alimentary system: i. Liver ii. Spleen iii. Ascites

16. Anxiety/depression
17. Diagnosis
18. Remarks

Name of investigator:
Date:

SECTION IV : LUNG FUNCTION TESTS

1. House No. : .....
2. Area/Basti : .....
3. Head of household : .....
4. Name of individual : .....
5. i) Height : cms
   ii) Weight : kgs
   iii) Surface area:

6. Lung function:

Recording	FEV_1	FVC
1		
2		
3		

Name of Investigator : .....

Date : .....

SECTION V : ADDITIONAL PROFORMA FOR WOMEN

1. House No. :
2. Area/basti :
3. Head of household :
4. Name of individual : Age:
5. Marital status :
6. Menstrual history:

Details	Past (since when)	Present (after gas leak)
1. Occurrence (cycle per month)		
2. Dysmenorrhoea		
3. Flow		
4. Peculiarities		
5. Leucorrhoea		
6. Itching		
7. Burning sensation with urination		

Doctors seen Yes/No

7. a. Whether pregnant during gas leak? Yes/No

   b. If yes, exposure during which month of pregnancy?

   c. Outcome of pregnancy:

Details	Remarks (when, how, any peculiarities?)
1. Spontaneous abortion	
2. MTP	
3. Still birth	
4. Premature delivery/live	
5. Full term	
6. Still pregnant (whether foetal movements normal)	

8. Lactation (milk output) Supressed (significant) Normal

Name of investigator:
Date:

SECTION VI : PATIENT'S PERCEPTION ABOUT AVAILABLE HEALTH FACILITIES

1. Where do you go for medical treatment?

   a. Government dispensary b. Private doctor c. Self-medication

2. Can you walk down to the government hospital/dispensary?

3. How long do you have to wait in the dispensary in the queue for your turn to come?

   a. examination

   b. getting medicines

4. How many days of medicines are given at a time?

5. a. Do you get all the medicines from the government dispensary? Yes/No

   b. If not, do you have to buy any medicines from the market?

   A few medicines/all the medicines

6. Were the medicines useful? (specify)

7. How was the behaviour of the government doctor?

   a. enquiry b. examination c. advice

8. Were you referred to the hospital anytime during this illness? Yes/No

   If yes, how was the experience at the hospital?

9. Did you go to a private doctor? Yes/No

   If yes, did he tell you anything different about your illness?

   How much did you spend for private treatment?

   a. Doctor's fees: b. Drugs

10. Has any doctor told you so far anything about the nature of your disease or has given any advice? Yes/No

    It yes, what was the advice?

APPENDIX II

An English translation of a Handout in Hindi distributed among the people of the bastis selected for the study.

To our brothers and sisters affected by the gas leak tragedy in Bhopal.

We are a team of socially-conscious doctors and health workers belonging to a group called the medico friend circle. As an expression of our concern for you all we have come to try and help you in our own small way. We have come to assess and find out whether there are any ways in which the medical relief and advice that is being given to you can be improved.

Soon after the disaster some of our members came to Bhopal and were involved in relief work. They also made suggestions to the government about medical relief work based on their own experiences. These suggestions are also available in Hindi. We have now come to investigate in detail what are the health problems you still have three months after the disaster and to try and find out what can be done for them. From these investigations and from an assessment of the treatment services being given to you, we hope to make suggestions to the government and to all those involved in health work of improvements that can be made.

All of you have been affected by the gas leak. To find out the health effects of this exposure it is not necessary to examine everyone of you. To find out the main effects on your health it would be adequate to do a complete survey on every tenth or twentieth house in the basti. From this survey it will become evident as to how many of you are suffering from the different illnesses caused by the gas exposure.

Whatever we find out on examination of each of you will be written out concisely in a note, a copy of which will be given to you. Apart from this we shall also send you a copy of whatever other general recommendations we have about improving your health status.

We shall explain to you what has been the effect of the gas on each and every part of your body and what you should do to tackle this situation. Which drugs are useful ? Which drugs are not useful ?

With your cooperation we shall try to decide whether there will be any improvement in your lungs by the use of respiratory exercises. We shall teach you these respiratory exercises. These exercises will also help to prevent further damage to your lungs.

Brothers and Sisters - We are not working for government or any other official agency. We have come here through the support of collections made from many others who have contributed as an expression of their concern for you. We are doing what we can through this low-cost venture and have come here voluntarily. We are confident that you will give us your whole-hearted cooperation in this work.

Yours
Bhopal Study Team,
medico friend circle

APPENDIX III

INDIAN COUNCIL OF MEDICAL RESEARCH
MINUTES OF THE MEETING ON THIOSULPHATE THERAPY IN MIC EXPOSED POPULATION HELD ON 14TH FEBRUARY, 1985 AT HEADQUARTERS NEW DELHI.

1.0 Participants

Dr. J.S. Guleria
Dr. N.P. Mishra
Dr. P.S. Narayanan
Dr. P.N. Pande
Dr. K. Ramachandran
Dr. A. Ramaiah
Dr. H.H. Siddiqui

ICMR Representatives

Dr. S. Sriramachari (Chairman)
Dr. C.R. Ramachandran
Dr. A.K. Prabhakar (Rapporteur)
Dr. R. Parhee (Rapporteur)

2.0 The Chairman, Dr. S. Sriramachari, Additional Director General, ICMR, welcomed the members on behalf of Prof. V. Ramalingaswami, Director-General, and on his own. He explained that the purpose of the meeting was to discuss the different aspects of use of Sodium Thio Sulphate (NTS) in MIC exposed population. He also reiterated that the preliminary results of the double blind study conducted at the 30 bedded community hospital at Bhopal had indicated the presence of "cyanogen pool" in the exposed persons. He pointed out the several physiological parameters and optimal time for urinary excretion of thiocyanate had since been worked out and the method of monitoring could thus be standardised. He informed that since the utility of NTS had been established, the criteria of selection and contraindications, if any of cases, details of dosage, duration of administration should be urgently worked out. Apart from the continuation of the Controlled Studies with Thiosulphate Therapy, the questions relating to the extension of the therapeutic measures to all patients with clinical symptoms should be decided.

On the basis of the double-blind trial conducted by Dr. Narayanan and Dr. A. Ramaiah at Bhopal Dr. Guleria and other members of the group emphasised that Sodium Thio Sulphate should not be withheld from affected victims and should be made available to all patients with clinical symptoms. However, he cautioned that strict criteria for use need to be laid down. This should include specific criteria for selection of patients based on symptoms and severity of exposure; as well as guidelines for maintenance of records; investigations; monitoring for adverse reactions; and clinical and laboratory investigative follow up paramteers. In addition, contraindication for use should be clearly spelled out. He also mentioned that the final decision for use and/or stoppage of treatment with Sodium Thiosulphate should be left to the judgement of the clinician.

Dr. N.P. Mishra, presented, in brief, his earlier as well as recent observations on the use of NTS at Gandhi Medical College, Bhopal. He mentioned that he had observed adverse reactions in 2 persons among 200 individuals who had received one injection of NTS. Severe gastro intestinal symptoms of vomiting and nausea, with fever was observed within 10-20 minutes of injection. Dr. Mishra stressed that this drug should be administered to hospitalised patients. In this connection, Dr. P.S. Narayanan presented his experience with 322 injections of NTS administered to 76 patients. The only mild adverse reaction observed in 2 patients was feverishness experienced several hours after receiving the injection which was relieved with aspirin in one case. In view of this, the members of the group felt that NTS injections should be given to patients at hospitals, clinics and dispensaries under

medical supervision, with strict monitoring for adverse reactions. As it may not be possible to admit all patients while they are under therapy, it was considered advisable to keep the patients under medical observation for at least one hour after administering the injection.

Dr. Mishra informed that the predominant symptoms observed in patients suffering from effects of MIC relate to the respiratory, gastro intestinal and neuromuscular systems. In addition, patients with psychological symptoms are seen. Dr. Narayanan emphasised that some patients present themselves with relapse or recurrence of symptoms after having obtained almost complete relief from the acute phase.

After considerable discussion, it was agreed that NTS injections should be given to all patients with the following criteria;

1. Patients suffering from acute and/or chronic symptoms relating to the respiratory, gastrointestinal, and neuromuscular symptoms. The symptoms should be causally related to possible exposure to MIC gas;

2. Patients presenting with recurrence of symptoms after having obtained some measure of relief from the acute phase;

3. Recorded cases of acute pulmonary oedema and/or coma, that occured immediately following the episode, and who are currently symptomatic;

4. Patients who have a history of death in their family, and also those who reside within 2 km of the factory in the direction of the wind on the day of the tragedy or in the vicinity of the factory.

It was emphasised that baseline clinical and laboratory data should be obtained for all recorded cases. With regard to old cases, where records may be available fresh baseline data should be obtained.

Detailed discussion was held regarding dose and duration of treatment. It is generally understood that in acute or severe cyanide poisoning, 12.5 to 25 gm of NTS can be administered as a single dose intravenously. However in the preliminary trials, clinical improvement had been observed with I gm of NTS given as a single dose, or in 3 successive doses. Giving allowance for the time lag in the build up of the cyanogen pool after its first depletion, it was felt that the subsequent injections could be given after larger intervals. It was finally suggested that two regimens on administration of NTS should be followed, viz:-

A.	Day 1	- 2 gm NTS,	intravenous
	Day 2 to 6	- 1 gm NTS,	- do -
B.	Day 1	- 1 gm NTS,	- do -
	Day 3	- 1 gm NTS,	- do -
	Day 5	- 1 gm NTS,	- do -

Children should receive lower doses appropriate to the body weight. Urine levels of thiocyanate should be monitored initially prior to the injection, and then daily, 3 hours after administration of the injection. Whenever possible, 24 hour urine output should be monitored. Mixture Alkaline Diuretic with sodium chloride

should be administered to the patient to facilitate excretion of thiocyanate, for the duration of therapy. Therapy may be terminated if thiocyanate excretion reaches or remains at normal levels. The members of the group agreed that the drug should not be administered routinely to pregnant women. The decision for use will depend upon the severity of the symptoms. Pulse rate, respiratory rate, response to exercise, and level of physical activity should be recorded during therapy and afterwards in order to evaluate the progress of improvement. Adverse reactions, if any, should be brought to the notice of the local senior physicians and health authorities including the ICMR.

It was also recommended that urine estimation of sodium thiocyanate should be standardised at all centres undertaking this investigation. For this purpose, Dr. A. Ramaiah was requested to help in standardising the procedure at the laboratory, of the Medico Legal Institute at Gandhi Medical College, Bhopal. For quality control periodical cross checking between the two laboratories should be worked out.

Finally, it was recommended that Dr. A. Ramaiah should prepare a detailed protocol on the laboratory monitoring of thiosulphate therapy in MIC affected population. This would be circulated to all members of the group at the earliest.

All the participants including Dr. N. P. Mishra and Dr. P. S. Narayanan agreed to the above recommendations. It was decided that the above information should be conveyed to the concerned health authority in Bhopal as well as Min. of Health so as to ensure adequacy of supply of NTS. The next meeting of the group would be held after 3-4 weeks to review the progress of the studies.

The meeting ended with a vote of thanks to the chair.

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APPENDIX IV

STUDY OF MEDICAL RELIEF TO GAS VICTIMS

Some members of the team visited various medical centres near JP Nagar—the basti selected for our study. These included:

i) a government polyclinic

ii) the DIG Hospital—a 30 bedded hospital specially established for care of disaster victims

iii) three non-governmental private clinics in the adjoining area.

From these visits and interviews with the doctors, some understanding of the dynamics of medical relief services emerged. The points specifically noted were staff pattern, timing, availability of drugs, standard guidelines if any and doctors' perceptions of the health problems etc.

Government Services

i) The polyclinic was kept open 24 hours of the day. It was an ordinary dispensary and did not consist of specialists from different branches as the name suggests.

ii) The DIG hospital was, however, staffed by specialists in medicine, obstetrics, ophthalmology, paediatrics, ENT and surgery. It had 14 doctors and a smaller number of paramedics. The out-patients department was open from 9.00 a.m. to 1.00 p.m. and for one hour in the evenings. About 600-800 patients were seen per day, resulting in long queues. There seemed to be no problem of drugs - these being available in adequate range and quantity.

There were no standard guidelines for investigating, diagnosing and treating gas victims. The doctors used their own lines of treatment. Most of the doctors interviewed had no definite knowledge about the role of sodium thiosulfate nor had seriously reviewed the problem of danger to the foetus and the option of MTP for pregnant women. There were no definite criteria for referring patients to bigger hospitals. Facilities for routine biochemical and microscopic investigations were available.

The DIG Hospital was also being used for the double blind clinical trial of ICMR on the rationale/ efficacy of sodium thiosulfate. It had facilities for blood gas analysis and measurement of urinary thiocyanate levels by spectrophotometry. These were being carried out on all patients being selected for a course of sodium thiosulfate injections.

iii) Our interviews with doctors about the range of symptomatology and clinical syndromes they were seeing each day in the OPD'S revealed that even though they thought that many patients were ill, they felt that many were exaggerating and implicating the gas in all types of complaints. The quality of reporting/recording these symptoms and findings of examination were poor and would therefore, not be of much use in any type of retrospective research studies.

On the whole though a medical service had been established and medical teams were available to the gas disaster victims, we felt that these had not been adequately oriented to meet the demands of the situation; there were no standardised guidelines for investigation or management; and no continuing education or on-going communication of research and other information to the treating doctors to support rational management. The doctors' attitudes were somewhat biased against the phenomena of multisystemic symptomatology with many of them perceiving this as malingering or compensation neurosis.

By and large due to inadequate planning the dispensaries were understaffed and the doctors overworked. This was particularly true of the DIG hospital.

Non-government clinics

Three such centres were available near the basti. One of them was a free clinic specially set up after the gas disaster with the help of a Muslim Charitable group. The therapist was using mainly homeopathic medicines but also had ayurvedic and allopathic medicines in his armamentarium. He used these 'depending on the case'. He made tall claims of cure for gas related diseases as well as other problems. Our intensive but informal talks with the basti people for three days did not reveal any cases of substantial relief with his treatment schedules.

Another general practitioner had a clinic about 1 km. from the basti. He was not an MBBS doctor but his clinic was overcrowded. He seemed courteous and soft spoken to his patients but hardly examined anybody in detail. Injections, antibiotics and prednisolone were liberally used. In his discussion with us he shared that antibiotics, antacids, bronchodilators and steroids had been used by him to treat the patients without much result. He did not know about the details of the use of Inj. sodium thiosulfate or the medical controversy about it. However, he thought that the advice given by a forensic expert (doctor of the dead as he described him) regarding cyanide poisoning should be taken with 'a pinch of salt'. He also felt that some of his patients who had been given injection sodium thiosulfate had not benefited. He also shared with us that he himself had been exposed to the gas and suffers from symptoms even now. Recently he had started taking an ayurvedic preparation with 'gratifying results'.

The third practitioner was a lady doctor working near the basti. She had closed down her clinic after the disaster for two months and could not tell us much. She had used antacids, cough mixture and antibiotics without much results. Most patients, she said, did not come back the next day in spite of their continued illness since "they were too poor to pay fees every day". When asked specifically about the problems of women, she felt that there had been an increased incidence of gynaecological problems but since she did not undertake gynaecological examinations, she could not give further details. Most of these cases were referred to her sister who was a trained gynaecologist. None of these practitioners had received any communication or guidelines from the government health service doctors or medical college and there was no coordination between them and the government polyclinics or dispensaries.

APPENDIX V

PEOPLE'S PERCEPTION ABOUT AVAILABLE MEDICAL FACILITIES

Forty out of the sixty families selected in our study of JP Nagar were included in the survey of people's perceptions of the available medical services. One person from each of the families was interviewed and the questions asked are given in Appendix I (study proforma, Section 6). The main findings of this survey were :

(i) **Choice of treatment** : Seventy percent had gone to government dispensaries and 82.5 percent had gone to private practitioners and only one was on self-medication. Ten persons had not gone to any government dispensary and five persons had not gone to any private practitioner. Many had decided to go to private practitioners because they were dissatisfied with the experience in the government hospitals.

The distances were not too much and most people said they could walk down to the government hospital or dispensaries

(ii) **Time at dispensary/hospital** : Six persons said they had to wait 1-2 hours for their turn in the hospital, 8 persons - 2-4 hours and 13 persons more than 4 hours. The delays were probably due to these service units being understaffed and to overcrowded.

(iii) **Medication** : Medicines were given mostly for 1-3 days in 70 percent of the cases whereas 6 respondents said they had received medication for more than three days. (This is inclusive of the practice in the private clinics).

Medicines were received free in the government dispensary by 70 percent of the respondents. 5 persons mentioned they had to buy a few medicines from the market.

Twenty five percent had no relief from the medication, 52.5 percent got some symptomatic relief while one respondent mentioned that he got substantial relief.

Interestingly the only therapy that was being given was drugs which were being prescribed faithfully by the doctors in large doses and repeatedly with no thought of over-medication. Many patients showed us platefuls of coloured capsules and tablets which they had received from different doctors in the same centres and in different centres. These were not very effective but were continuously being prescribed in a sort of routine conditioned reflex!

(iv) **Attitude of doctors and quality of care** : Forty percent said that the doctors hardly made any enquiries, whereas 42. 5% mentioned that the enquiries were sympathetic. 15 percent said that no examinations were done, 37. 5% had cursory examinations and 25 percent had proper physical examinations. 75 percent were given no advice other than instructions for medication. One received some reassurance and only one could recall being given some dietary advice.

(v) **Referrals to Hospital** : Nineteen respondents were referred to hospitals during the last few weeks. 9 felt the same after hospitalisation, 5 felt worse and 3 got better.

(vi) **Experience with private practitioners :** The experience with private practitioners, whom over 82.5 percent had consulted, was not very different except that the doctor-patient relationship was somewhat more satisfying. All of them got a medication but no other advice.

Ten respondents had spent upto Rs. 100.00 on treatment, 10 between Rs. 100. 00 and Rs. 500.00 and 13 had spent more than Rs.500.00. No doubt this was adding to the economic burden of the families and would be reflected in the loans taken by many families. One family had spent more than Rs. 3500/- on treatment.

(vii) **Health education :** Thirty seven of forty respondents had been given no inkling about the nature of the illness or any other supportive advise, e.g. no smoking for those with lung complaints, special advise to women who were pregnant, breathing exercises, psychological reassurance or counselling. One mentioned that he had been told 'it was a recurring illness'.

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medico friend circle

The medico friend circle (mfc) is a circle of friends with medical/non-medical backgrounds who share the common conviction that the present system of health services and medical education is lopsided in the interest of the privileged few and must be changed to serve the interests of the large majority, the poor. mfc fosters a 'thought current' upholding human values, people and community orientation of health care and medical education, demystification of medical science and a commitment to the guidance of medical interventions by peoples' needs and not commercial interests.

mfc offers a forum for dialogue/debate, sharing of experience and experiments with the aim of realising the goals outlined above, and for taking up issues of common concern for action.

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Distorted Lives

Women's Reproductive Health and Bhopal Disaster

medico friend circle
October 1990

Distorted Lives

Women's Reproductive Health and Bhopal Disaster

A community based epidemiological study of the effect of the toxic gases on the menstrual pattern and pregnancy outcomes in women affected by the Bhopal gas leak disaster

MEDICO FRIEND CIRCLE
(Regd. Off) 150, LIC Quarters
University Road, Pune 411 015

October
1990.

Contribution
Rs. 20/-

THIS STUDY IS DEDICATED TO THE GAS - AFFECTED WOMEN OF BHOPAL

WHOSE SPECIAL SUFFERINGS HAVE BEEN NEGLECTED AND WHO

CONTINUE TO SUFFER SILENTLY.

C O N T E N T S

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PREFACE

The Bhopal gas tragedy, the biggest and the worst man-made disaster in the history of human kind, has not as yet taken its complete toll. Thousands are still going through the hell of incapacitating health problems created by this poisonous gas leak. It was argued by Union Carbide circle as well as some local medical experts that the gases that leaked on the night of 2nd December, 1984 produced only local irritant effects on the skin, eyes and the lungs; that MIC (methyl iso cyanate) as a chemical cannot produce systemic effects. There has been mounting evidence to give a lie to this claim. The present study is one more significant addition to this evidence. It shows that the gas leak considerably altered the menstrual pattern of the gas exposed women and significantly increased the incidence of spontaneous abortions and still births. This study has not only brought forward the neglected aspect of the health problems of gas affected people, but has used the sensitive indicator - spontaneous abortions - to assess damage to the pregnancies, compared to other less sensitive indicators used in the ICMR studies. The increase in spontaneous abortions also point out to the possible mutagenic effect of the gas leak.

It must be made clear that this study covers only the reproductive health of gas-affected women in Bhopal and that they also suffer from many other health problems related to other systems of their bodies.

It is hoped that serious implication of this study would be appreciated.

We have no words to apologise for the inordinate delay in the publication of this study.

Anil Pilgaokar

Convenor

Medico Friend Circle

THE STUDY TEAM

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Most of the above participants represented one of the following orgnisations :

Medico Friend Circle, ARCH (Mangrol), Sabla Sang, Action India, Ankur, Saheli and Jagori, (All from Delhi), Prayas (Rajasthan), Mahila Mukti Morcha (Sewapuri), Nari Atyachar Virodhi Manch (Bombay), Sahiyar (Baroda).

Further details of this study are available with

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BACKGROUND

In February 1985, three months after the gas leak disaster in Bhopal, a fact finding team of four doctors observed that women have suffered from abortions, still births, diminished fetal movements, suppression of lactation, abnormal vaginal discharge and menstrual disturbances (1). Later, based on the information on women from two affected bastis attending Gynaecological Clinic, two women doctors reported the presence of a large number of menstrual and gynaecological disorders. The clinical conditions were pelvic inflammatory disease, endocervicitis, excessive menstrual bleeding and suppression of lactation (2). While the fact finding team's observations were based on unstructured interviews, and the clinic based survey on a self-selected sample and therefore needed to be interpreted with caution, they were both indicative of an important area of morbidity that required detailed and sustained epidemiological investigation.

In March 1985, a study, done between 104-109 days after exposure, organized by the Nagarik Rahat Aur Punarvas Committee, Bhopal, showed that out of the 198 women examined, 100 had persistent gynaecological symptoms. Leucorrhoea or excessive vaginal discharge was the commonest symptom noticed both in groups from severely exposed area and mildly exposed area. Majority of these had no local or pelvic factor responsible for this symptom. In 26.5% of women from the severely exposed area the examination of cervical smear showed presence of inflammatory cells with evidence of dysplasia in a small number of them. Of the 38 women pregnant at the time of the disaster, 29 had first or second trimester abortions (3). The study organized by NRPC was cross sectional, community based, using random sampling. However, this

study had to be interpreted with caution because of the clinic nature of the survey which expected the surveyed people to "walk" upto the clinic thus introducing self-selection into the sample.

In the same month, a socio-medical survey carried out by the medico friend circle (mfc), focused on the continued effects of the toxic gases in Bhopal (4). The study showed that between 50-70% of the ambulatory population in the severely exposed areas of Bhopal continued to have one or more serious symptoms implicating different body systems. Among women in the reproductive age group, a significant alteration in the menstrual cycle had taken place. The alteration was in the form of shortened cycles, abnormalities in the menstrual flow, dysmenorrhoea, leucorrhoea, and lactation suppression. The mfc study was a population based, cross sectional survey comparing a severely exposed area with a mildly exposed one through a pre-designed questionnaire with defined parameters and the use of random sampling. The findings of this study were therefore of greater epidemiological significance. However the number of women in the sample was too small to comment on the effect of toxic gases on pregnancy outcomes.

Although, the above mentioned studies/surveys were not designed to systematically explore the effect of the leak on the menstrual pattern of women and on the pregnancy outcomes, they had, in a way, corroborated the experience of social activists working in these bastis and had underlined the urgent need to systematically study this important aspect of the health status of the gas exposed women.

Despite this urgent need, there was no indication that the official established research institutions were planning to

respond in an adequate and appropriate manner. Under the sponsorship of the Indian Council of Medical Research (ICMR), several research studies had been launched in Bhopal to look into the effects of the gases on the different systems. However, none of the studies was designed to explore the effect of the toxic gases on the menstrual health of the women. Further, the preliminary findings of the study on pregnancy outcomes, at least upto May 1985, indicated that there had been no adverse outcomes following the disaster. This seemed to contradict the popularly held impressions of an increase in spontaneous abortions in the post gas leak period and it was not possible to assess the authenticity of the data because of the Official Secrets Act imposed on all matters concerning the disaster.

There was thus a need for an independent study that would assess the effect of the toxic gases on pregnancy outcomes and on the menstrual health of the women in Bhopal and mfc decided to undertake this task.

Since to study the effect of the gas leak on the overall gynaecological morbidity and pregnancy outcomes was beyond the financial and other resources capacity of mfc, it was decided to limit the objectives to a study of menstrual patterns, spontaneous abortions and still births in the period following the gas leak.

Once the decision was made, letters announcing the proposed study were sent to several women's organisations for help with the carrying out of the survey. The overwhelming response of women activists to this announcement indicated that the survey was a realistic and feasible proposition.

C H A P T E R I

SURVEY DESIGN & METHODOLOGY

STUDY POPULATION AND CONTROL

Our study set out to find answers to three questions.

1. what was the effect of the toxic gases on the menstrual cycle of the non-pregnant women?
2. what was the effect on the spontaneous abortion and still birth rates of the women pregnant at the time of disaster?
3. what was the effect on the spontaneous abortion rate of the women conceiving after the disaster?

It was decided to undertake a retrospective study of the gas exposed population for this purpose. For the purpose of "control", it was decided to study the same population for a period of one year before the toxic exposure took place.

The reasons for selecting this form of historic control were:

1. The studies carried out earlier on the gas exposed population, both by governmental and non-governmental institutions had used distance from the Carbide factory as an indicator of the differential exposure and had selected population from the low socio-economic strata residing 8-10 kms from the Carbide factory as the control population. The selection also seemed to be justified by the differential mortality rates in these areas. However, the results from the

both the mfc & NRPC studies had revealed significant symptoms of gas exposure in the control population as well. In fact, the mfc study had concluded that "a control population selected like Anna Nagar (colony 10 kms from Carbide factory) is not strictly speaking a 'non-exposed' population as it should be but serves as a control population by virtue of being minimally exposed in comparison to JP Nagar (colony across the road from Carbide factory). This also implies that even in our control population one would expect to observe some of the disabilities or debilitating morbidities in a higher proportion of the population than would be the case in an unexposed contorl area. Actually this is what we did observe" (5). Thus, it was not possible to find a socio-economically matched, control population within Bhopal as all such colonies were situated down-wind to the Carbide factory and therefore could not be considered 'non-exposed'

2. Selecting a control population outside of Bhopal would have created the important problems of logistics and resource availability. The survey was being carried out with the help of unpaid volunteers and with limited financial support. To sutdy two large samples in two different cities would have stretched the organisation's resources beyond a limit.

However, while the problem of matched control could be resolved by studying the same population before and after the gas leak, the potential disadvantage of this survey design was the problem of differential recall. It will be discussed later.

The time-scale of the study design could be represented diagramatically as follows:

1st December 1983	3rd December (Gas Leak) 1984	22-29 September 1985 Survey
12 months	Gas exposed women (Study Population)	10 months

Of all the abnormal outcomes of pregnancy, only spontaneous abortions and still births were selected since the population to be covered could not be too large. Further, of the different pregnancy outcomes, spontaneous abortion rates are considered to be both a specific and sensitive indicator of chromosomal anomalies (6). In order to asses the effect of the gases on menstrual pattern, it was decided to study the changes in cycle length, menstrual flow and to study the occurrence of delayed and missed periods.

Sampling the study population:

On the basis of post gas leak morbidity and/or mortality rates, three areas adjacent to the Carbide factory were chosen for the study. These figures were available to us from a study carried out in January 1985 by the "Centre of Social Medicine and Community Health", Jahawarlal Nehru University JNU which covered a population of 68,000 in 29 mohallas through a systematic random sampling of 6.66% households (7). The areas selected for the study were:

JP Nagar	-	mortality rate 65.3/1000
		morbidity rate 66%
Kazi Camp	-	mortality rate 46.7/1000
		morbidity rate 54.60%
Kenchi Chola	-	mortality rate 35.7/1000
		morbidity rate 91.9%

The three areas selected for the study fell into Municipal ward 13, one of the officially recognized severely exposed wards in Bhopal.

Each of the three areas selected consisted of more than one basti but were given area codes and were identified by the name of the largest basti in that area by the Indian Council of Medical Research.

Thus,

JP Nagar	(area code 01) consisted of JP Nagar, Risaldah Colony, Chola Naka, Shakti Nagar and Rajgarh Colony.
Kazi Camp	(area code 02) consisted of Kazi Camp, Old Sindhi Colony, Phoota Maqbara & part of Chola Road upto the Nallah.
Kenchi Chola	(area code 07) consisted of Kenchi Chola & houses along the North of the railway track (Bhopal-Delhi line) upto Nishad Pura Yard.

Each household in these gas exposed areas has an ICMR plate and using this ready made list of houses, the random sample for the study could be drawn. Since random selection of the individual women was not possible, it was decided to select random

households and cover all the women in the reproductive age group in the selected household. The number of households in each were (according to the ICMR sample framework) JP Nagar area-1998, Kazi Camp - 1950 and Kenchi Chola - 1300. The total population in these areas was between 31,000 to 35,000 (8). This formed our study population.

Sample Size :-

A review of literature shows that there are very few population based studies on pregnancy outcomes. Even in the few studies available, estimates of spontaneous abortion rate vary widely both because of the definition selected and because of the methodology adopted. The data obtained in Khanna study in rural Punjab through prospective field observations over a period of 3-5 years from the village population of roughly 12,000 indicated an overall rate of 100 abortions per 1000 pregnancies (9). Another study on pregnancy wastage in a rural community near Delhi between December 1983 & May 1984 showed that of the 3351 pregnancies reported by the respondents, 2.09% ended in still births & 8.12% in spontaneous abortions (10).

For the purposes of our study we assumed the "normal" rate of spontaneous abortion in the community to be 10% of all pregnancies. To detect a two fold increase in the rate of spontaneous abortions i.e., 20%, with an error of 5% and error of 10%, 260 pregnant women needed to appear in the sample. Assuming a birth rate of 35/1000 population, with the period of observations for the post gas leak period being 10 months, the size of the sample population that would yield the required number of pregnant women would be 9000. A random sample, using

the random numbers table, of 30% of the total households yielded the necessary number of 1586 households. Keeping in mind the high non-response rate of 29% in the earlier study of mfc in Bhopal (11) another 10% of households were selected randomly and the interviewers were specifically instructed in the criteria of replacement should the need arise. Thus the number of households from each area selected was : JP Nagar - 596, Kazi Camp - 585 and Kenchi Chola - 390 households.

METHODOLOGY

The World Health Organisation defines spontaneous abortion as any non-deliberate interruption of an intra-uterine pregnancy before the twenty eighth week of gestation in which the fetus is dead when expelled. According to embryological evidence, the greatest loss is during the week following implantation. Since these early losses are not associated with any clinical signs or symptoms, they remain largely unrecognized as spontaneous abortions. Since no previous study has been reported concerning the possible incidence of this event, an occult abortion is defined as a pregnancy which aborts so soon after its implantation that its existence is not clinically suspected except by a few days, delay in the onset of an otherwise normal menstrual period. The data of Block SK indicate that approximately 37.5% of those cycles which would otherwise have been thought to represent a prolonged luteal phase, were actually occult abortions (12). In this study, spontaneous abortion was defined as fetal loss occuring between 8 weeks and 28 weeks of gestation, signified by the passing of products of conception

with or without abdominal cramps. Since there is no equivalent in Hindi for the term "products of conception", descriptions such as "pieces of blood", "pieces of tissue", or the experience of something "expelled" were taken to signify products. All fetal loss after 28 weeks of gestation was defined as still births.

By taking a cut off point of 8 weeks i.e., two missed periods as the lower margin of gestation, we were missing out on the early occult abortions of gestational period of less than 8 weeks. This was inevitable, because to diagnose occult abortions, history alone is insufficient. Further, no authentic information was available to help with the estimation of occult abortion among those reporting secondary amenorrhoea following the gas leak. Hence secondary amenorrhoea of less than 8 weeks was tabulated and analysed separately from recognized spontaneous abortions. A delayed period was defined as one missed period while only if two periods were missed (without the history of spontaneous abortion) it was termed a missed period. In order to asses the changes in the menstrual pattern following the gas leak, changes in the duration of menstrual flow, alteration in cycle length, and the regularity of cycle were studied; here irregularity was defined as unpredictability of cycle.

For the purpose of analysis of spontaneous abortions, both fetal death ratio (FDR) and cumulative incidence rate have been used. FDR is defined as the number of spontaneous abortions per 100 pregnancy outcomes (live birth + still birth + spontaneous abortion). Incidence rate has been calculated as number of spontaneous abortions per 100 conceptions. Induced abortions have been removed from all the tables.

By its very timing to the gas leak, our study had to be based on retrospective data. In such a study, immediately three methodological problems become aparent. Firstly, since it is retrospective, it has to rely on the memory recall of the population studied; secondly, it has to rely on histories' with no supportive objective data; and thirdly, determination of Last Menstrual Period (LMP) becomes crucial. These aspects are discussed below with reference to spontaneous abortions, one of the important variables in the study. In studies using recalled data, several factors relating to recall failure have been identified. These include time elapsed since the event, gestational age of the fetus at the time of abortion, the timing of the abortions to a particular event in a woman's life, the total number of births and spontaneous abortions in a woman's life, a woman's age at the time of pregnancy, medical treatment and hospitalisation related to abortion and the social class and the educational level of the women (13 & 14).

These factors have been identified in long term studies where the length of time elapsed since the abortion have played a crucial role in recall of the event. The period for recall in our study was only 21 months,which was not considered long enough to affect recall appreciably. This also meant that the total number of births and spontaneous abortions in a woman's life and her age at the time of pregnancy would not have formed major factors affecting recall. However, in these 21 months, an unforgettable incident of the gas leak disaster had taken place and unlike in the period prior to the disaster, women were more likely to be hospitalised in the post gas leak period. Therefore a relatively more accurate reporting of spontaneous abortion in the post gas leak period could not be ruled out.

A final methodological problem of recall was that relating to the respondents' motivation in answering the proforma. In surveys of this kind which consists of questions of intimate nature, the women respondents feel embarrassed or more importantly wonder how the collection of such information will be of benefit to them. Often this reluctance is expressed in the form of "inability of recall". While this was not considered a major constraint in the context of the disaster, the real problem was of possible exaggeration because of incorrect association with individual compensation. Care was therefore taken to explain through a Hindi pamphlet,the need for accuracy. Further, the random nature of the selected houses together with the decision of not giving a copy of the proforma to the respondents helped in disassociating the survey from the process of assessing monetary compensation for the individuals affected by the disaster.

With regard to the determination of the last menstrual period, efforts were made to make the dates as accurate as possible. The population in the selected bastis consisted of both Hindus and Muslims who follow different indigenous yearly calendars. Using the different phases of the moon, the Hindu & the Muslim calendars, and the different festivals, a 'local events' calendar was prepared. To be doubly sure that the mistakes in assessing LMPs were kept to the minimum, the survey team was asked to write down all the relevant dates (LMP, date of abortion, date of delivery) in the same words as that of the respondent. After the survey was completed, these dates were converted into the English months and dates, using the local events calendar., and transferred into the box provided for it in the proforma. (A sample of the clendar is annexed. (Annexure - I).

History Taking:

A pre-designed, pre-tested proforma in Hindi consisting of five sections was administered to the eligible members in the sample. Section I containing family composition and income levels could be administered to the head of the family. Section II was to be specifically administered to all married women in the reproductive age group in the sample. Section III, IV & V were to be administered depending on whether a woman had aborted or delivered in the post gas leak period or was currently pregnant at the time of the survey. (See Annexure II for a copy of the proforma).

Section I:- This included the following information about each household: composition of the family, history of exposure to the gas, dead or missing members in the family since gas leak, and the income of the family before the gas leak.

Section II:- This was to be administered to all the married women in the households selected who were in the reproductive age group. It included details of the menstrual history in the year preceding the gas leak as well as in the period following the gas leak. Specific questions related to the number of times the menstrual period had been delayed or missed. The question were formulated in such a way that it led to the least amount of confusion and yet enabled the survey team to get accurate information. For instance to determine regularity of menses the proforma contained six questions.

The section also included information on the past obstetrical history of the women i.e., number of conceptions, number of abortions, still births, live births and the number of children alive at the time of the survey. The family planning status and the changes in libido were also recorded.

Section III:- This was for those women who had aborted after the gas leak. Both spontaneous abortions and induced abortions were included. Activity during pregnancy, the last menstrual period date of abortion, description of abortion (onset, symptoms), changes in fetal movements after gas leak in those who aborted after 20 weeks of gestation as well as reasons for induction in case of induced abortions were recorded.

Section IV:- This was for women who had delivered a child live or still birth) after the gas leak. It included details of the antenatal, delivery and post natal period. Special attempts were made to find out if any significant changes had been noticed by the women after the gas leak (e.g. changes in fetal movement) and significant changes between this delivery and previous deliveries.

Section V:- This was for women who were currently pregnant during the time of the survey. Although the proforma intended that at least a minimum of physical examination be carried out, it was not possible to do so because the majority of the survey team consisted of people not trained in such skills.

The data for the study were collected between the 22nd and 29th of September, 1985. Throughout the survey, a constant check was maintained to assess the coverage of the sample population and to reduce non response to a minimum. A non-respondent was considered to be a person/household that could not be contacted

even after two repeated visits. If only the woman respondent was not contactable, information was taken from other members of the family (husband, mother-in-law, sister-in-law). This information was however not used for the purpose of analysis.

Apart from the door to door survey of the selected population, a gynaecological-clinic with facilities for internal examination was run in the bastis by qualified gynaecologists from our team Women reporting gynaecological/symptoms, whether part of the sample or not, were referred to the clinic. A report of the findings in the women attending the clinic is annexed (Annexure III).

Training of the survey team:

The survey team consisted of two types of women, the majority belonging to the working class who had undergone training in Community Health and were working as health workers for the last three years; the other group consisted of middle class women with or without medical background but with experience in data collection. All the members were literate but most were conversant with only Hindi, and therefore the proforma was prepared in Hindi. The team members had volunteered for the survey and were not paid any remuneration for their participation in the survey.

About a month prior to the survey, the proforma was explained to the health workers and was tested out on them. The initial scepticism gave way to a somewhat realistic assessment of the ability to recall. The proforma was then administered to several

households in the slums of Delhi and Bhopal and necessary changes were made. The first day of the survey period was spent in briefing the participants and in giving practical experience in administering the proforma in the bastis in Bhopal. During the briefing, each question was explained, the need to fill every column emphasised and the survey team was asked to write out on the reverse side of the proforma any other information that they felt was relevant but which could not fit neatly into the columns provided. The concept of random sampling was explained and emphasis was placed on the fact that on no account were the sample numbers to be changed.

CONSTRAINTS IN THE STUDY:

As a consequence of the political climate prevailing in Bhopal after the disaster, the study was constrained by several factors. Although these did not affect the overall quality of the data, they need to be stated to emphasis the tensions under which the survey team had to function.

To begin with, it was impossible to get any information from the medical establishment in Bhopal. This conspiracy of secrecy was extended to such ridiculous lengths that even innocuous information such as the ICMR maps of the bastis was treated like classified documents. It was only at the intervention of ICMR's head office in Delhi, that we were finally able to get some help from the various department of Gandhi Medical College and hospital.

The survey was first to have been conducted in July 1985. However, the dates had to be postponed because on June 25, 1985, in a sudden move, the MP Government arrested the doctors and activists working in the Jana Swasthya Clinic (People's Health Clinic) of Bhopal and seized their medical records under preventive detention. These activists and doctors were branded as terrorists and the MP Government issued strict warnings against any 'outsiders' entering the affected area. The atmosphere in the bastis following the arrests was extremely tense as local people from the slums had also been picked up. Even previously sympathetic doctors from the medical community of Bhopal refused help because of the media reports. The dates for data collection therefore had to be postponed. The change in dates and the repression by the MP Government led to a large number of drop outs from those who had agreed to participate in the survey. Thus the number of volunteers available during the survey was far less than that required.

Once the survey began, the third problem was the constant harrassment from the police. Since the safety of the proforma was of concern, every night after the day's work was completed, the filled proforma had to be spirited' away to some safe place. This resulted in the loss of some of the completed proforma.

C H A P T E R II

OBSERVATIONS AND RESULTS

Non-Respondents

Out of the total 5248 households, a random sample of 1571 were selected for the study from the three areas viz., Kenchi Chola, JP Nagar and Kazi Camp. In order to compensate for the non-response rate, another 523 households were chosen as reserves'. Of the total 2094 households selected, 1632 responded giving a non-response rate of 22.06%. Table I gives the reasons for non-response.

TABLE I

Reasons for non-response (Figs. in parentheses % of total)

		Kenchi Chola	JP Nagar	Kazi Camp	Total	(%)
1.	House locked	34	70	49	153	(33.11)
2.	House not located	11	14	87	112	(24.24)
3.	Migrated/shifted out	13	26	10	49	(10.5)
4.	Form missing/incomplete	2	33	20	55	(11.9)
5.	Out of station	12	24	14	50	(10.8)
6.	Miscellaneous reasons (converted into sewing centre, temple, shop).	3	5	9	17	(3.67)
7.	Empty house	5	5	5	15	(3.24)
8.	Disappeared with ICMR plate	5	4	1	10	(2.16)
9.	Refused to be surveyed	-	1	-	1	(0.21)
10.	Total	85	182	195	462	(100)

A non-respondent household was one that could not be contacted even after two repeated visits. Approximately 30% of the respondents whose house was locked had gone out for work and could be contacted only very late in the evenings. In Kazi Camp, 87 households could not be located and about 50% of these households belonged to consecutive numbers. The reason for these missing households, as told to us by th ICMR field staff, was that while the houses were being numbered in Jan/Feb 1985, about 100-150 families had put up their huts in the vacant land (Khabar Khana) in Kazi Camp and after a few months, these families had shifted out of the area. Since these families moved in after the gas leak, their non-response would not affect the results. Proforma of 55 households were removed from the analysis because they were either missing or incomplete. As mentioned in the chapter on methodology, during the survey period, due to constant harrassment, the completed proforma had to be shifted every night to a safe place to prevent them being seized, thus leading to the misplacement of some. 10% of the non-respondent households had shifted out of Bhopal permanently after the gas leak and another 10% were out of Bhopal on social visits. Only one household refused to be surveyed.

A. GENERAL CHARACTERISTICS OF STUDY AND CONTROL POPULATION

A total population of 8165 in 1632 households was surveyed between the 22nd and 29th September, 1985. Of those exposed to the toxic gases on 2/3 December 1984, 253 (30.98/1000 population) individuals had died following the exposure. Of the 8165 individuals, only 43 individuals had moved into the area since the gas leak. Unlike the general slum' situations, the population in the area under survey is a stable population with a

history of residence going several generations back. Even the residents of the relatively "new" basti JP Nagar, are settlers in this area for more than ten years and in April 1984, had received `patta' for their residential plots declaring them as permanent residents.

In the population covered in the survey, there were 1486 married women in the reproductive age group. 261 of these women could not be contacted during the survey as they were either out on work or had gone on a visit to the maternal home. Thus a total of 1225 married women formed our sample population. 59.76% of the women respondents were Hindus, 39.6% Muslims, and 0.65% belonged to religions other than these two. 7.2% of the respondents were between the ages of 15-19 years, 53.3% between 20-29, 30% between the ages of 30-39 years and 9.45% were more than 40 years of age.

373 of the women had a pregnancy outcome (livebirth, still birth or spontaneous abortion) in the year prior to the gas leak and 368 women had a pregnancy outcome (live birth, still birth or spontaneous abortion) in the period following the gas leak. The control period i.e., the period before gas leak (BGL) was from 1st December 1983 to 2nd December 1984, and the study period (AGL) was from 3rd December 1984 to 22-29 September, 1985.

Table II shows that the sample of women who had a pregnancy outcome in BGL period and in AGL period are comparable with reference to age, gravidity and religion. History of smoking was not considered an important variable although it is known that smoking is strongly related to spontaneous abortion rate (15). In our study population, there is strong taboo against women smoking and cultural factors are powerful enough to prevent women from smoking. Hence history of smoking was not enquired into.

TABLE II

Comparison of characteristics of women who had a pregnancy outcome (live birth, still birth, spontaneous abortion) before and after gas leak (Figs in parentheses are the % of the total)

Age	Before gas leak*	After gas leak**
	n = 373	n = 368
15-19	17 (4.56)	31 (8.42)
20-29	247 (66.2)	237 (64.4)
30-39	102 (27.34)	88 (23.9)
40+	7 (1.87)	12 (3.26)
Gravidity		
1 & 2	155 (41.55)	132 (35.86)
3 & 4	120 (32.17)	130 (35.32)
5 & 6	63 (16.89)	63 (17.11)
7	35 (9.38)	43 (11.68)
Religion		
Hindu	210 (56.3)	207 (56.25)
Muslim	163 (43.7)	161 (43.75)
Others	---	---

* The control period i.e. from 1st December 1983 to 2nd December 1984 from now on to be referred to as BGL. (Before Gas Leak)

** The study period i.e. from 3rd December 1984 to 22-29 September 1985 from now on to be referred as AGL. (After Gas Leak)

For the purpose of the study, the current marital status was not considered necessary because the number of women who had lost their husbands in the gas leak would not affect fertility status adversely as only ten months had passed since the gas leak. Contraceptive usage was enquired into as both tubectomies and IUCDs can disturb the menstrual pattern. In the period between January 1984 to September 1985, only 19 women had undergone tubectomy and only 4 had IUCDs inserted.

B. EFFECT OF THE GAS LEAK ON THE MENSTRUAL PATTERN:

In order to assess the effect of the gases on the menstrual pattern, only those women who were menstruating in the year prior to as well as in the period following the gas leak were taken so that the menstural histories could be compared between the period before and the period after the gas leak. 571 women (46.6 percent) of the woman respondents fitted this category and each individual women served as her own control. Detailed history in terms of regularity of the cycles, number of days menstrual flow lasted and the length of the cycle were taken. Table III describes the changes in the duration of menstrual flow before and after gas leak. The changes in blood flow in AGL is significantly different from that in BGL ($p < 0.01$).

TABLE III

Comparison of menstrual blood flow before and after gas leak:

Duration of menstrual blood flow	BGL	AGL
1 day	9 (1.57)	19 (3.32)
2-3 days	191 (33.45)	179 (31.34)
4-7 days	329 (57.61)	316 (53.34)
8+	17 (2.97)	33 (5.77)
Irregular	25 (4.37)	17 (2.97)
Stopped	---	7 (1.22)

Changes in blood flow significantly different between AGL & BGL ($p < 0.01$).

From each of the women, the length of the menstrual cycle was enquired into for the BGL and AGL period and changes in the length of the cycle in this group of women is shown in Table IV. This table has been computed on the basis of the alteration in cycle length of each individual woman after the gas leak keeping her cycle length bfore the gas leak as normal for her. 14% of women reported a shortening of cycle by 5 days or more which is significantly different from the BGL period ($p < 0.05$).

TABLE IV

Alteration in cycle length after gas leak

n = 571

Remained same	429 (75.13)
Increased by 5 or more than 5 days	21 (3.67)
Decreased by 5 or more than 5 days	80 (14.01)
Irregularly irregular	34 (5.95)
Stopped	7 (1.22)

Alteration in cycle length significant $p < 0.05$

Table V describes the cyclical regularity of the menstrual cycle.

In 11.56% women the menstrual cycle was irregularly irregular after gas leak as compared to 5.6% women before the gas leak.

TABLE V

Change in the cyclical regularity of the menstrual cycle gas leak

n = 571

	BGL	AGL
Cyclically regular	539 (94.39)	498 (87.21)
Irregularly irregular	32 (5.6)	66 (11.56)
Stopped	---	7 (1.22)

Change in the cyclical regularity significantly different ($p < 0.01$).

Menstrual histories also tried to ascertain the episodes of delayed and missed periods before and after gas leak. Table IV shows the number of women with at least one episode of missed/delayed periods.

TABLE VI

Women experiencing at least one episode of missed/delayed periods BGL & AGL

n = 571

	BGL	AGL
Delayed period*	11	52
Missed period**	10	62

* Delayed period - amenorrhoea of 5 to 7 weeks.

** Missed period - amenorrhoea of more than 8 weeks.

Difference is significant ($p < 0.001$)

C. EFFECT OF THE TOXIC GASES ON THE REPRODUCTIVE OUTCOMES:

1. Still births: Table VII shows that the number of still births in the AGL period is statistically higher than that in BGL ($p < 0.01$) period.

TABLE VII

Still births in BGL and AGL Population

	BGL	AGL
No. of live births	348	240
No. of still births	1	13

Difference is significant ($p < 0.01$)

2. Fetal Death Ratio

In studies that use retrospective case histories to assess the incidence of spontaneous abortions in populations, the measure of such an incidence is the fetal death ratio (FDR). Table VIII gives the overall fetal death ratio BGL & AGL. The increase in FDR, after gas leak is statistically significant.

TABLE VIII

Fetal Death Ratio before and after gas leak.

	BGL (n = 373)	AGL (n = 368)
No. of live births + Still births	349	253
No. of spontaneous abortions	24	115
Fetal death ratio*	6.43	31.25

* FDR = $\frac{\text{No. of spontaneous abortions}}{\text{No. of spontaneous abortions + Live births + Still births}} \times 100$

Increase in FDR in AGL period is highly significant.

Table IX compares FDR for the same calendar month periods, like with like i.e., between January 1984 to June 1984 and 1985 to June 1985. The difference in FDR is significant between BGL and AGL periods.

TABLE IX

Comparison of FDR for similar periods in BGL and AGL

	Jan.1984-June 1984	Jan.1985-June 1985
Total No. of live births + still births	131	143
Total No. of spontaneous abortions	17	51
FDR	11.49	26.29

Difference in FDR significant ($p < 0.001$).

3. Cumulative Risk of spontaneous abortions in the exposed population.

Fetal Death Ratio is basically a ratio and the denominator does not belong to the same population and therefore the risk involved cannot be estimated. In order to work out the risk involved, the cumulative risk has been worked out in the exposed and unexposed population. This would also give the relative risk, measure the strength of casual relationship and the attributable risk which can help in measuring the magnitude of the problem in the exposed population.

For this purpose, the conceptions of Jan. 1984 to April 1984 are selected because they form a cohort whose outcome in the form of spontaneous abortion will not be modified or distorted by the occurrence of exposure on 3rd December 1984. Hence conceptions in this period forms a cohort for the unexposed population. The abortion rate in this period when compared to the abortion rate in the period following exposure January 1985 - April 1985, as shown in table X is significantly less, the relative risk is 1.94, the attributable risk is 7.44, and the etiologic fraction is 48.5% of all abortions occurring in conceptions conceived after the gas leak.

TABLE X

Cumulative incidence of spontaneous abortions BGL & AGL

Month of conception	Total no. of conceptions	Total No. of abortions	Cumulative incidence
Jan. 1984 - April 84	139	11	7.9%
Jan. 1985 - April 85	163	25	15.34%

Cumulative incidence calculated by

$$\frac{\text{No. of spontaneous abortions}}{\text{No. of conceptions}} \times 100$$

Cumulative incidence significantly different ($p < 0.05$)

C H A P T E R III

DISCUSSION

The present study carried out ten months after the gas leak disaster in Bhopal, is community based in a randomly selected sample of families and focusses on the effect of toxic gases on the menstrual pattern and pregnancy outcomes in the gas exposed population. The same population one year prior to the gas leak has formed the control.

In the immediate aftermath of the disaster, the Union Carbide Corporation, USA, responsible for the disaster, had maintained that the effects of the gases were local, affecting only the eyes and lungs and that these effects were temporary. This attempt at minimizing the effect of the gases had been countered as early as March 1985 i.e., three months after the disaster on the basis of data obtained through epidemiological studies which showed the gases to have a multisystemic effect.

The results of the present study support the contention that the gases have affected organs other than eyes and lungs by indicating damage to the reproductive system also of the exposed women. The results also indicate that the effect was unlikely to be temporary as it could be discerned even ten months after the disaster. The results of our study show a significant alteration in the menstrual pattern in the form of decreased cycle length, increased duration of bleeding and in the disruption of the cyclical rhythm of the menstrual cycle. Significantly higher number of women have reported episodes of delayed and missed periods.

The effect of the toxic gases on the pregnancy outcomes studied have shown that both still births and spontaneous abortions are significantly higher in the post disaster period. The increase in spontaneous abortions is not confined to the immediate post gas leak period but the rates have continued to remain high even ten months after the disaster. Further, the increase in spontaneous abortions are not confined to only those pregnancies conceived before the gas leak but pregnancies conceived after the gas leak have also experienced a significantly higher termination as spontaneous abortions.

The more refined indicator of cumulative incidence shows that the exposed population is at a relative risk of 1.94, the attributable risk being 7.44. Of the spontaneous abortions in conceptions after gas leak, 48.5% are a result of exposure to toxic gases.

Thus, contrary to the hypothesis that the effects of the toxic gases are temporary and limited to the organs directly exposed to them, the results of the present study indicate a continuous systemic poisoning along with a direct toxic effect. In addition to this, the increase in spontaneous abortions suggests a strong possibility that the gases are potentially mutagenic.

Spontaneous abortions as an index for detection of mutagens:

In assessing hazards posed by chemical agents, of special concern are those agents that might cause cancer, birth defects, or gene mutation, since their defects may not be detected for years or even generations and the damage caused is usually irreversible.

Hence while assessing genetic risks, the rapidity with which mutation is detected and the ability of the system to detect small increases in the mutation rates are two important criteria for selecting the indicator. The review of epidemiologic procedures as aids in population studies for detection of mutagens conclude that monitoring population for fetal deaths is one of the most important surveillance methods in conjunction with more specific tests such as biochemical cytogenetic analysis.

Stein - et - al. have pointed out that "most inferences about the distribution of specific congenital anomalies and about their causes have relied on observation made at birth or later. We wish to emphasise that observations made at early stages of gestation are a valuable and largely untapped source of information about congenital anomalies. Observations on fetal deaths are essential to an understanding of congenital anomalies; to rely solely on data from birth can lead to a false view of their natural history... Infants born at term are the survivors of cohorts which have suffered morbidity and loss during the months since conception. The incidence of a defect at birth is thus a function of the incidence of that defect at conception or in early gestation and of the probability of fetal survival" (17).

Using the model of Stein - et - al., and by applying currently available estimates to the model, Buffler has shown that it is possible to evaluate the utility of monitoring for spontaneous abortions as an indicator of chromosomal anomalies in an exposed population (18). Current estimates of all chromosomal anomalies among live births are fairly consistent as are spontaneous

abortions among recognized pregnancies. Using the probabilities of fetuses with anomalies aborting and of fetuses without anomalies aborting in a hypothetical series of 1000 pregnancies, Buffler has shown that 94.7% of defective fetuses would be detected or screened out of the population by spontaneous abortion, leaving only 5.3% of the estimated total infants with chromosomal anomalies to be detected at birth. Spontaneous abortion also appears to be highly specific in that only 6.6% of all fetuses without anomalies are aborted compared to an abortion rate of 94.7% for fetuses with anomalies.

Thus, spontaneous abortion rates, while indirect, are both sensitive and specific indicators for assessing the mutagenic potential of a hazardous chemical agent in the exposed population.

The results of our study would indicate that the toxic gases that leaked on the night of 2nd December 1984 from the UCIL factory in Bhopal are potentially mutagenic. This indirect evidence of increased spontaneous abortions in the exposed population, however, needs to be substantiated through biochemical, cytogenetic analysis. There is also need to monitor the exposed population for delayed long term effects for the next 20 or 30 years and spontaneous abortion rates could form one of the important surveillance methods.

Annexure : I

Sample from the indigenous calendar prepared for the survey

Indigenous Calendar	Their Equivalent in English Calendar
Amavas	3.1.84
Rabial awful	upto 4 Jan 84
Rabial akhir	5.1.84
Makar Sankranti	14.1.84
Purnima	18.1.84
Magh (month beginning)	19.1.84
Amavas	2.2.84
Jamadil awful	4.2.84
Basant Panchami	7.2.84
Purnima	16.2.84
Phalgun (month beginning)	17.2.84
Mahashivaratri	29.2.84
Amavas	29.2.84
Jamadil akhir	5.3.84
Holi	16.3.84
Purnima	16.3.84
Chaitin (month beginning)	18.3.84
Amavas	1.4.84
Rajat	4.4.84
Purnima	15.4.84
Baishaki	16.4.84
Amavas	30.4.84
Shabhan	3.5.84

Annexure : II

Study Proforma (Translated from Hindi)

Section I : Information regarding Household.

1. Date
2. Area/Basti
3. ICMR number
4. Head of household
5. Religion
6. Composition of family : (Start with the household head; Include members who are dead and missing since gas leak)

No	Name	Age	Sex	Marital status	Exposed to gas - yes/no	If ill, symptoms
1.						
2.						
3.						
4.						
10.						

7. Economic status before gas leak

No.	Name of the earning member	Daily wage	No. of days of work	If on regular salary monthly
1.				
2.				
3.				
4.				
10.				

Section II : Menstural History (All married women between 15 - 44 years)

1. ICMR No.
2. Woman's name
3. Did you have a period this month?
   a. If yes, how long did it last?
   b. If no, when was your last menstrual period?
   c. And how long did it last?
4. Did you have a period in _____ month? (Investigator to mention the month prior to the LMP)
   a. If yes, how long did it last?
5. Did you have a period in _____ month? (Investigator to mention the month prior to that in question 4)
   a. If yes, how long did it last?
6. Can you tell me, after how many days do you get your period ?
7. Does your period usually come after _____ days? (Investigator to quote answer to question 6)
8. Has your period been ever delayed since the gas leak?
   a. If yes, how long was the delay?
   b. How many times did this happen?
9. Has your period been ever missed since the gas leak?
   a. If yes, how many times?
10. Did you get your period every month in the year before the gas leak?
11. In the year before the gas leak did you ever miss your period?
    a. If yes, how many times?

12. Was your period ever delayed in the year before the gas leak?

a. If yes, how long was the delay?

b. How many times did this happen?

13. Age of the youngest child?

14. Did you conceive after this child?

a. If yes, month and year of conception _____

b. What was the result of the conception?

(Investigator to take complete information)

15. Please tell me the names of all your children who are living at this time; start with the oldest.

No.	Name	Age	Sex
1.			
2.			
3.			
4.			
10.			

16. Now I will read out to you the names of your children who are still living. Is anyone missing? (If yes, add the name to the list)

17. Tell me about the children who were born alive but died subsequently. If there were any, give details.

18. Have you ever given birth to a child that was dead at birth?

If yes, give details.

19. Did any of your conceptions end in an abortion?

(give details)

20. Family Planning status: Tubectomy ( ) Date

Vasectomy ( ) "

IUCD ( ) "

Other ( ) "

None

21. Has there been any change in the libido since the gas leak?

Yours/husband's

Signature of Investigator

Date

Section III :For those women who aborted after the gas leak.

1. ICMR No. Basti

2. Woman's name

3. Occupation

4. Were you engaged in heavy labour during your pregnancy? Yes/No

   a. Fetching water (Uptill which month)

   b. Fetching firewood (_____ "_____)

   c. Any other heavy work (_____ " _____)

5. The last menstrual period before the abortion

   _____

   (Write in the same way as the woman states)

6. When did you abort: date and month _____

7. Did you abort spontaneously or was it induced?

8. If it was spontaneous, give details about the abortion

   (Complete information is to be taken)

9. If there were fetal movements before the gas leak, was there any change after the gas leak?

10. If the abortion was induced give reasons _____

Where was it done and who performed it? _____

Signature of Investigator

Date:

Section IV : For those women who delivered a live/dead child after gas leak.

1. ICMR No. Basti

2. Woman's name

3. Occupation

4. Were you engaged in heavy labour during your pregnancy? Yes/No

   a. Fetching water (uptill which month)

   b. Fetching firewood (" " ") _____

   c. Any other (" " ") _____

5. Last menstrual period _____

6. Date of delivery _____

7. Fetal movements:

	Same	Increased	Decreased	Remarks
Before gas leak				
During gas leak				
After gas leak				

8. Any problem/complaint after the gas leak?

9. Was there any difference between the labour in the delivery as compared to your previous ones? (Give complete information)

10. Delivery

a. Vertex

b. Breech

c. Forceps

d. Caesarean

11. End result : a. Live child

b. Dead child (Fresh)

c. Dead child (Macerated)

12. Single / Twins

13. Did the child cry immediately after birth?

a. How long was it after birth ?

b. Colour of the skin

c. Other reflexes

14. Any problem in breast feeding?

15. Any congenital deformity?

16. Sex of the child

a. Female

b. Male

c. Indeterminate

17. If it was a live birth,

a. Is the child still alive and well?

b. If ill, give details

c. If dead, give cause of death

18. Health of the mother

a. Alive and well

b. Ill (give details)

c. c. Dead (give cause of death)

Signature of investigator

Date:

Section V: For those women who are pregnant at the time of the survey

1. ICMR No. Basti
2. Woman's name
3. Occupation
4. Were you engaged in heavy labour ? Yes/No
   a. Fetching water (uptill which month)
   b. Fetching firewood (" " ")_____
   c. Any other (" " ")_____
5. Last menstrual period _____
6. Is there fetal movement?
7. Any complaint during this pregnancy?

Signature of the Investigator

Date:

---

8. Examination (to be carried out by a doctor)
   a. Abdominal girth
   b. Fetal heart sounds
   c. Per abdomen
   d. Oedema
   e. Blood Pressure
   f. Other

Signature of the examining doctor

Date of examination

Annexure : III

Effects of toxic gases on the health of the women (clinic based data)

During the survey period (22-29 September 1985), a gynaecological clinic was run simultaneously by qualified gynaecologists in the survey team to examine women with gynaecological problems. Depending on the area where the survey team was carrying out the interviews, clinics were held at all the three areas viz., Kenchi Chola, JP Nagar and Kazi Camp selected for the study. The clinic was housed in rooms provided by the basti women and the necessary equipment was loaned to us by voluntary organisations and private dispensaries in Bhopal. SEWA, Bhopal, offered us the services of two nurses working with them. The clinic was open to all the women in the survey area whether they formed part of the sample or not. Women in the area had been informed earlier about the clinic through the pamphlet and the members of the survey team were encouraged to refer women with gynaecological or obstetrical problems. Detailed history was taken and physical examination including a pelvic examination was done by qualified gynaecologists. A total of 343 women were examined in the clinic. The characteristics of these 343 women were as follows.

Age	No. of women (n = 343)	%
10 - 14 yrs.	2	0.58
15 - 19 yrs.	23	6.7
20 - 29 yrs.	183	53.35
30 - 39 yrs.	95	27.7
40 +	34	9.9
Not recorded	6	1.75
Religion		
Muslim	152	44.3
Hindu	191	55.68

The findings on clinical examination were as follows:

Total No. of pregnant women examined	: 159
Clinically suspected malformed babies	: 6(3.77%)
Clinically suspectedd intra uterine growth retardation	: 10(6.3%)
Threatened/inevitable/missed/incomplete abortion	: 5(3.14%)
Total No. of non-pregnant women examined	: 184
Complete abortion since gas leak	: 51 (27.7%)
Pelvic Inflammatory Disease	: 21 (11.4%)
Menorrhagia/Polymenorrhoea	: 17 (9.24%)
Cervical erosion/Endocervicitis	: 26 (14.1%)
Vaginitis/Leucorrohoea	: 45 (24.46%)

Besides these, there was history of still births in 6 women, neonatal deaths in children born after gas leak in 11 cases. 4 women who had lost their children in the gas leak requested recanalisation as they had been sterilized.

Since these data are on a self selected sample of women attending the clinic, they need to be interpreted with caution. The clinic data suggest that probably the overall morbidity with regard to gynaecological problems in the exposed women has decreased in the 10 months following the gas leak as compared to the earlier clinical studies in Bhopal. However, it continues to remain high as compared to clinic based studies in unexposed population; with 24.45% having vaginitis/leucorrhoea, 14.1% with cervical erosion/endocervicitis, and 11.4% with pelvic inflamatory disease. In the case of women with leucorrhoea, the discharge from the vagina was typically profuse, thick, whitish yellow, without any foul smell or local irritation unlike any commonly found vaginal discharge of infective origin. For establishing aetiological diagnosis, women with the above mentioned gynaecological problems need to be investigated further and appropriate treatment needs to be suggested. There is a need for population based epidemiological study with facilities for examination at the field level and for laboratory, diagnostic investigations when needed.

Annexure : IV

Problems in Deliveries Post Gas Leak

From the surveyed population, extensive history was taken regarding deliveries that took place after the gas leak. A total of 253 women delivered in the AGL period. Of this only 18 women (7.1%) had conceived in December 1984 - the month of disaster, whereas the rest i.e., 235 women (92.9%) were already pregnant when the disaster occurred. At the time of gas leak, 89 women had entered the third trimester of pregnancy. A major symptom at the time of gas leak in these women was change in the fetal movements. 21 women (23.6%) reported an increase, 22 women (24.7%) reported a decrease and in 13 women (14.6%) the fetal movements had completely stopped. Changes in fetal movements were also noticed by women who entered the 20th week of gestation. The fetal movements were also considerably reduced in these pregnancies as compared to previous pregnancies. Only 1% of women reported painful contractions unlike fetal movements.

Post maturity appeared to be another problem. Of the 253 women who delivered in the AGL period, 32 women (12.65%) appeared to have given birth to post term babies as calculated from their last menstrual period. Almost all the women reported prolonged labour. Since culturally labour is not divided into first stage and second stage, it was difficult to ascertain which stage of labour had been prolonged. However, even women who had normal labour in their earlier pregnancies reported prolonged or difficult labour with labour lasting for more than 48 hours.

Women reported a decrease in breast milk production. This was in women who had successfully breast fed their earlier infants. Of the 223 women with a living child at the time of the survey, 45 women (20.18%) noticed a considerable decrease in breast milk production.

All these symptoms could indicate an adverse effect on the development of the child. Changes in fetal movement and post maturity could indicate intrauterine hypoxia, placental insufficiency and therefore probable intrauterine growth retardation, while suppression of breast milk could have had an adverse effect on the growth of the infant. Further studies are needed to explore these findings systematically.

Annexure : V

A critique of the ICMR study on pregnancy outcomes and reproductive health of women exposed to the toxic gases in Bhopal

Complete neglect of gynaecological problems.

The Indian Council of Medical Research (ICMR) and the Gandhi Medical College, Bhopal, have attempted to collect data on the reproductive outcomes in the gas affected population as part of their longterm epidemiological study. The proforma entitled "ICMR/GMC study on longterm effect of MIC gas"collects morbidity data under conditions affecting the following organs viz. lung, eye, GIT, skin, hearing and mental. No information is collected regarding the gynaecological disorders following the gas leak. Questions No. 49 to 54 to be administered to women between the ages of 15 to 49 years age group are related to pregnancy outcomes only. Question No. 49 enquires about the "present pregnancy status" and question No. 51 enquires into the "pregnancy status on 3.12.84". Since it is not clear at what point of time this proforma was administered i.e., in relation to the gas leak, and the date by which the collection of information was completed, it is not possible to tell from the proforma the gap in information between the gas leak and the time of administering the proforma. Since even as late as September 1985, when data were being collected for our study, the field workers of ICMR were still administering their proforma on long-

term effects, we could say that the gap in information was for at least ten months. This gap would relate to those women who were not pregnant at the time of the ICMR survey, and who were not pregnant on 3.12.84 (their response to questions 49 & 51 being in the negative) but who had conceived between these two periods and had aborted before the proforma was administered to them. This is the first stage where under reporting occurs in the ICMR - GMC study. (See ICMR - GMC study proforma in Annexure VI).

The women who were pregnant at the time of the gas leak or were pregnant at the time of the administration of the proforma are then referred to a team from the Oby Gynaecological department of GMC involved in the ICMR sponsored research. Members of this team visit the women thus referred and administer a second proforma entitled "Epidemiological study of teratogenic effects of MIC affected population at Bhopal" (see Annexure VI). Questions 14 to 24 relate to pregnancy outcomes following the gas leak. Questions 15 & 17 relate to the LMP & EDD of the current pregnancy whereas for events occuring after the gas leak but prior to the administration of the proforma, only gestational age is enquired into. This is for abortion, still birth and live birth following the gas leak. As the study team of ICMR had not prepared an indigenous events calendar, rechecking these important dates and gestation periods, may be very difficult. It is possible that a second stage of misreporting takes place at this point. Since there were no written guidelines or report, we are not in a position to comment on methodology of the ICMR - GMC study.

Both these proforma contain information, albeit insufficient, relating to pregnancy outcome events only and do not attempt to collect information on either the gynaecological disorders in the nonpregnant women or on the health problems related to pregnancy. They thus reflect the dominant view of modern medicine which perceives women as vehicles for the production of the progeny. This view has led to the loss of valuable information regarding the specific toxic effects which women reported such as leucorrhoea, changes in the menstrual pattern, dysmenorrhoea, prolonged labour and suppression of lactation etc. While the failure to record such crucial information is serious enough from the medicolegal and scientific points of view, it also reflects the inherent bias in medical research to the health problems of women.

The inadequate and faultily designed proforma did, as expected, lead to an under estimation of adverse pregnancy outcomes in the ICMR study. During a meeting of ICMR in Delhi in June 1985, preliminary results of the pregnancy outcome study of the ICMR sponsored research in Bhopal were presented. Till date, according to the Chief Investigators, a total number of 3259 pregnancies had been recorded at the time of the gas leak. Of these, 15% had ended in abortions, the still birth rate was 2% and the rate of congenital malformation was 1.4%. Comparing these results with hospital based studies, in which spontaneous abortion rate was 25 30%, still birth rate 1.8 3.5%, congenital malformation 1.5 2%, it was concluded that although the spontaneous abortion rates had increased dramatically in the immediate post gas leak period, it had fortunately stabilized and the current rates were all within normal. In the meeting it was

also stated that abortion rates "always" go up dramatically during periods of social and environmental stress such as war, floods, earthquakes because of psychological factors. The participants of the meeting also expressed a sense of relief that congenital malformation had not gone up but cautioned that the time to watch was "now" when the women who had been in the first trimester at the time of gas leak would deliver. While both these statements may sound unexceptional in themselves, they have to be placed in the context of Bhopal to understand their implications. Firstly, there was enough evidence to point to the extremely toxic nature of the gases as could be seen by the high mortality rate after the leak. Hence it was more likely that the spontaneous abortions and still briths in the immediate post disaster period were due to the direct toxic effect on the fetus in utero. But this was insufficient to explain the effect in pregnancies aborting several months after the gas leak. If the high adverse outcomes were due to "stress" alone, as stated by the ICMR team, neither was the statement substantiated by studies to support this view point, nor were we able to find any supportive evidence through library research. Secondly, it must also be remembered that these statements were being made at the time when controversy was raging about whether the gases had temporary local effects only or whether they affected organs other than lungs and eyes. Thirdly, ICMR's emphasis for assessing damage to the embryo and fetus seemed to rest on the assessment of congenital malformations alone, spontaneous abortion on the other hand was considered a regrettable and unfortunate fetal loss without grave implications.

By concentrating on congenital malformation alone, valuable information regarding pregnancies conceived after the gas leak and terminating in spontaneous abortions was lost in the ICMR study. This was regrettable on two counts. Firstly, it would have pointed to the systemic efect of the toxic gases, and their probable mutagenic potential (as the conceptions were in the period after the exposure) to be confirmed by cytogenetic studies. Secondly, by continuing the long term studies on spontaneous abortion rates, it would have been possible to monitor the continuing environmental risk the population in Bhopal was being exposed to.

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Annexure : VI

I.C.M.R. - G.M.C., STUDY ON LONG TERM EFFECT OF MIC GAS : DEPARTMENT OF PREVENTIVE & SOCIAL MEDICINE, GANDHI MEDICAL COLLEGE, BHOPAL.

NAME OF HEAD OF HOUSE HOLD : (IN CAPITALS) _____

NAME OF INDIVIDUAL : (IN CAPITALS) _____

ADDRESS : _____

1. JOB NO. (1–5) B 0 2 2 1

2. TYPE OF HOUSE HOLD (6)
(Key- House hold old, interviewed 1.
House hold old, not interviewed 2.
New house hold, interviewed 3.
New house hold, not interviewed 4.

3. LOCALITY (7–8)

4. SL. NO. OF FAMILY (9–12)

5. SL. NO. OF MEMBER (13–14)

6. TYPE OF HOUSE (15)

Key- KUTCHA		PUCCA	
Canvas	0	Canvas	5.
atched	1	Thatched	6.
Tiles	2	Tiles	7.
Tin	3	Tin	8.
Concrete	4	Concrete	9.

7. TOTAL NO. OF FAMILY MEMBERS (AS ON 3-12-84) (16–17)

8. NO. OF GUESTS (IF ANY, ON (3-12-84) (18–19)

9. PER CAPITA MONTHLY INCOME (IN RUPEES) (20–23)

10. RELIGION (24)
Key- Hindu 1
Muslim 2
Christian 3
Sikhs 4
Others 5

11. AGE (IN COMPLETED YEARS (AS ON 3-12-1984) (25–26)

12. SEX (27)
(Key- Male 1.
Female 2)

13. EDUCATION (28)
(Key- Illiterate 1
Literate 2
Primary 3
Midule 4
Secondary 5
College 6
Technical 7)

14. OCCUPATION (Key in instruction manual) (29–30)

15. PRESENT/ABSENT IN THE HOUSE ON THE NIGHT ON GAS - LEAKAGE (31)
Key- Present 1
Absent 2)

16. IF ABSENT FROM HOUSE WHERE WERE YOU- (32)
(Key-Not in Bhopal 1
In Bhopal 2)

17. IF IN BHOPAL WHICH AREA (MENTION THE AREA BY NAME) NOT TO BE CODED)

_____

_____

_____

18. LIVING STATUS ON THE DAY OF INTERVIEW 34 ☐
(Key- Alive 1
Dead 2
Absent 3
Missing 4)

19. DATE OF DEATH 35 ☐☐☐☐☐☐ 40
NAME OF INFORMANT

---

20. TYPE OF EXPOSURE 41 ☐
(Key-Sleeping Outside 1
Sleeping - Inside 2

21. IF SLEEPING INSIDE WHERE WINDOWS OPEN OR CLOSED 42 ☐
(Key-Open 1
Closed 2)

22. WHAT DID YOU DO WHEN THE GAS LEAKAGE OCCURED 43 ☐
(Key-Ran away 1
Went outside 2
Protected by wet cloth to face 3
Stayed indoor 4
Covered with sheet/
(Please specify)

---

23. IF YOU RAN AWAY, WHAT MODE DID YOU TAKE 44 ☐
(Key-By foot 1
By vehicle 2
Both 3)

24. NATURE OF WORK DONE BY YOU BEFORE THE EPISODE (SPECIFY) 45 ☐

---

25. ARE YOU ABLE TO DO THE SAME WORK NOW 46 ☐
(Key- Yes 1
No 2)

26. IF NOT WHAT ARE YOUR PROBLEMS 46 ☐
(Key-Breathlessness 1
Chest Pain 2
Fatigue 3
Blackout 4
(1 + 2) 5
(1 + 3) 6
(1 + 4) 7
Any other combination 8
(Specify Combination)

---

27. HABITS
SMOKING - EVER 47 ☐
(Key-Yes 1
No 2

28. SMOKING CURRENT 48 ☐
(Key-Yes 1
No 2

29. ALCOHOL EVER 49 ☐
(Key-Yes 1
No 2

30. ALCOHOL-CURRENT 50 ☐
(Key-Yes 1
No 2

31. DID YOU CONSUME ALCOHOL ON THE NIGHT OF EPISODE 51 ☐
(Key-Yes 1
No 2

32. CHEW TOBACO-CURRENT 52 ☐
(Key-Yes 1
No 2

33. CHEW TOBACO-EVER 53 ☐
(Key-Yes 1
No 2

34. IMMEDIATE EFFECTS 54 ☐
DID THE GAS EXPOSURE HAVE ANY EFFECT IMMEDIATELY ON 3.12.84.
(Key-Yes 1
No 2)
IF YES, CONTINUE IF NO. PROCEED TO QUESTION 41.

IF YES

Condition	Effect Key-Yes 1 No 2	Were you hospitalised Key-Yes 1 No 2	Duration of hospitalisation in days	Duration of illness in days	Dates of hospitalisation (Not to be coded)	Name of hospital (Not to be coded)
1	2	3	4	5	6	7
35. Lung.	56	57	58 59	60 61		
36. Eye.	62	63	64 65	66 67		
37. GIT	68	69	70 71	72 73		
38. Skin	74	75	76 77	78 79		
39. Hearing	80	81	82 83	84 85		
40. Mental	86	87	88 89	90 91		

LATER EFFECTS (ON Set on 4.12.1984 or later)

41. DID YOU DEVELOP ANY COMPLICATIONS ON 4.12.1984 OR LATER. 92
(Key-Yes 1
No 2)

IF YES, CONTINUE, IF NO, CLOSE INTERVIEW. PROCEED TO ITEM 49 ONLY FOR MARRIED WOMEN BETWEEN 15-49 YEARS.

Condition	Effect Key-Yes 1 No 2	After how-many weeks Key *	Were you hospitalised Key-Yes 1 No 2	Duration of hospitalisation Key *	Duration of illness in weeks Key *	Dates of hospitalisation (Not to be coded)	Name of hospital
1	2	3	4	5	6	7	8
42. LUNG	93	94	95	96	97		
43. EYE	98	99	100	101	102		
44. GIT	103	104	105	106	107		
45. Skin	108	109	110	111	112		
46. Hearing	16	17	18	19	20		
47. Mental	21	22	23	24	25		

Within 1 week	-	1
1-2 Week	-	2
2-3 Week	-	3
3-4 Week	-	4
4-8 Week	-	5
8-12 Week	-	6
More than 12 Week	-	7
Still Continuing	-	8

48. DID YOU DEVELOP ANY OTHER COMPLAINTS AFTER 4.12.84.

a) Tiredness [ ] 26
Key-Yes 1
No 2

b) Fatigue [ ] 27
Key-Yes 1
No 2

c) Giddiness(Chakkar) [ ] 28
Key-Yes 1
No 2

d) Anxiety(Ghabharat) [ ] 29
Key-Yes 1
No 2

e) Headache [ ] 30
Key-Yes 1
No 2

f) Bodyache [ ] 31
Key-Yes 1
No 2

g) Pain in the limbs [ ] 32
Key-Yes 1
No 2

PREGENANCY STATUS (ASK ONLY MARRIED WOMEN IN 15-49 YEARS AGE GROUP)

49. PRESENT PREGNANCY STATUS [ ] 33
Key-Yes 1
No 2

50. PERIOD OF GESTATION IN WEEKS 34 [ ][ ] 35

51. PREGNANCY STATUS ON 3.12.1984 [ ] 36
Key-Yes 1
No 2

52. OUTCOME OF PREGNANCY [ ] 37
Key- Live Birth 1
Still Birth 2
Abortion 3
M.T.P. 4
Continuing 5

53. DURATION OF GESTATION AT THE TIME OF OUT COME OF PREGNANCY (IN WEEKS) 38 [ ][ ] 39

54. DATE OF OUTCOME 40 [ ][ ]-[ ][ ]-[ ][ ] 45

NAME OF INTERVIEWER

SIGNATURE OF INTERVIEWER

DATE _____ ___ ___

NAME OF A.P.O.

NAME OF STATISTICIAN

DATE OF SCRUTINING

Key for occupation (No.14)

01. No occupation 02. Professional technical and related worker. 03. Sales worker
04. Farmers, fisherman, hunters, Lumperman related worker. 05. Worker in mines quarry 06. Worker in transport occupation. 07. Craftsmen labour not elsewhere clarified. 08. Service workers.
09. Occupation unreported. 10. Members of armed forces. 11. Housewife.

EPIDEMIOLOGICAL STUDY ON TERATOGENIC EFFECTS OF MIC
IN EXPOSTED POPULATION AT BHOPAL

REGISTRATION

Name of head of House hold _____

Name of Woman _____ Husband _____

Address _____

1. ICMR PROJECT NO. 1 [ ][ ][ ][ ][ ]
2. S.NO. OF HOUSEHOLD 6 [ ][ ][ ][ ] 9
3. S.NO. OF WOMAN 10 [ ][ ] 11
4. AREA CODE 12 [ ][ ] 13
5. DATE OF VISIT 14 [ ][ ][ ][ ][ ][ ]
6. AGE OF WOMAN 20 [ ][ ] 21
7. RELIGION 22 [ ]

   1.Hindu 2.Muslim 3.Sikh
   4.Christian 5. Others

8. EDUCATION 23 [ ]

   1. None 2. Primary 3. Secondary
   4. Graduate 5. Postgraduate/ Professional

9. CURRENT MARITAL STATUS 24 [ ]

   1. Single 2. Married 3. Widow
   4. Separated 5. Divorced

10. PER CAPITA INCOME PER MONTH 25 [ ][ ][ ][ ] 28

11. TYPE OF HOUSE 29 [ ]

    1. Thatched hut 2. Masonary
    3. Block of huts 4. Banglow
    5. Tents 6. Others

12. HISTORY OF CONSANGUINITY

    1. Yes 2. No. 30 [ ]

13. DURING THE PERIOD OF GAS LEAK WHERE HAVE YOU BEEN 31 [ ]

    1. Inside house sleeping no symptoms 2. Inside house, came out no symptoms
    3. Inside house, symptoms +
    4. Outside house, symptoms +
    5. Outside area 6. Others

14. CURRENTLY PREGNANT 32 [ ]

    1. Yes 2. No

15. IF YES, L.M.P. 33 [ ][ ][ ][ ][ ][ ] 38

16. DURATION OF PREGNANCY(wks) 39 [ ][ ] 40

17. E.D.D. 41 [ ][ ][ ][ ][ ][ ] 46

18. DID SHE ABORT AFTER DEC.3, 1984 47 [ ]

    1. No 2. Spontaneous abortion
    3. Induced Abortion

19. IF YES, GESTATIONAL AGE AT THE TIME OF ABORTION 48 [ ][ ] 49

20. DID SHE DELIVER AFTER DEC.3, 1984 50 [ ]

    1. No 2. Live birth 3.Still birth

21. IF DELIVERED AGE OF GESTATION 51 [ ][ ] 52

22. IF LIVE BIRTH 53 [ ]

    1. Is child alive 2. Died within one week 3. Died within 7-28 days
    4. Died later on

23. SEX OF CHILD 54 [ ]

    1. Male 2. Female 3. Indeterminate

24. DATE OF BIRTH

    AGE: Months 55 [ ] Days 56 [ ][ ] 57

25. AGE AT CONSUMMATION OF MARRIAGE (yrs) 58 [ ][ ] 59

26. AGE AT FIRST CONCEPTION (yrs) 60 [ ][ ] 61

27. ANY TREATMENT TAKEN FOR STERILITY 62 [ ]

    1. Yes 2. No.

28. NO. OF PREGNANCIES 63 [ ][ ] 64

29. NO. OF LIVE BIRTHS 65 [ ][ ] 66

30. NO. OF STILL BIRTHS 67 [ ][ ] 68

31. NO. OF SPON. ABORTIONS [ ] 69

32. NO. OF INDUCED ABORTIONS [ ] 70

33. NO. OF INFANT DEATHS (LESS THAN 12 MONTHS) [ ] 71

34. NO. OF LIVING CHILDREN 72

    MALE [ ]

    FEMALE [ ] 73

35. TIME ELAPSED SINCE LAST DELIVERY(mths) (EXCLUDE ABORTION) 74 [ ][ ] 75

36. TOBACCO CONSUMPTION [ ] 76

    1. No 2. Chewing 3. Smoking 4. Both 5. Other

37. ALCOHOL CONSUMPTION [ ] 77

    1. No 2. Regular 3. Occassional

38. WORKING STATUS [ ] 78

    1. Housewife 2. Work in a office
    3. Work in a Industry

39. TYPE OF WORK [ ] 79

    1. Desk job 2. Labourer 3. Domestic

MEDICO FRIEND CIRCLE

The Medico Friend Circle (MFC) is a national organisation of health professionals and activists who share the common conviction that the present system of health services and medical education is lopsided in the interest of the privileged few. MFC believes that this system must be changed to serve the interests of the large majority, the poor. MFC fosters a 'thought current' upholding human values; people and community orientation of health care and medical education; demystification of medical science and a commitment to medical interventions guided by peoples' needs and not by commercial interests.

MFC offers a forum for dialogue and debate, sharing of experience and experiments with the aim of realising the goals outlined above, and for taking up issues of common concern for action.

Details about MFC can be had from : Anil Pilgaokar, Convenor, 34-B, Noshir Bharucha Road, Bombay - 400 007. Tel. 368608.

MFC Bulletin: A monthly Medico Friend Circle Bulletin, now in its fourteenth year of publication, is the medium through which we communicate our ideas and experiences. The bulletin publishes articles broadly reflecting pro-people perspective on health - problems.

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Effect of Bhopal Gas Leak on Women's Reproductive Health

MEDICO FRIEND CIRCLE
1877 Joshi Galli
NIPANI
BELGAUM Dist

Medico Friend Circle

The Medico Friend Circle (MFC) is a circle of friends with medical/non-medical backgrounds who share the common conviction that the present system of health services and medical education is lopsided in the interest of the privileged few and must be changed to serve the interests of the large majority, the poor. MFC fosters a 'thought current', upholding human values, people and community orientaion of health care and medical education, demystification of medical science and a commitment to the guidance of medical interventions by peoples' needs and not commercial interests.

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For further details regarding MFC—Women's Reproductive Health Bhopal Study, contact.

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New Delhi - 110 014.

[A detailed report of the study including background, objectives, materials and methods, observations and results, discussion, recommendations, important appendices including proformae and references and reading list is also available on request from the above address.]

Acknowledgement

MFC is extremely grateful to the following organisations that participated in the survey viz: Sabla Sangh, Action India, Ankur, Saheli, Jagori, Prayas, Mahila Mukti Morcha Sewapuri, Sahiyar, Nari Atyachar Virodhi Manch and Search. Without their active participation and the help given by Ekalavya, Jana Swasthya Kendra, Bhopal, this survey could not have been completed successfully. We take this opportunity to express our heartfelt thanks and empathy to the gas affected women who gave overwhelming response to the sympathetic, concerned enquiries of the survey team.

Published by Padma Prakash on behalf of Medico Friend Circle at I.B.C.S., Bombay, Telephone: 26 07 25.

Effect of the Gas Leak on Women's Reproductive Health in Bhopal

DURING the second half of March 1985, three months after the Bhopal gas disaster, MFC conducted an epidemiological, sociomedical survey on the effects of the toxic gas in the bastis of Bhopal [1]. The study showed that between 50-70 per cent of the ambulatory population in the severely affected areas of Bhopal continued to have one or more serious symptoms implicating different body systems. Among women in the reproductive age group, a significant alteration in menstrual cycle had taken place. The alterations were mainly in the form of shortened cycles, abnormalities in the menstrual flow, dysmenorrhoea, (painful menstruation) and leucorrhoea (white discharge). These findings were also supported by independent studies carried out by Drs Rani Bang and Mira Sadgopal on women attending gynae clinics in the affected bastis [2]. This evidence of extensive damage to the different body systems especially to that of the reproductive system in the women added to the already growing concern over the effects on the developing foetus in pregnant women exposed to the gas. This concern had been voiced earlier in February '85 by a fact-finding team of doctors [3].

Unfortunately at that time MFC was not in a position to assess the risks to the foetus, since the socio-medical survey had covered only 60 families, a number too small to measure abortion rates. However, as months passed and no authentic information was available either on pregnancy outcomes, or on effect on women's reproductive system in general, MFC, despite its ever-present limitation of resources, decided to design and coordinate an independent survey on these two problems.

Letters requesting help were circulated to various women's groups and the overwhelming response of women activists indicated that the survey was a realistic and feasible proposition. However, the study was beset by many problems right from the start. To begin with, it was next to impossible to get any information from the medical establishment in Bhopal.

This conspiracy of secrecy was extended to such ridiculous lengths that even innocuous information such as the ICMR numbering and the maps of the bastis was treated as classified documents. The situation worsened in June when in a sudden move the MP government arrested the doctors and the activists of the Jan Swasthya Kendra under preventive detention. This un-called for action of the government had the effect of terrorising the basti people as well as the few previously helpful doctors from the Gandhi Medical College. That the study took place at all was a reflection of the conviction shared by the women activists participating in the survey and the affected women from the bastis on its absolute necessity.

Methodology of Study

The survey was conducted in three of the affected bastis which were selected on the basis of the post-gas leak morbidity and/or mortality rate [4]. These were J P Nagar (mortality rate 65.3/1000, morbidity rate 66 per cent), Kazi Camp (mortality rate 46.7 per cent and morbidity rate 54-60 per cent), and Kenchi Chola (mortality rate 35.7 per cent and morbidity rate 91.9 per cent).

The selection of the area and the sample was also facilitated by the fact that the ICMR had already accomplished one important task fairly efficiently, namely the division of the bastis into 13 areas and numbering of all the houses providing the much-needed sampling frame.

Based on studies done elsewhere [5] which showed abortion recall of 82 per cent accuracy even after a lapse of ten years, a '*historic control*' was decided upon. This was to be the status of the study population in the year preceding the event of the gas disaster. Detailed information on the menstrual cycles and reproductive history gathered from the study population for the period from December 1983 to December 1984 (the year before the gas leak) was to be the control for the period after the gas leak. This method of using a historic control eliminated the problems of finding an identical population, even though it could have introduced an element of under-reporting due to memory lapse. The families were selected by 'random-sampling', taking into account a non-response rate of 25 per cent.

In many surveys of such nature, the quality of primary data, the information elicited from the study population, on which a number of sophisticated statistical, (sometimes computerised) tests are done, is not good. A lot of care was taken in this survey to ensure quality of work. For example, a lot of attention was paid to the proper *training of the survey team*. One aspect of this training was getting well-versed with the questionnaire. The survey team consisted of two types of women; the majority belonged to the working class from the slums in Delhi or rural areas who had undergone training as health workers and were working as health workers for the last three years; the other group consisted of middle class women activists with or without a medical background who had participated in other surveys during the course of their work. All the members were literate but most were conversant with only Hindi and, therefore, the proforma was prepared in Hindi. All the members had volunteered and were not paid any special remuneration for their participation in the survey. About a month prior to the survey, the proforma was explained in great detail to the health workers. At first the questionaire was greeted with some amount of scepticism as it seemed impossible that women would remember their menstrual history in such details. The questionnaire was, therefore, tested out on the health workers themselves, most of whom were women in their twenties and thirties, and as each one tried to answer the questions, it became apparent that memory recall was not such a problem after all. The health-workers became convinced that if they could remember *their* menstrual history of the last two years, given the fact that no conscious effort had been made in the past to store this memory, then surely women in Bhopal with the event of the gas leak acting as a spur for memory recall would remember the menstural disturbances they had gone through since the gas leak. The questionnaire was then administrered to some of the households in the slums of Delhi by the health workers. Based on the information collected the proforma was pruned and modified.

A) Pregnancy Outcome

A total population of 8,165 in 1,632 households was surveyed from the 22nd to 29th of September, 1985. Table 1 gives the Foetal Death Ratio, which indicates the toxic effect of the gas-leak on pregency.

Table 1: **Foetal Death Ratio**

	*Before gas-leak	**After gas-leak
(1) No of deliveries	255	253
(2) No of spontaneous abortions	24	115
(3) No of still births	1	13
(4) Total no of conceptions (1+2+3)	280	381
(5) Foetal Death Ratio***	8.6	31.33

* This is the events during the control period i.e. from January, 1984 to the 2nd December, 1984 from now onto be referred to as BGL;

** This is the events during the post gas leak period i.e. from the 3rd December '84 to the 29th September '85, from now on to be referred to as AGL;

*** FDR = 2 ÷ 4 × 100.

The Foetal Death Ratio or the overall spontaneous abortion rate after gas leak is 31.33 which is significantly higher than the spontaneous abortion rate of 8.6 before the gas leak.

Table 2 compares the quarterly distribution of spontaneous rates. The differences in the ratios between the quarters is statistically highly significant. Difference in the rates of abortion between the three quarters. In the period BGL and AGL are highly statistically significant.

Table 2: **Quarterly Foetal Death Ratio Before and After Gas Leak**

Quarter :	BGL LB + SB*	BGL No. aborted	BGL FDR	AGL LB + SB	AGL No. aborted	AGL FDR
JAN-MAR	42	4	8.69	6	27	26.21
APR-JUN	84	9	9.67	77	24	23.76
JUL-SEP	55	4	6.78	82	20	19.23
OCT-NOV	74	1	—	—	—	—
DEC	26	44	—	—	—	—

* LB = Live Births, SB = Still Births.

B) Effect on Menstruation

In the MFC study conducted in March 1985, it was observed that gas-affected women were suffering from short-ended menstural cycles. altered pattern of discharge, dysmenorrhoea (excessive pain during menstruation) and excessive white discharge. The difference was statistically significant [4]. In this study, an attempt has been made to study this change further.

It was found that out of the 571 women whose menstrual history was studied in detail, in 2.97 per cent (17 women) menstrual bleeding used to be for 8 or more days Before the Gas Leak (BGL). This proportion had gone upto 5.77 per cent (i e, 33 women) After the Gas Leak (AGL). 142 women (i e, 23.87 per cent) reported change in the length of their menstrual cycle; 80 women (14.01 per cent) reported a shortening of menstrual cycle by seven days or more. Table 3 gives the distribution in the affected women of this change in the length of the menstrual cycle.

Menstrual histories also tried to ascertain the number of episodes of delayed

and missed periods before and after gas leak in this population. The results are given in Table 4.

C) Other Gynaecological Disorders

In February and March 1985, a clinic was set up by a gynaecologist, Dr Rani Bang, with the help of Dr Mira Sadgopal, in one of the worst affected bastis in Bhopal to assess the damage done to the reproductive system of women. These two members of the Medico Friend Circle found that out of 218 women examined in this clinic, 90 per cent had excessive white discharge, 79 per cent had Pelvic Inflammatory Disease, 75 per cent had cervical erosion or endocervicitis (inflammation of the mouth of the uterus) and 31 per cent complained of increase in bleeding [6].

The women who come to such a clinic do not constitute a random sample; and those who are suffering are more likely to come to a clinic. These figures, therefore, overestimate the incidence of the problem in the community. But these figures were much higher as *compared* to those found in a similar clinic in a basti about 10 km away and in *absolute terms* also these figures are so startlingly high that they assume great significance. Similar findings were reported by a study conducted by a group of voluntary organisations [7]. It was, therefore, decided to run a similar clinic again in the same basti, during the time of this September 85-survey. It was run by the same two doctors, helped by a male gynaecologist, Dr Sanjeev Kulkarni.

During the five days of the clinic, 159 pregnant and 184 non-pregnant women were examined. Out of the 184 non-pregnant women, 21 (i e, 11.4 per cent) were suffering from Pelvic Inflammatory Disease; 26 (i e, 14.8 per cent) had cervical erosion/endocervicitis; and as many as 45 (i e, 24.45 per cent) were suffering from inflammation of the vagina/white discharge. The discharge from the vagina was typically profuse, thick, whitish yellow, without any foul smell or local irritation, *unlike* any commonly found vaginal discharge of inefective origin.

Table 3: **Percentage Alteration in Cycle-length After Gas Leak**

Remained same	:	75.13 (429)
Increased by 7 or more than 7 days	:	3.67 (21)
Decreased by 7 or more than 7 days	:	14.01 (80)
Irregular	:	5.95 (34)
Stopped	:	1.22 (7)

Table 4: **Episodes of Delayed and Missed Periods Before and After Gas Leak**

	BGL	:	AGL
Delayed Periods :	16		64
Missed periods :	14		73

(Delayed periods—amenorrhoea (lack of menstruation) from 5-8 weeks; Missed periods—amenorrhoea of more than 8 weeks which was not reported as a spontaneous abortion by the woman.)

Significance of The Findings

A) Pregnancy outcome

Experts have pointed out that to assess the damage done to pregnancy (including the incidence of congenital malformations-birth defects) due to an environmental injury, the Foetal Death Ratio or the Rate of Spontaneous Abortions is a very specific and sensitive indicator compared to the incidence of congenital malformations found at birth [8]. For example, some abnormalities are never seen in full-term infants and the rate of all chromosomal abnormalities in spontaneous abortions is more than 100-fold the rate at birth; while 2.5 to 3 per cent of live-births show major birth-defects, numerous studies have shown that 90 per cent of the conceptions with congenital abnormalities abort in early pregnancy. Unlike the Indian Council of Medical Research (ICMR) which has focussed its attention extensively on the incidence of congenital malformation; in this study, rate of spontaneous abortion has been taken as the indicator of damage to pregnancy.

The almost four-fold increase in the rate of spontaneous abortion after the gas leak is highly significant and indicates serious damage to the reproductive system of the gas-affected women. In at least two public health controversies in the US (one relating to Love Canal, and the other to the herbicide 'Agent Orange'.) Spontaneous abortion rate has been accepted as crucial evidence in assessing hazards to human beings.

Those women who have conceived after the gas leak also show a higher proportion of spontaneous abortions indicating a continued effect of the toxic gas leak. This finding tallies with the findings of others that the poisoning of the body persists even months after the gas disaster.

Though the survey done by ICMR reports no increase in the birth defects after the gas leak, the highly significant increase in spontaneous abortion rate as found in this study shows that this report by ICMR cannot be taken to mean that "no damage has been done" to the reproductive health of women. On the contrary, use of this more sensitive indicator shows a serious damage to the reproductive capacity of gas affected women in Bhopal.

B) Disturbance of Menstrual Cycle

Women are generally looked upon only as mothers. In the ICMR studies also, only the effect of the gas leak on pregnancy was studied; neglecting menstrual and other disorders. In this study, however, these problems have also been consciously studied. That 23.87 per cent of women report change in the length of the menstrual cycle adds to the evidence that women's reproductive health in general has been affected by the gas leak. 14.01 per cent of women have reported that they get their menses more frequently AGL as compared to BGL. These women are more likely to develop anaemia.

C) Other Gynaecological Disorders

The clinic-based study on a non-randomised sample shows that many women continue to suffer from inflammation of the cervix and other internal organs due to the gas leak. The type of clinical findings shows that the

disorders have been caused by the pathological changes in the reproductive organs brought about by the poisoning of the body due to the gas leak.

Fortunately compared to February-March 1985, the proportion of women suffering from these gynaecological disorders has come down a lot in September 1985. But still, this proportion, found 10 months AGL, is high as compared to a normal population. This fact further corroborates the argument that the gas leak has led to a continued generalised poisoning of the body of the affected populaion.

Recommendations

1) The gas affected women of Bhopal have silently suffered from the physical and psychological agony of abortions, menstrual disorders and inflammation of their internal reproductive organs. These sufferings are in addition to the other health problems caused by the gas leak. These specific additional problems of women have not been properly studied and documented by bodies like ICMR. This survey, conducted by voluntary effort and planned and executed with meticulous regard for accuracy, has scientifically proved that the reproductive system of gas affected women has been seriously damaged. Further study with similar approach be urgently conducted by the official agencies on an extensive scale to assess the status of the reproductive system of each and every gas affected woman. On this basis adequate compensation should be given to those who have suffered from these problems.

2) The menstrual and other gynaecological disorders reported above should be kept in mind by all health personnel in Bhopal, while dealing with their patients. Women with these problems should be listened to with respect and proper treatment be given to them. If these problems continue to be attributed to "compensation-neurosis," or to "usual bad hygiene of poor women," these women would continue to suffer silently due to this neglect. At least now let there be a proper recognition of the fact of these gynaecological problems and their cause. Would this be too much to expect from the health authorities in Bhopal?

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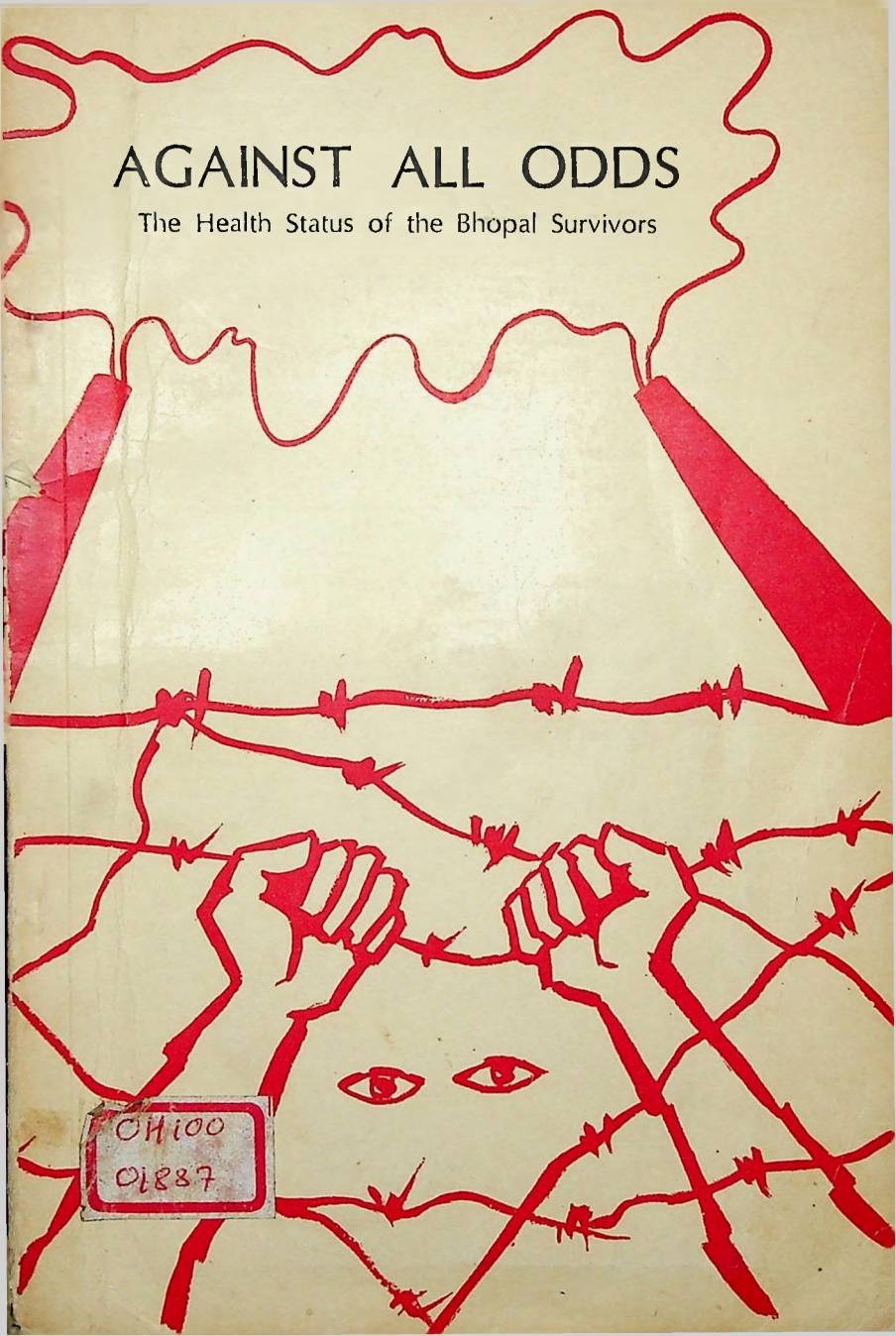
AGAINST ALL ODDS

The Health Status of the Bhopal Survivors



AGAINST ALL ODDS

Continuing effects of the Toxic Gases on the Health Status of the Surviving Population in Bhopal

Preliminary Report of a Medical Study carried out Five Years after the Disaster

Coordinated by

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VOICES FROM BHOPAL

1) इतने साल हो गए; ऐसा लगता है कभी ठीक न होंगे।

रशीदा बी, 60 वर्ष, सुभाष नगर

So many years have gone by ; it feels as though we will never get well again.

Rashida bi, 60 years, Subhash Nagar

2) ऐसा लगता है अल्लाह ऊपर बुला ले। इतनी दवाई खाने से तो मर जाना अच्छा है।

बिल्किस बी, 49 वर्ष, कैंची छोला

Sometimes I wish Allah would release us from this life. It would be better to die than have so much medicine.

Bilkis bi, 49 years, Kainchi Chola

3) अब तो चलती फिरती लाशें हैं, कभी भी खत्म हो जाएँ। बच्चों का क्या होगा ?

अब्रार मोहन, 40 वर्ष, जे० पी० नगर

Now I am just a living corpse, death can come any moment. What will happen to my children ?

Abrar Mohan, 40 years, J.P. Nagar.

4) हज़ारों आदमी उस समय खत्म हो गए। अपन भी खत्म हो जाते तो यह तकलीफ से बच जाते। भविष्य तो अब नरक ही है।

बिहारीलाल, 60 वर्ष, जे० पी० नगर

Thousands of people died then. If I had died too, I would have at least escaped this torture. Now the future is only hell.

Bihari Lal, 60 years, J.P. Nagar.

5) मुझे तो लगता है जल्दी स्वर्ग सिधार जाएँ। जीकर भी क्या करना है ?

नर्गिस, 19 वर्ष, फूटा मक़बरा

I feel I should simply die. What is the use of living anyway ?

Nargis, 19 years, Phoota Magbara.

6) अब सब मुसीबत से मर जाएँ तो अच्छा। गैस खाई तबसे मजदूरी बिल्कुल नहीं बनती। तीन लड़की हैं और तीन लड़के, कैसा चलेगा ?

ताराबाई, 35 वर्ष, ग़रीब नगर

Only death can relieve us of this misery now. Ever since the gas, we can't even work. I have three daughters and three sons. How will we ever manage?

Tarabai, 35 years, Garib Nagar.

7) दिमाग में ऐसा आता है कि बस अब ज़्यादा दिन के मेहमान नहीं हैं। कैन्सर है, क्या ? प्रश्न उठता है।

सलीमुद्दीन, 30 वर्ष, राम मन्दिर

I keep thinking I don't have many more days to live. What is this? Is it cancer?

Salimuddin, 30 years, Ram Mandir.

NAMES OF THOSE WHO MADE THE SURVEY A REALITY

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16. Dr Yogesh Jain — Bombay
17. Rajani Vohra — Bombay

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INTRODUCTION

In Bhopal, since the gas leak disaster of 2/3 Dec. 1984, several studies, by both governmental and non-governmental organizations, have been carried out to assess the health effects of the toxic gases on the survivors of the disaster. The information gathered through these studies together with the evidence from laboratory studies, have shown the gases to cause extensive damage to several systems in the body, to affect reproductive health by an increase in spontaneous abortions, still birth rate etc, to decrease life expectancy due to premature senility and has raised the serious possibility of delayed effects due to changes in the immune system, genetic damage and mutagenic changes in the survivors.

Apart from the effect of the toxic gases on physical health, the traumatic event of the disaster, an event outside the range of normal human experience, has had a serious, widespread effect on the mental health of the victims, resulting in depression, adjustment disorders and post traumatic stress disorders. The disruption in family due to deaths and illness, fall in income because of a decreased or a total inability to earn a livelihood has contributed further to the overall decline in general health status and in the sense of well-being in the individual and has led to the destruction of the integrity of family and community life.

Around mid Jan 1987, two years after the disaster, the Madhya Pradesh government, in order to provide medical documentary evidence for all the claimants in the case against the Multinational Union Carbide Corporation responsible for the disaster, initiated the process of assessing personal injuries in approximately 6,00,000 persons who had filed claims. However in 1989, two years after the process of medical evaluation had started, less than 10% of the claimants had been assessed for personal injuries.

Therefore, when in Feb. 1989 the Supreme Court settled the case against Union Carbide, the amount of money settled for

was not on basis of assessment of all the 6,00,000 odd claimants but on the basis of some figures arrived at arbitrarily. The clarification order of the Supreme Court in May 1989 gave the figures on which calculations for compensation had been based viz, fatal cases at 3000, permanent total and partial disability at 30,000 temporary total or partial disability at 20,000, and minor injuries at 50,000. According to the order, the basis for arriving at a figure of 30,000 permanent total and partial disability was not on any epidemiological evidence but was based on the assumption that, "it would not be unreasonable to expect that persons suffering serious and substantially compensatable injuries would have gone to hospitals for treatment." Therefore, on the basis of records from the hospitals of cases treated at Bhopal 30,000 was taken by the Supreme Court as that of permanent partial and total disability.

A further shock awaited, when the MP government presented the numbers of claimants whose injuries had been assessed and categorized. According to their affidavit submitted in the Supreme Court in the Interim Relief Petition on 25th August, 1989, out of the total 2,04,000 medical folders evaluated, 1,23,560 had been categorized. Out of this, only 19 were in the category of permanent total disablement and another 762 were in the categoty of permanent partial disablement. An extrapolation meant that out of the 6,00,000 claimants, approximately 4,000 would finally be categorized as permanent partial and total disability, one seventh of the already low figure on which settlement amount had been calculated.

To challenge these figures of disablement, carrying out a cross sectional study of the entire gas exposed population was out of the question for any "voluntary" effort. We therefore, limited our objectives to providing evidence to challenge the methodology of categorization evolved by the Directorate of claims, Bhopal Gas leak Tragedy, Madhya Pradesh.

PART I

Continuing effects of the toxic gases on the affected Population in Bhopal

Preliminary Report of a Medical Survey (15-22 Oct. 1989)

In the immediate aftermath of the Bhopal disaster, several estimates were made on the quantum of morbidity in the surviving population. According to an ICMR manual, approximately 2,00,000 persons who had inhaled the gas "took ill". The Nagarik Rahat Aur Punarvas Committee study reported that approximately 1,07,249 persons exposed to the gas were seen to have persistent medical disability of "some kind or the other" in March 1985. The Medico Friend Circle in their epidemiological study (March 85), observed that even in the population living 10 Kms from the Union Carbide factory (Bhopal), that was chosen as the "Control" population (this population also forms part of the ICMR control), serious health problems could be discerned and that "strictly speaking" it could not be considered non-exposed.

Broadly, the conclusion was, that almost the total population that was axposed to the gas, suffered from health problem in the immediate period following the gas leak or at least upt.ll March 85. Given the prognosis of these illnesses that was predicted at that point of time, and the evidence available later through published reports of the laboratory studies, the MP government's assessment of personal injuries on the basis of medical evaluation seemed to be grossly inadequate. Since, most of the voluntary efiorts which supplied some of the critical information were confined to the first year of the gas leak, the evidence necessary to challenge the MP government's estimate was available only with the governmental organisations such as the ICMR, Dept of Relief and Rehabilitation, (Bhopal Gas leak Tragedy) etc., involved with medical research in Bhopal.

To carry out a cross sectional study of the entire exposed population to assess current morbidity, was out of question for any voluntary effort. The objectives of the study had to focus on gathering information that would be of direct and immediate use in strengthening the case of the gas affected victims.

The first step was in developing a critique of the methodology of processing of claims adopted by the Directorate of Claims, Bhopal. (A detailed critique of the processing of claims forms Part II of this report).

Briefly, the methodology of assessing personal injury by the Directorate of Claims, Bhopal, is based on a scoring system. Each claimant is allotted marks for his/her suffering in the post gas leak period as well as that on the date of examination. The two scores are then compared to arrive at a category. This method adopted by the Directorate of Claims, for evaluating personal injuries, is based on inadequate information, is arbitrary, and works against the interests of the gas victims.

—The medical record prepared by the Directorate of Claims contains information relating only to injury, and there is no information to assess the disability of a claimant. Yet, the categorization process, claims to be able to differentiate claimants into the category of injured and/or disabled.

—A system, that uses marks to assess the health status of the claimant, gives an inaccurate picture of the nature and extent of injury and it also gives an inaccurate picture of the current health status.

—The system does not take into account the possible future outcome of each of the gas related effect on the claimant.

—The method of comparing the scores in the post exposure period and current health status is arbitrary because the conditions in the acute, sub-acute and chronic phase of a 'disease' cannot be compared.

—The scoring system in the current health status treats the different body systems, investigations, and even specialists opinion in an unscientific manner by placing them in an arbitrary hierarchy.

—The scoring system in the post exposure period is unfair to the claimant because it is based solely on the production of records by the claimant as proof of ill health, the onus of proof for injury thus resting squarely on the claimant.

In order to substantiate the theoretical critique of the processing of claims, there was need for some hard data. The Second step therefore lay in gaining access to the completed medical records of the claimants who had been categorized by the Directorate of Claims, Bhopal. Although the Supreme Court passed an order to the effect that the Directorate of Claims should provide a copy of the medical record of the claimant, on the claimant's request, machinery necessary for this provision is yet to be set in motion.

It therefore became imperative that evidence be collected on the nature of injuries of the gas affected victims in Bhopal today by using a different method for assessing their injuries.

Objectives of the Study

Keeping the critique of the processing of claims in view, the following objectives were defined for the study.

1. To determine the status of claims in the gas affected population.
2. To determine the quality of claims' assessment i.e., medical injury evaluation and categorization of the claimant.
3. To determine the extent of current morbidity in the population.
4. To assess the effect of gases on the children exposed to them in-utero.
5. To determine the natural history of "disease" in the affected population.
6. To explore the existence of "new" symptoms which could indicate the delayed effects of the gas.
7. To study the effect of gas on fertility.

Data Collection :

Data for the study was collected between the 15-22 Oct. 1989 by 34 persons who gave of their time and energy voluntarily.

This report presents the preliminary findings of the medical survey based on only part of the data that has been analyzed and covers the first two objectives. The final report with statistical analysis of the complete data will be published later.

The Study Population :

The Study population was from 11 of the most seriously affected and 1 from the mildly affected bastis in Bhopal. The individuals surveyed in March 1985 (3 months after the gas leak) from these bastis by the two non-governmental organizations viz NRPC* and MFC** formed our study population. Rather than take a fresh sample, the decision to study the individuals from the NRPC and MFC sample was taken because of the possibility of easy access to their medical records of March 1985 in the form of the proforma filled by the earlier survey teams. Hence, although it meant that a considerable amount of time had to be spent in locating the households and individuals surveyed in the NRPC and MFC survey (as five years had passed), the time was thought to be well spent.

Apart from these previous studies' sample, a fresh sample was taken to study the effect of the gases on the menstrual and reproductive health of the women between the age group of 8 to 80 years.

Since, previously, several weeks had been spent by part of the team in locating the households, rapport had already been established with the basti people. Communication was facilitated further by the distribution of a Hindi pamphlet describing our objectives during the survey.

Table 1 gives a description of the study population.

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*NRPC : Nagrik Rahat Aur Punarvas Committee, Bhopal organized a study in March 1985 in Bhopal, in collaboration with the Voluntary Health Association of India and with the cooperation of Bhopal Relief Trust, Bombay. The survey was carried out by a team of doctors and technicians from Bombay Municipal Corporation.

**Medico Friends Circle, an all India group of medicos carried out a medical survey in Bhopal in March 1985 with the help of their members and three doctors from the Baroda Medical College.

TABLE I

Study Population

(For which Preliminary Data is presented)

Sample	*Name of Basti*	*Individuals Covered in the present Study*	*Characteristic of Population*	*Original Sample Selection*
MFC (Group I)	J.P. Nagar	107	Age group +15	Random, using ICMR No.
MFC (Group III)	Anna Nagar	82	Age group +15	Random, using ICMR No.
NRPC (Group II)	(1) Kainchi Chola			
	(2) Garib Nagar			
	(3) Oriya Basti			
	(4) Ram Mandir			
	(5) Phoota Maqbara	214	Age group——5	Random, using House No.
	(6) Rajgarh Colony			

Sample	*Name of Basti*	*Individuals Covered in the present Study*	*Characteristic of Population*	*Original Sample Selection*
	(7) Subhash Nagar (8) Railway Colony (9) Chola Mandir			
Families included in previous studies (MFC & NRPC)		169**	All age groups	——
Fresh Sample (Group IV)	(1) J.P. Nagar (2) Kazi Camp	397	Women 8-80 Yrs.	Random, using ICMR No.
(Group V)	(3) Anna Nagar	283	Women 8-80 Yrs.	House to House

*All Bastis except Anna Nagar fall in the seriously affected areas. Anna Nagar, though considered a 'control', is in reality a mildly exposed area.

**No. of Families covered.

Methodology :

To assess injuries to the different body systems, the method adopted in our study was the one that is followed in routine clinical practice. This was to arrive at a *clinical diagnosis* for each of the individual surveyed based on history and physical examination. The clinician was then to recommend a list of investigations and specialists' opinion to confirm the tentative diagnosis. To assist in this effort, and to standardize procedures, a diagnostic criteria for each of the gas related condition was prepared along with a standardized criteria for referral, to both specialists and for investigations. (Annexure I).

The individuals in the sample were administered a pre-tested pre-designed, proforma on their "health" status as well as a proforma seeking information about the family, by a non-medical volunteer. This was followed by a complete history taking and examination by a medical volunteer. Written instructions were given to both the medical and non-medical volunteers for filling in the proforma. In addition, the medical volunteers were given a copy of the profile of the gas victims which was a compilation of all the salient findings from several studies that has been carried out since Dec. 1984, on the effect of the toxic gases on the body systems.

The non-medical proforma was designed along the lines of Claim Form, Part B, issued by the Directorate of claims, Bhopal, with additional critical questions necessary to assess overall health status. The medical proforma dealt with detailed 'history' taking and clinical findings. The family proforma contained details about the status of claims with regard to all the family members of the individual surveyed.

Results

I. *Current Health Status of the Surveyed Population :*

Almost all the individuals in the surveyed population in both the seriously and mildly affected area were diagnosed by the examining doctor in the survey team as either suffering from an illness or requiring investigations and/or specialist opinion to rule out an illness. The systems affected were respiratory, eye, gastro-intestinal, neuro muscular, musculo-skeletal, reproductive, and mental health.

Each of the tables given at the end of Part I, give the details of the number of persons from the sample who have been diagnosed by the doctor in the Survey team to have an illness. These diagnosis have been made on the basis of history and clinical examination, and remain to be confirmed by investigations. The rationale and criteria of diagnosis has been annexed to this report.

1. Physical Health

A. *Respiratory System :*

70% of the sample from the seriously affected area and 19.5% of the sample from the mildly affected area reported breathlessness as a symptom. Of those reporting breathlessness from the seriously affected area, 72% could be diagnosed as having breathlessness due to respiratory illness, which includes 55.6% who are likely to have allergic alveolitis or chronic obstructive lung disease (with or without a history of repeated infections); 4.5% could be diagnosed as allergic alveolitis and 9.8% as chronic obstructive lung disease solely on the basis of history and clinical examination, but the diagnosis of the rest need to be confirmed by investigations. In 27.5% of those reporting breathlessness in the seriously affected area, it could be ascertained through history that the breathlessness was not probably of respiratory origin. Table II gives the distribution of the different respiratory illnesses in the affected population.

B. *Gastro-intestinal system :*

26% of the sample from the seriously affected area and 6.1% of that from the mildly affected area had symptoms related to upper gastro-intestinal system. Of those reporting upper gastro-intestinal symptoms from the seriously affected area, 42% possibly suffer from atrophic gastritis; 24% from oesophagitis; 33% from either of these two or duodenal ulcer. 2.8% of these had hepato splenomegaly (englarged liver and spleen). Table III gives the distribution of the different gastro-intestinal conditions in the affected population.

C. *Eye :*

From the seriously affected area, 71% of the sample and 35% from mildly affected area were diagnosed to have an eye

disease. Chronic conjunctivitis was diagnosed in 56% of the seriously affected and 20% of the mildly affected sample, followed by decreased visual acuity for both distant and near in 21% and 10%. Corneal opacity was seen in 3.4% of the seriously affected sample and 2.4% from the mildly affected area.

The ICMR has admitted that there has been an increased incidence of cataract in the gas exposed population following gas leak. Our data shows an overall prevalence of 16% (seriously affected) and 12% (mildly affected) cataract in the sample. When prevalence of cataract is seen in relation to age, 8.4% of the sample in the seriously affected and 3.7% of the sample in the mildly affected, was seen to have cataract below the age of 50 years. Table IV gives the distribution of diseases related to eyes.

D. *Neuro-musculo-Skeletal system :*

66% of the individuals from the sample in seriously affected area and 33% from the mildly affected area reported symptoms related to neuro-musculo-skeletal system. 41% from seriously affected area and 24% from mildly affected area reported muscle ache; muscle fatigue in 30% and 8.5%; and joint pains in 27% and 11% respectively. Table V gives the distribution of neuro-musculo-skeletal disorders in the sample population.

E. *Sexual Disorders :*

Of the surveyed population, 13% of the individuals in the seriously affected area and 8.5% from the midly affected area reported a loss in Libido. Impotency was reported in 3.4% and 1.2% respectively. Table VI gives the distribution of sexual disorders.

F. *Menstrual Disorders :*

Even five years after the gas leak, a large number of women continue to have menstrual problems. Unfortunately, in the processing of claims, gynaecological problems have not been given adequate weightage. ICMR has infact categorically stated that they do not have any evidence to show that an increase in dysfunctional uterine bleeding, chronic cervicitis, non-specific leucorrhoea and, pelvic inflammatory diseases is gas related.

Our study shows that menstrual problems in the seriously affected population is high, with 64.7% of women (19-44 years)

in the seriously affected area and 47.6% (19-44 years) in the midly affected area reporting at least one symptom related to gynae problems.

The distribution of gynae problems show an increase in dysmenorrhoea, irregularity in menstrual cycle, excessive vaginal discharge, increased blood loss during menstruation, shortening of menstrual cycles and scanty periods, in women aged 8-80 years in the seriously affected area. Table VII and VIII give the overall prevalence of gynae problems in women aged 19-44 years and their distribution.

2. Mental Health

Post traumatic stress disorder (PTSD)* is a disorder which characteristically develops following a psychologically traumatic event that is generally outside the range of usual human experience. This disorder is well described in survivors of several natural and man-made disasters eg; Coconut Grove, Buffalo Creek disasters and among Vietnam veterans and prisoners in concentration camps.

PTSD increases over a period of time and has infact been described in survivors of prisoners of war, World war II, even after a lapse of 40 years. It is also well known that "manufactured" disasters as compared to natural disasters, regularly produce a higher prevalence of PTSD.

Using the diagnostic criteria of DSM III R, an attempt was made to study the prevalence of PTSD in the survivors of the *manufactured* disaster in Bhopal. In the surveyed population PTSD was diagnosed in 39% of the individuals in the seriously affected area and 26% of the mildly affected. Adjustment disorders with or without depression were diagnosed in 18% and 10% respectively. 27% and 21% in the seriously and mildly affected area had psychiatric symptoms which needed further exploration. Thus almost 80% of the individuals in the seriously affected area and 56% in the mildly affected area reported symptoms related to mental health. Table IX gives the distribution of psychiatric illness in the surveyed population.

*For further information on PTSD refer DSM-III-R, "Diagnostic and Statstical Manual of Mental Disorder", 3rd Edition.

Referral to the psychiatrist in the survey team:

Presence of one or more symptoms related to mental health was the criteria used for referral to the qualified psychiatrist in the survey team. Due to a lack of time only 70 out of the 317 individuals thus referred, from both seriously and mildly affected area could be examined by the psychiatrists. Out of these 70 examined, diagnosis of PTSD was confirmed in 40 individuals (57.14%); Adjustment disorder with or without depression in 10 (14.3%); and 3 individuals were diagnosed to have other psychiatric illnesses. 17 of the total 70 individuals examined i.e. 24.3% were not found to be psychiatrically ill. The clinical severity ranged from moderate to severe in 45 out of 53 psychiatrically ill individuals i.e., the illness was severe enough to affect their day to day living grossly. A preliminary statement on the psychiatric morbidity as assessed by the psychiatrists is annexed (Annexure-II).

II. General Morbidity

A. *Fever :*

Animal studies and studies on the immune system in the gas affected population have shown an adverse effect of the toxic gases on immune response. Repeated infections could be one of the manifestations of such a disturbance, fever being an accepted indicator. Three or more episodes of "definite" fever in 3 months is a reflection of repeated infections with a resultant cyclical effect on health of the affected population. Fever in the last week is a reflection of current ill health in the population surveyed.

23.57% of the total population surveyed reported fever lasting for more than 3 days in the week preceeding the date of survey. Three or more than three episodes of fever in the last three months, was reported by 31.76% of the individuals surveyed (Table X).

B. *Medications :*

In the seriously affected area more than 40% of the individuals were on some form of allopathic medication on the day of the survey, whereas in the mildly affected area 20% were on medi-

*Two psychiatrists from the Department of psychiatry, J J Hospital, Bombay formed part of the survey team.

cation. Allopathic medicines are generally more expensive and the fact that even five years after the gas leak, an impoverished population continues to spend its meagre earnings on medicines is a reflection of the status of health. Table XI gives the number of individuals who were on some form of allopathic medication in the surveyed population at the time of survey.

C. *Individuals diagnosed to have tuberculosis :*

Since the gas leak, a large number of individuals are being diagnosed, rightly or wrongly, as having pulmonary tuberculosis, ICMR claims that there has been a real "flare up" of tuberculosis since gas leak as a result of toxic gases. 25 individuals from the most seriously affected area and 2 individuals from the mildly affected area reported that they had been diagnosed as having pulmonary tuberculosis by a "doctor". The prevalence in the most seriously affected area i.e., 7.8%, is three and a half times higher than the national average whereas, in the mildly affected area, only 2.43% had been diagnosed to have tuberculosis which compares well with the national average of 2%.*

Of the individuals who reported a diagnosis of tuberculosis only 10 (or 37%) were on anti-TB treatment currently. The reasons for not taking treatment was not inquired into. Table XII gives the details of those who were diagnosed to have tuberculosis in the post exposure period.

The National Tuberculosis Control programme is known to have a high default rate, the 'default' being the reflection of the inability of the programme to maintain adequate follow up. If, as the ICMR states, there has indeed been a flare up of tuberculosis in the gas affected area, the authorities concerned should have taken up case detection and treatment in a more concerted way. The fact that only 37% of the individuals who were diagnosed to have tuberculosis are taking anti TB treatment is a sad reflection of the state of medical relief to Bhopal victims.

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*We are not in a position to confirm the diagnosis in these individuals due to lack of information about the basis of diagnosis. A large number of gas victims are being diagnosed as tuberculosis on the basis of chest X-ray findings which in the case of gas victims may not be an adequate tool as the toxic gases themselves are known to have caused similar chest X-ray findings.

D. *Impairment in the ability to work :*

The respondents were asked an open ended question regarding their ability to work before and after gas leak. Overall, from the individuals in the seriously affected area, 90% of those engaged in an income generating activity and 90% of those engaged in non-income generating activity reported a decrease in their ability to carry out the respective activities since gas leak. Table XIII gives the detail of the reported inability to work. Although no attempt was made to assess a fall in income in those whose ability to carry on income generating activity has been affected, it goes without saying that all 90% of persons in the sample (and their families) have experienced a fall in income since gas leak resulting in a further socio-economic deterioration.

III. Status of Claims

According to the Directorate of Claims, Bhopal, approximately 6,00,000 individuals have registered their claims under the Bhopal Act. On the basis of the critique of the processing of claims, there was a need to collect information on the problems related to filing of claims, completion of formalities for medical evaluation and a need to assess the parameters by which the personal injury of a claimant was being assessed by the Directorate of claims.

A. *Problems related to the filing of claims :*

Table XIV gives the status of claims of the 403 individuals surveyed and the status of claims of all the individuals in their families. Approximately 20 to 30% of the individual in the sample had not filed their claims. A major reason for not filing claims was that initially, when claims were being registered, those aged less than 18 years were informed to register their claims along with one of the parents. This rule was changed later and all individuals, irrespective of age, were to be considered as separate claimants. Since this information on the changed criteria for filing claims was not communicated adequately by the Directorate of Claims, a sizeable proportion of the population (aged 5-23 yrs as of today) is yet to file claims for injuries suffered. Approximatly 61% of those who had not filed claims gave this as the reason.

The other important reasons for not filing claims were the inconvenient procedures (long queues, delays, loss of wages),

and inadequate information on the procedure. Three of the respondents reported that they were too ill to stand in the queue.

B. *Problems related to the procedure of personal injury evaluation :*

The Directorate of Claims, Bhopal has claimed that 40% of the registered claimants have not "turned up" for medical examination despite being sent three notices.

Among the surveyed population who had filed claims, approximately 20-25% are yet to be medically examined for personal injury evaluation. Among reasons for not "presenting" themselves for medical examination, 58.3% had not received a single notice; 18.3% coud not go on the appointed day because of ill health or loss of wages. Either because they were not in town on the appointed day or were delayed in reaching at the appointed time, 13% of the individuals were refused examination.

C. *Assessment of the parameters used by the Directorate of Claims in personal injury evaluation :*

The entire method of personal injury evaluation as devised by the Directorate of Claims, Bhopal, revolves around the ability of the claimant to produce medical records documenting his/her injuries since the gas leak.

1. **Availability of OP records :**

Table XV gives details of the number of individuals who reported symptoms in the immediate post gas leak period (0-1 month) and their ability to produce records for out-patient treatment in that month. Out of the 98% of the individuals in the seriously affected area who reported symptoms in the immediate post gas leak period, only 35% could produce record as "proof" of their treatment.

2. **Availability of in-patient records :**

It may be argued that even if the claimant was unable to produce out-patient record, a claimant so ill as to have stayed in a hospital could surely be able to produce some proof for hospital admission.

Table XVI gives details about the availability of records for hospital admission in the post exposure period*. Out of the total of 200 episodes of hospital admission in the sample from the most seriously affected area, only in 53.5% of the cases, records were available.

3. **Quality of Medical Injury Assessment :**

Since we do not possess the medical records of the respondents prepared by the Directorate of Claims, Bhopal, we are not in a position to comment on the quality of history taking, and medical examination of the examining doctors.

4. **Adequacy of investigations ordered and referrals given:**

According to the "Guidelines For the Medical Officers" prepared by the Directorate of Claims, Bhopal, the investigations the examining doctor can order for a claimant are chest X-ray, Pulmonary Function Tests (PFT), Exercise Tolerance Test (ETT) and Urinary thiocyanate (UScn).

The method of categorization evolved by the Directorate of Claims, claims to assess "disability". Since there is no information contained in Part B of the medical records prepared by the Directorate, the attempt made is probably to assess "functional" impairment. For measuring functional impairment of the respiratory system, PFT and ETT are the only two investigations listed in the guidelines to medical officers. Chest X-ray is one of the important investigations for diagnosis of illness.

As the table XVII shows, PFT and ETT are done in barely 14% and 1% of the sample surveyed whereas chest X-ray is done for more than 70% of the sample surveyed. To measure functional impairment of the respiratory system, at least a detailed PFT and ETT with a Dyspnoea Index should be carried out in all the claimants complaining of dyspnoea.

Of the sample, our assessment is that more than 60% require PFT and ETT before the impairment in their respiratory function can be measured.

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*Great effort and time was taken by the survey team to go through *all* the records a respondent possessed which would perhaps not be the case in the medical assessment camps.

According to an ICMR guidelines, all individuals having respiratory, gastro intestinal, or neuro-muscular symptoms should have their urinary thiocyanate measured. Since this is a suggested investigation for measuring the toxins in the body, this investigation remains significant. The Directorate of Claims has carried out this investigation in 77% of those they have assessed for personal injury from the sample whereas, the survey team's recommendation is that it should be carried out in 83% of the sample.

In terms of referral to specialists, it is obvious from the fact that only one person from our sample was referred by the Directorate of Claims to a psychiatrist, a gross under estimation of psychiatric illness is taking place. According to the survey team, 80% of the sample population need to be referred to a psychiatrist. The failure on the part of the examining doctor assessing personal injuries, could be due to the faulty criteria requiring 3 symptoms or more for a referral, or could be a deliberate attempt on the part of the Directorate of Claims to underestimate psychiatric morbidity. All individuals with even one psychiatric symptom need to be referred to a psychiatrist since a Graduate medical officer does not possess the necessary skills to unmask all the psychiatric symptoms.

Similarly, in terms of referral to an ophthalmologist, all persons with any eye disease need to be referred for correct diagnosis and treatment. According to the survey team, 64% of the sample need referral to an ophthalmologist while only 17% had been referred by the Directorate of Claims.

Conclusion :

1. 70-80% of the gas affected population in the seriously affected area and 40-50% from the mildly affected area in Bhopal suffer from a medically diagnosed illness even five years after the gas leak.

2. The major systems affected are respiratory, eye, gastro-intestinal and musculo skeletal.

3. A large proportion of women from both the seriously affected and mildly affected area continue to report menstrual disturbances.

4. Post traumatic stress disorder (PTSD) is gas related and therefore a definitely compensatable disorder. Mental health problems, particularly PTSD is a serious problem, among the survivors.
5. The process of personal Injury Evaluation as carried out by the Directorate of Claims is designed to underestimate both the nature and volume of injuries in the gas affected population.
6. Categorization of claims is being carried out by the Directorate of Claims on the basis of insufficient investigations and speeialists' opinion.
7. A considerable proportion of the population is yet to file claims or to be assessed for personal injury evaluation.

Recommendations :

1. More concerted effort should be made to contact all the affected people to register claims and for assessing personal injuries.
2. Personal Injury Evaluation should be on the basis of a pathophysiological diagnosis and not on an arbitrary scoring system. The diagnosis should include a battery of investigations which must be carried out in all claimants who require it before the verdict of 'no injury' is given. These investigations should range from gastroscopy in all those reporting upper gastrointestinal symptoms to measuring the different parameters of the immune system even in those reporting only cyclical illhealth or repeated infections.
3. Serious effort is required to assess the mental health problems both for claiming 'damages' and for treatment.
4. The processing of claims for personal injury evaluation should not be an exercise unrelated to the provision of medical relief and rehabilitation of gas victims. The issue of medical relief and rehabilitation continues to be a major need of the gas victims even five years after the disaster.
5. At present the Directorate of Claims expects the victims to provide proof of their own injuries. Instead, the onus should be with the government and the Union Carbide Corporation to prove that the victims are *not* injured.

TABLE II

Respiratory Illness

Sample	*Number Reporting Dyspnoea*	*Breathlessness Due to Respiratory Illness*						*Pulmonary Tuberculosis*	*Others*	*Dyspnoea & Cause*
		Allergic Alveolitis		*Chronic Obstructive Lung Disease*		*Dyspnoea of Respiratory Origin*				
		H/o Repeated RTI	*No H/o Repeated RTI*	*H/o Repeated RTI*	*No H/o Repeated RTI*	*H/o Repeated RTI*	*No H/o Repeated RTI*			
Group I	89	2	2	4	5	18	16	11	4	27
Group II	136	4	2	10	3	46	13	19	4	35
Total Gr I + Gr II	225 (70.04%)	6 (2.7%)	4 (18%)	14 (6.2%)	8 (3.6%)	64 (28.4%)	29 (12.9%)	30 (13.3%)	8 (3.6%)	62 (27.5%)
Group III	16 (19.5%)	—	—	1 (1.2%)	—	6 (7.3%)	1 (1.2%)	1 (1.2%)	1 (1.2%)	6 (7.3%)

RTI — Respiratory Tract Infection

H/O — History of

TABLE III

Gastro-Intestinal Illnesses

Sample	*No. Reporting Upper G.I. Symptoms*	*Illnesses of Upper G.I. System*				*Hepato Spleno-Megaly*	*Ulcers in the Mouth*	*Others*
		Atrophic Gastritis	*Oeso-phagitis*	*Oeso phagitis or Atrophic Gastritis*	*Oesophagitis or Duodenal Ulcers*			
Group I	35	18	8	5	4	1	3	3
Group II	48	17	12	6	13	8	5	16
Total Gr I+ Gr II	83 (25.9%)	35 (42.16%)	20 (24.1%)	11 (13.3%)	17 (20.48%)	9 (2.8%)	8 (2.5%)	19 (5.9%)
Group III	5 (6.1%)	1	1	0	3	0	0	2

TABLE IV

Eyes

Sample	Number with Eye Diseases	Cataract			Corneal Opacity		Visual Disturbances			Phlycten	Pterigium	Chronic Conjunctivitis
		Age <50	<50	Total	One Eye	Both Eyes	Diminished Distant	Diminished Near	Diminished Distant & Near			
Group I	83	14	8	22	2	1	16	6	0	11	9	66
Group II	146	13	16	29	6	2	17	15	14	14	18	113
Total Gr I+Gr II	229 (71.3%)	27 (8.4%)	24 (7.5%)	51 (15.9%)	8 (2.5%)	3 (0.9%)	33 (10.3%)	21 (6.5%)	14 (4.4%)	25 (7.8%)	27 (8.4%)	179 (55.8%)
Group III	29 (35.4%)	3 (3.7%)	7 (8.5%)	10 (12.1%)	1 (1.2%)	1 (1.2%)	4 (4.8%)	3 (3.7%)	1 (1.2%)	5 (6.1%)	12 (14.6%)	17 (20.7%)

Note: Since a person can have more than one Eye Ailment at the same time, Percentages are calculated on Total sample to Give Prevalence.

TABLE V

Neuro - Musculo - Skeletal Illnesses

Sample	*No. complaining of Relevant Symptoms*	*Muscle Ache*	*Muscle Fatigue*	*Joint Pains*	*Peripheral Neuritis*
Group I	75	49	34	38	11
Group II	137	8	62	50	27
Total Gr I + Gr II	212 (66.04%)	132 (41.1%)	96 (29.9%)	88 (27.4%)	38 (11.8%)
Group III	27 (32.9%)	20 (24.4%)	7 (8.5%)	9 (11.1%)	2 (2.4%)

TABLE VI

Sexual Disorders

Sample	*Number of Individuals Covered*	*Loss of Libido*	*Impotency*
Group I	107	16	10
Group II	214	27	1
Total Gr I + Gr II	321	43 (13.4%)	11 (3.4%)
Group III	82	7 (8.5%)	1 (1.2%)

Note : The Percentage is on Total Population and not sex or Age Specific.

TABLE VII

Women Reporting Distrubances in Menstrual Cycle in the Last Three Months

Sample	*Total Number of Women 8-80 Years*	*No. of Women in the Age Group of 19-44 Years*	*No. of Women Menstruating Currently*	*No. of Women with Menstrual Disturbances Currently*
Group IV	397	213 (53.65%)	173 (81.22%)	112 (64.73%)
Group V	283	169 (59.71%)	124 (73.37%)	59 (47.58%)

TABLE IX

Psychiatric Illness

Sample	*No. Reporting Psychiatric Symptom*	*Post Traumatic Stress Disorder (PTSD)*	*Adjustment Disorder with Depression*	*Adjustment Disorder*	*To Rule out Psychiatric Illness*
Group I	99	52	10	6	31
Group II	172	74	32	11	55
Total Gr I + Gr II	271 (84.42%)	126 (39.25%)	42 (13.08%)	17 (5.3%)	86 (26.79%)
Group III	46 (56.09%)	21 (25.61%)	6 (7.32%)	2 (2.44%)	17 (20.73%)

Note : Percentage Taken out from Total Sample.

TABLE VIII

Pattern of Menstrual Disturbances in the Last Three Months

Sample	*Total Number of women Menstruating Currently* (8-80 *yrs*)	*Dysmenorrhoea*	*Irregular Cycle*	*White Discharge*	*Increased Blood Loss*	*Shortened Cycles*	*Scanty Periods*	*Amenorrhoea*	*Delayed Cycles*
Group IV	246	104 (42.27%)	66 (26.82%)	59 (23.98%)	42 (17.07%)	23 (9.34%)	21 (8.53%)	18 (7.31%)	7 (2.8%)
Group V	162	42 (25.92%)	20 (12.34%)	22 (13.58%)	17 (10.49%)	6 (3.70%)	12 (7.40%)	12 (7.40%)	0 —

TABLE X

Individuals Reporting Fever

Sample	*No. Reporting one Episode of Fever for > 3 Days in the Week Preceding Survey*	*No. Reporting Three or < Three Episodes of Fever in the Last Three Months*
Group I	31 (28.97%)	32 (29.90%)
Group II	45 (21.02%)	67 (31.30%)
Group III	19 (23.17%)	29 (35.36%)
Total	95 (23.57%)	128 (31.76%)

TABLE XI

Individuals Taking Some Allopathic Medication on The Day of the Survey

Sample	*Number of Individuals*	*Number of Individuals Taking Allopathic Medication*
Group I	107	42 (39.25%)
Group II	214	85 (39.71%)
Group III	82	19 (23.17%)
Total	403	146 (36.22%)

TABLE XII

No. of Individuals Diagnosed as Having T.B. in the Post Exposure Period

Sample	*No. of Indivduals Diagnosed to Have T.B.*	*No. on Anti T.B. Treatment Today*
Group I	11 (10.28%)	3
Group II	14 (6.54%)	5
Group III	2 (2.43%)	1
Total	27 (6.7%)	9

TABLE XIII

Effect of Gas on the Abiity to work Today

Sample	*No. Engaged in Income-Generating Activity before Gas Leak*	*Number whose ability in income Generating Activity Affected Today*	*No. Engaged in Non-income-Generating Activity Before Gas Leak*	*Number whose ability to carry Non-income Generating Activity Affected Today*
Group I	62 (57.94%)	56 (90.32%)	61 (57.0%)	52 (82.24%)
Group II	75 (35.04%)	67 (89.33%)	147 (68.69%)	134 (91.15%)
Group III	56 (68.29%)	29 (51.78%)	39 (47.56%)	17 (43.58%)

TABLE XIV

Status of Claims

Status of Claim	*Individuals Covered in Present survey*	*Total individuals als Exposed to Gas (Age + 5) in Families Surveyed*
Total Number	403	861
Number Who Filed Claims	323 (80.14%)	589 (68.40%)
Number Assessed for Personal injury by Directorate of Claims	263 (81.42%)	449 (76.23%)
Number who have been intimated about their Categorization	21	23

TABLE XV

Immediate Post Exposure Health Status (O-1mth) as Judged by Availability of Records for Out-Patient Treatment

Sample	*No. of Individuals with Immediate Symptoms after Gas Leak*	*No. of Individuals who could Produce Records for O.P.D. Treatment for the Immediate Post-Exposure Period*
(Group I	105 (98.13%)	31 (29.52%)
Group II	209 (97.66%)	83 (39.71%)
Group III	71 (86.58%)	13 (18.30%)
Total	385 (95.53%)	127 (32.98%)

TABLE XVI

Availability of Records for Hospital Admission in Post Exposure Period*

Sample	*No. of Hospital Admissions*	*No. of Admissions for which Records are Available*
Group I	67	37 (55.22%)
Group II	133	70 (52.63%)
Group III	34	10 (29.41%)
Total	234	117 (50.00%)

*Post Exposure Period is from 3/Dec/1984 to Date of Survey.

TABLE XVII

No. of Individuals Referred for Investigation/Specialist for Personal injury Evaluation by Directorate of Claims

Sample	*No. Examined For Personal Injury Evaluation*	*Number Referred for Relevant Investigation*				*No. Referred to Specialist*	
		X-Ray	*PFT*	*ETT*	*USCN*	*Ophthalmologist*	*Psychiatrist*
Group I	83	68 (81.92%)	13	0	67	23	0
Group II	143	114 (79.72%)	24	2	99	19	1
Group III	37	9 (24.32%)	0 ..	1	12	3	0
Total	263	191 (72.62%)	37 (14.06%)	3 (1.14%)	178 (67.68%)	45 (17.11%)	1 (0.38%)

TABLE XVIII

No. of Individuals Referred for Investigation/Specialist by the Survey Team

Sample	*Total No. Examined by Survey Team*	*Number Referred for Relevant Investigation*				*No. Referred to Specialist*	
		X-Ray	*PFT*	*ETT*	*USCN*	*Ophthalmologist*	*Psychiatrist*
Group I	107	89	89	89	97	83	99
Group II	214	136	136	136	179	146	172
Group III	82	16	16	16	57	29	46
Total	403	241 (60%)	241 (60%)	241 (60%)	333 (83%)	258 (64%)	317 (79%)

PART II

Critique of the processing of claims by the Directorate of Claims, Bhopal

The claim form issued by the Directorate of Claims, Bhopal Gas Leak Tragedy, Bhopal, consists of four parts, viz Part A, Part B, Medical Record Abstract and the Personal Injury Evaluation forms.

Part A contains details of the income, employment and the occupation of the claimant and is to be filled in by the person conducting the interview.

Part B contains the Medical record of the claimant. In this part, items 1 to 8 are related to personal identification. Item 9 and 10 record the medical history (of illness, treatment taken etc.) since the gas leak. Item 11 lists the present symptoms (on the examination date) the claimant has under respiratory, gastrointestinal, mental, musculoskeletal, eye, and gyneic/obsteric. Item 12 records the relevant clinical findings on physical examination by the examining doctor.

If the examining doctor feels that certain investigations are necessary, or that the claimant needs to be referred to a specialist, the appropriate forms are filled and the claimant is given the date of appointment for investigation/examination by a specialist.

Once all these formalities are completed, the evaluating doctor summarizes the clinical findings in the Medical Record Abstract on the basis of which the Personal Injury Evaluation form is filled. The completed forms along with all relevant documents are sent to a Panel doctor who categorizes the claimant into one of the six categories of injury and disability.

Personal Injury Evaluation :

The methodology of assessing personal injury by the Directorate of Claims is based on a scoring system. Each claimant is

allotted marks for his/her suffering in the post gas leak period as well as on the date of examination and the two scores are compared to arrive at a category.

Assessment of injury in the post exposure period:

The Directorate of Claims defines the post exposure health status as the state of health during the period immediately after exposure to gas till the current medical examination. The examining doctor writes down the history of the claimant since exposure (night between 2/3 Dec. 1984 till the date of interview) including places where treated (i.e. names of emergency camp, government hospitals/dispensary) dates of treatment and name (s) of treating doctor(s), only *to the extent that the information is discernible from record/treatment papers produced by the claimant.* "Marks" are given to the claimant on the basis of documents produced by him/her as proof of signs and symptoms s/he had, treatment received indoor/outdoor and investigations carried out in the post exposure period. (See Annexure-III).

—The scoring system of evaluation followed for assessing post exposure health status is *subjective* because it is to be on "facts available in the records produced, adjudged by the examining doctor" (emphasis supplied).

—The scoring system in the post exposure period is *unfair* to the claimant because it is based solely on the records produced by the claimant*. It is said in "the Guidelines For the Medical Officers", Directorate of Claims, "the severity of injury was at its peak during the immediate post disaster period", and the inability on the part of the claimants to produce documentary evidence, for no fault of their own, should not weigh against them in the process of estimating injuries.

—The design of the scoring system to assess post exposure health status is *irrational/illogical.* For example, the treat-

*It is well documented that in the immediate post leak period, the relief camps were flooded with the victims and the camps were under - staffed. In the resulting chaos, at times even death certificates were not issued. Even as late as Aug. 1985, the Heerji Committee sent by the Prime Minister observed that the health cards then in use were more or less identification cards and did not provide a running history of all Pathological, radiological data and medication provided.

ment received at inpatient and that received in the outpatient is given separate scores and a person who was or is so ill that she could not leave the hospital ward to receive outdoor treatment will forfeit 14 marks.

—The design of the scoring system in the post exposure health status is *faulty*. Although the maximum marks a person can receive is hypothetically 100, because of faulty scoring system under "investigations" and also because the obstetric/gynaeic system is included in this 100, the maximum marks a male or a female in the non-reproductive age group can get is only 79 and the maximum marks a woman in the reproductive age group can get is 85.

Assessment of current health status :

"The Guidelines for Medical Officers" for medical documentation of claimants issued by the Directorate of Claims gives specific instructions for filling the medical record form for present symptoms, criteria for ordering investigations and referring to specialists.

—The method of ascertaining the 'present symptoms' is not **standardised.** The guidelines state that the meaning of each symptom should be explained to the claimant. However there are no gujdelines on how these symptoms are to be explained. For instance, there could be wide difference in explaining the symptom "depression" by two doctors.

—The lists of symptoms given in the form **does not include all the symptoms** necessary to arrive at a clinical diagnosis. For instance, the symptom "recurrent recall of the disaster event" is important at arriving at a diagnosis of post traumatic stress disorder and this symptom has been left out.

—The reproductive health problems of women have not been given adequate importance. The form includes "irregularity of cycles" and "vaginal discharge" as the two complaints whereas the post disaster studies have shown an increased number of women complaining of menorrhagia, dysmenorrhoea, dyspareunia. With respect to pregnancies

at the time of gas leak or thereafter, women had multiple abortions and this has not been taken into consideration.

—The guideline that only those complaining of three or more psychiatric symptoms are to be referred for psychiatric evaluation is arbitrary.

—General health status as recorded in the form (R) is subjective as there are no specific guidelines for adjudging a claimant's health to be good/fair/poor.

—The guidelines for referring claimants for specific investigations is arbitrary. For instance, the procedure for referring a claimant for "Pulmonary Function Tests" only if s/he becomes breathless on "40 steps brisk walk" is not a standard test, and may not be adequate to unmask breathlessness in a population that earns its livelihood through physical labour. Further, previous studies have shown that even those who are breathless on carrying out 'normal' work had abnormal pulmonary functions.

The assessment of the current health status is also based on marks given to positive findings under different heads viz: symptoms, signs, investigations and specialist opnion.

—The effects on different systems in the body is given unequal weightage in terms of scores with respiratory system on top of the hierarchy. This is without any scientific foundation. The assumption implied in the claim form that the respiratory system is the most important system in the body and that effect on this results in maximum dysfunction, works against claimants who have serious disorders in systems other than respiratory. For instance, a person who has severe post traumatic stress disorder and is unable to carry out even the simple tasks of living with no other system involvement, can aspire to get a maximum possible score of 6 (six) while another person whose repiratory system has been affected will get a maximum of 36.

—Similarly, the different weightage given to different investigations is also arbitrary. For instance, in the claim form, X-rays get maximum marks in the score sheet i.e. 15 whereas Pulmonary Function Tests get only 4 while, from past

findings, it has been found that even persons who have normal chest X-ray can have abnormal Pulmonary Function Tests.

—The practice of giving different weightage to different investigations also works against claimants who have non-respiratory system findings but are suffering from the effect of gas on systems which cannot be diagnosed by any of the investigations that are being administered in evaluating personal injury. For instance a claimant complaining of pain in the abdomen or discomfort in the upper abdomen, fullness after small meals and loss of appetite could have atrophic gastritis, a pre-cancerous condition that can be diagnosed only through gastroscopy and biopsy*. A claimant with such complaints will forfeit his/her rightful share of the compensation money for serious progressive permanent damage to health because the condition is not being diagnosed through necessary investigations.

Finally a system that uses marks to assess health status, does not give an accurate picture of the nature and extent of injury and it also does not give an accurate picture of current health status. The scoring system does not tell how seriously ill the claimant is or if a single system or multiple stystem in the body is affected; it does not tell whether the condition is prognosed to deteriorate or improve and whether the damage is permanent or not.

The process of categorization of the claimants :

The scores obtained by the claimant for post exposure health status and current health status is totalled separately and the panel doctor compares the two scores as well as looks at all the medical information given in the record to arrive at one of the following six categories of injury/disability.

(a) The claimant aforesaid has suffered no injury.

---

*A person suffering from atrophic gastritis may infact get only 1 (one) of the total marks of 100 because of no clinical findings and because she/he may not have been referred to a specialist as referral is on the "discretion" of the examining doctor.

(b) The claimant aforesaid suffered physical/mental injury and the same has been treated* and the same has not deteriorated into permanent injury.

(c) The claimant aforesaid suffered physical/mental injury which despite treatment has deteriorated into permanent injury.

(d) The claimant's aforesaid physical/mental injury has resulted in temporary partial disablement.

(e) The claimant's aforesaid physical/mental injury has resulted in permanent partial disablement.

(f) The claimant's aforesaid physical/mental injury has resulted in total disablement.

Of these six categories the first three are meant to be pronouncements on the state of injury and the latter on disability. Although no definitions of injury and disablement are given, explanations regarding each category is given in the 'guidelines for evaluation of medical record forms and categorization of claims' issued by the Relief and Rehabilitation Department, Bhopal Gas Tragedy, M.P. According to the guidelines:

> If the claimant does not score any mark in post exposure health status and if any symptom in the current health status is not supported by positive findings in clinical examination and/or investigation, she falls in category (a) i.e., no injury.
>
> If the claimant scores in post exposure health status and the score in current health status either remains the same or decreases, s/he falls in category (b) i.e., temporary injury/cured.
>
> If the claimant scores in post exposure health status and the score in current health status increases inspite of the treatment s/he falls in category (c) i.e., permanent injury not amounting to disablement.
>
> If the post exposure health status of a claimant shows positive findings in physical examination and/or investigations (i.e.,

* It is also medically and legally incorrect to say that the gas victims have been cured/treated. If there is anything at all that everyone agrees about the gas affected victims (this includes ICMR), it is that there is no treatment for the effect of toxic gases.

s/he has records to prove all this) suggestive of continuing illness resulting in disablement, but the current health status shows either complete recovery or improvement, (the degree of improvement being such that it does not fall in the category ot disablement), s/he falls in category (d) i.e., temporary partial disablement.

If the post exposure health status shows any organ/system involvement resulting in partial disablement and it remains the same even in the current health status, she/he falls in category (e) i.e., permanent partial disablement.

If the post exposure health status and current health status both show an organ/system involvement ot total and permanent nature, she/he falls in category (f) i.e., permanent disablement.

Although the guidelines do not define injury and disability, there are International definitions and classifications of injury and disablement.

According to WHO, *International Classification of Impairments* (*injury*), *Disability and Handicaps:*

"In the context of health experience, an impairment (injury) is any loss or abnormality of psychological, physiological or anatomical structure or function".

and

"In the context of health experience, a disability is any restriction oi lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being."

According to this definition, disability is to be assessed on the basis of a person's ability or inability to perform the different tasks of daily living i.e. ability to perform the functions of personal care, household activities, disability in effective marital and family role, disability in occupational role, behaviour changes in terms of social role etc. Disability as defined can be assessed only if a person is observed for a period of time long enough to give adequate information on the effect of injury on one's daily living.

The categorization of the claimant in the process of personal injury evaluation is based on part B of the medical record which contains information on the effect of the gas on the physical and the mental health of the claimant. *Part B of the medical record has no information that could even begin to assess disability as defined internationally.*

By international classification, thus, the categories (d), (e) and (f) "explained" in guidelines for Categorization are without foundation and are based on non-existent information in the claim form.

Therefore by definition the claimant cannot be categorized into (d), (e) and (f) on the basis of information available in the medical records.

Categories (a), (b) and (c), according to the Guidelines, are meant to classify injuries into: no injury, temporary/cured and permanent injury, on the basis of records produced by the claimant.

The process of categorization is designed in a way that puts the onus of providing proof for injury on the claimant.

Only if the claimant can produce well-documented evidence (medical records) which explicitly state the symptoms/signs s/he may have had in the post exposure period, only if s/he provides records or proof for all hospital admissions, investigations, only then will s/he be even considered injured in the gas leak.

If the claimant is unable to produce any medical record for the post exposure period and even if his/her health is affected today, (i.e., at the time of evaluation) he/she will be put in category (a) i.e., not injured.

If the claimant's condition remains the same or deteriorates (even if the claimant does not regain the pre-gas leak health status) s/he will be put in category (b) temporary/cured. Thus, for example a person scoring 30 for the post exposure health status and 15 in the current health status and a person whose post exposure health status score was 60 and remains 60 in the current health status will both be put in category (b) temporary/cured.

Only if the claimant's score increases in the current health status as compared to post exposure health status (technically supposed to reflect a deterioration in the health stautus) will s/he be put in permanent injury. This is again irrational because claimant A getting a score of 25 in the post exposure period and 35 in the current health status will be put in (c) i.e. permanent injury; whereas a claimant B getting a score of 60 in the post exposure period and the score remaining same in the current health status will be put in category (b) i.e. temporary/cured.

Thus, the assessment of injury by the method arrived at by the Directorate of Claims, Bhopal is not just arbitrary but verges on the ridiculous.

To categorise a claimant who has serious gas-related problems today but who is unable to produce 'proper' records as "not injured" or "temporary/cured" is an injustice of great magnitude. It must also be remembered that the evaluation of personal injury is being carried out almost 4 to 5 years after the disaster, and to categorise an injury that exists even today as temporary is outside the realm of science.

Given all this, it is not surprising that the Directorate of Claims, Bhopal has categorized the 1,23,560 (categorized so far) into:

51,584 — no injury (category a)

64,064 — temporary/cured (category b)

By inadequately examining the claimants (clinically and through investigations) and by evaluating the injuries and categorizing them with the use of faulty tools biased against the gas victims, the Directorate of Claims, Bhopal has 'defined' away the injuries of more than 90% of the victims as 'no injury' or 'temporary injury'.

ANNEXURE - I

RATIONALE AND CRITERIA FOR DIAGNOSIS

Ref : Text Book of Medicine, Harrison, Ed-11; and ICMR Publications on Bhopal Gas Victims.

RESPIRATORY SYSTEM

1. Allergic Alveolitis (DRO-A)

A. *Rationale for Diagnosis*

1. Isocyanates (TDI, MDI, HDI) are known to cause this disease.
2. Symptoms of dyspnoea, cough, expectoration described in Bhopal Victims.
3. Pulmonary Function Tests showing Restrictive pattern described in about 30% of gas victims.
4. Transfer factor of Carbon Monoxide is reduced.
5. Lung biopsy and broncho-alveolar lavage showing changes of alveolitis.
6. Immune system abnormalities reported in almost 90% of gas victims.

B. *Criteria for Diagnosis*

1. Dyspnoea with or without cough and expectoration. Dyspnoea is at rest, or on exertion, continuous and progressive.
2. Fine crepitations particularly at the bases.
3. No evidence of emphysema or airway obstruction.
4. Presence of clubbing.

II. Chronic Obstructive Lung Disease (DRO-C)

A. *Rationale for Diagnosis*

1. Isocyanates (TDI) are known to cause this disease.
2. Symptoms of Dyspnoea with or without cough and expectoration described in gas victims.
3. Evidence of airway obstruction as suggested clinically by presence of rhonchi and obstructive pattern on PFT.
4. Evidence of Hyperinflation on X-ray chest, in gas victims.

B. *Criteria for Diagnosis*

1. Dyspnoea, progressive and continuous with or without cough and expectoration.
2. Clinical evidence of Emphysema (Barrel shaped chest, Hyper-resonant note on percussion liver dullness pushed down, Cardiac dullness obliterated).
3. Evidence of airway obstruction (H/O wheezing, prolonged expiration, rhonchi).
4. Crepitations, if present, are coarse.

III. Dyspnoea of Respiratory Origin (DRO)

A. *Rationale for using this term*

According to ICMR 75% of gas victims with Dyspnoea had no clinical signs. Many of this patients on investigation will demonstrate evidence of Allergic Alveolitis or Chronic Obstructive Lung Disease eg. Restrictive or Obstructive pattern on PFT, and can thus be diagnosed after investigation as either Allergic Alveolitis or Chronic Obstructive Lung Disease.

B. *Criteria for Diagnosis*

Persons with continuous, progressive dyspnoea with cough, with or without expectoration or any abnormal finding on examination of respiratory system but not fullfiling the criteria of Allergic Alveolitis or Chronic Obstructive Lung

Disease are clinically diagnosed as Dyspnoea of Respiratory Origin (DRO). After investigations most of these patients will be diagnosed as either Allergic Alveolitis or Chronic Obstructive Lung Disease or some other Respiratory illness.

IV. Dyspnoea ? Cause

A. *Rationale for Diagnosis*

In 50% of the gas victims complaining of Dyspnoea, the symptom seems grossly out of proportion to the clinical, Radiological and Pathophysjological findings. Here the mechanism may be:

(i) Minimal Pathological changes in bronchi and alveolar wall.

(ii) Psychiatric problems lowering the threshold for sensory perception.

(iii) Some unknown (obscure) mechanism.

B. *Criteria for Diagnosis*

These persons have progressive or continuous Dyspnoea on exertion but have no other symptoms or signs suggestive of involvement of Respiratory System. Some of them on investigation may turn out to be showing evidence of Respiratory illness but in many of them it may not be so. In these cases, one of the mechanisms described above may be the cause of dyspnoea.

V. Recurrent Respiratory Tract Infection (RTI)

A. *Criteria for Diagnosis*

Repeated attacks of cough with yellow expectoration and/or fever lasting for few days.

If recurrent RTI are associated with dyspnoea the diagnosis is made as DRO-A, DRO-C or DRO with Respiratory Tract Infection (DRO-A with I, DRO-C with I and DRO with I).

VI. **Bronchial Asthma**

A. *Rationale for Diagnosis*

Toxic gases in Bhopal are known to have exacerbated Bronchial Asthma in patients who suffered from it before gas leak and are known to have caused it in some others due to hypersensitization.

B. *Criteria for Diagnosis*

A person with episodic dyspnoea, with absence of symptoms in between the attacks.

VII. **Pulmonary Tuberculosis**

A. *Rationale for Diagnosis*

Toxic gases in Bhopal are known to have caused a "flare up" of Tuberculosis in persons who already had the infection, active or inactive.

B. *Criteria for Diagnosis*

1. Clinical evidence of cavity.
2. H/o Haemoptysis
3. Persons who are diagnosed by some doctor as having Pulmonary Tuberculosis.

   Since the diagnosis of Pulmonary Tuberculosis is confirmed only after Acid Fast Bacilli (AFB) are demonstrated in sputum (which in most patients is not being done in Bhopal), a differential diagnosis of DRO also is given since the possibility exists that many of them may not have Tuberculosis.

EYES

I. **Chronic Conjunctivitis**

A. *Rationale for Diagnosis*

ICMR has reported symptoms of itching, lacrimation, burning and foreign body sensation without physical signs. This is due to chronic Conjunctivitis which may be infective or allergic in nature.

B. *Criteria for Diagnosis*

1. Reported symptoms burning, watering, itching, foreign-body sensation and photophobia. Even if one symptom is reported by the patient spontaneously, without physical signs.

2. Presence of two or more symptoms on direct questioning, with or without clinical signs.

3. Conjunctival congestion.

II. **Cataract**

A. *Rationale for Diagnosis*

Increased incidence reported by ICMR. Reported in many young adults.

B. *Criteria for Diagnosis*

Opacity of lens with iris shadow, as seen under a torch light.

III. **Corneal Opacity**

A. *Rationale for Diagnosis*

Reported in gas victims. The toxic gases in acute phase caused corneal ulceration which healed with opacity.

B. *Criteria for Diagnosis*

As seen by torch light.

IV. **Diminished Vision**

A. Rationale for Diagnosis

Vision can diminish due to cataract, corneal opacity or refractory error. Refractory errors were reported higher in the gas exposed population in 1985.

B. *Criteria for Diagnosis*

Distant vision:

Vision less than 6/12 mtrs. using the standard Snellen's chart.

Near vision :

Considered diminished if person cannot read the newspaper at a distance of 30 Cms. or cannot thread a needle.

GASTRO-INTESTINAL SYSTEM

I. Atrophic Gastritis

A. *Rationale for Diagnosis*

Endoscopy with biopsy done in 50 gas victims with upper Gastrointestinal symptoms showed Atrophic gastritis in all of them. Both free and total acidity were reduced with many having achlorhydria.

B. *Criteria for Diagnosis*

Persons complaining of pain or discomfort in epigastric region, fullness after small meals and loss of appetite.

Among the general population such a patient will be diagnosed as non-ulcerative dyspepsia since many alternative conditions can be diagnosed. Also, the correlation between atrophic gastritis and upper GI symptoms is not good. Among the gas victims the available evidence indicates not only an extremely high prevalence of Atrophic Gastritis but a better correlation with upper GI symptoms.

II. Oesophagitis

A. *Rationale for Diagnosis*

Reported in gas victims.

B. *Criteria for Diagnosis*

Retrosternal burning, epigastric burning, both before food. Epigastric tenderness may be present.

MUSCULO-SKELETAL SYSTEM

A. *Rationale for Diagnosis*

Muscle ache, joint pains and muscle fatigue (severe enough to prevent the person from working) is reported. The pathophysiology is not known.

B. *Criteria for Diagnosis*

Whenever muscle ache, fatigue and joint pain are reported.

ANNEXURE II

Department of Psychiatry
Sir J.J. Group of Hospitals and Grant Medical College
Byculla, Bombay 400 008.

Date 10th Nov. 1989

PRELIMINARY REPORT ON SURVEY OF PSYCHIATRIC MORBIDITY IN BHOPAL GAS LEAK VICTIMS

In December 1984 when the mishap took palce, it resulted in a high incidence of mortality and morbidity. The morbidity included physical as well as psychological disturbances. Earlier reports on psychological disturbance revealed that a large number of people exposed to the gas had psychological disturbance in the form of Generalized Anxiety Disorder, Depression, and Adjustment Disorders. Post traumatic stress disorder (also known as Post Disaster Stress Syndrome) was not found in any of the victims interviewed according to these previous studies.

Post traumatic stress disorder is a collection of a number of symptoms and signs occuring after being exposed to an event which is extremely stressful and which does not fall in the domain of ordinary day-to-day life events and which most normal people would find overwhelming. e.g. Earth quake, floods, fire, Prisoner-of-War, combat, traffic accidents, air crash, train accidents— industrial disaster e.g. Gas Leak.

The current study was primarily conducted to determine whether any of the gas victims suffered from PTSD. The implications of this diagnosis are far-reaching.

The data were collected by Dr. Vinod S. Joshi— Lecturer, and Dr Anukant Mittal — Registrar, Deptt. of psychiatry, Grant Medical College and Sir J.J. Gr. of Hospitals, Bombay. The project was carried out by the Department of psychiatry, G.M.C./

J.J.H. voluntarily and there was no grant or any financial aid available. The details of the study are as following:

400 patients who were earlier examined for medical and psychiatric morbidity were reassessed. Of these 400, there was possible 350 patients who could be having a psychiatric disorder. Of these 350 suspected cases, 40 patients were examined by us (VSJ, AKM).

The results are as shown below:

Total No. N =	70	
Post traumatic stress disorder	40	
Adjustment disorder with depressed mood	7	
Depression	3	
Other diagnosis	1	Compensation Neurosis
	1	Paranoid Disorder
	1	Delirium
Nil Psychiatry	17	

Of the 53 psychiatrically ill patients, none of them had received a diagnosis of PTSD earlier. The clinical severity ranged from moderate to severe in 45 patients which is to say that their day to day functioning was severely affected. Since a large body of literature on PTSD is available e.g. Pitman *et al* found a life time diagnosis of PTSD in 40% of Vietnam Veteran interviewed by them, (Am. J. Psy. May 1989, 145 : 667-669), in our opinion the presence of PTSD could be correlated with the gas-leak.

Dr Anukant Mittal — Registrar
Dr Prakash Gangdev — Lecturer
Dr V S Joshi — Lecturer
Dr Alan De Sousa — Professor
Dr D K Deshmukh — Asst. Professor

ANNEXURE-III

BHOPAL GAS LEAK TRAGEDY

PERSONAL INJURY EVALUATION

CLAIM FORM NUMBER (1–6) | SEX (7) | AGE (8–9) | CENTRE CODE (10–12) | REGISTRATION NO. (13–17)

MUNICIPAL WARD: (18–19) NAME:- _____

POST EXPOSURE HEALTH STATUS

TABLE 'A'

TIME SINCE EXPOSURE	0 TO 1 MONTH	2nd MTH to 6th MONTH	7th MONTH 1 YEAR	AFTER 1 YEAR	TOTAL MARKS
Max-Mks*column	0 • 20	6 • 21	4 • 22	2 • 23	20•24-25
TREATMENT I P					
	6 • 26	4 • 27	3 • 28	1 • 29	14•30-31
TREATMENT O P					
Investigations	Severe	Moderate	Mild	Normal	Total
Max-Mks*column	5 • 32	3 • 33	2 • 34	0 • 35	10 • 36-37
X-ray					
	5 • 38	3 • 39	2 • 40	0 • 41	10 • 42-43
Urine SCn.					
	5 • 44	3 • 45	2 • 46	0 • 47	10 • 48-49
Others					

TABLE 'B'

SYSTEMS	—	RESP	G.I.T.	OBST & GYNAEC.	MUSCUL-OSKELE-TAL	CNS/ MENTAL	OPHTH.	TOTAL MARKS
Max-Mks*column	-	3 • 50	3 • 51	3 • 52	3 • 53	3 • 54	3 • 55	18•56-57
SYMPTOMS	-							
	-	3 • 58	3 • 59	3 • 60	3 • 61	3 • 62	3 • 63	18•64-65
CLINICAL SIGNS								

TOTAL OF TABLES A + B (115–117)

CURRENT HEALTH STATUS

TABLE 'C'

SYSTEMS	GENER-AL	RESP	G.I.T.	OBST. & GYNAEC.	MUSCUL-OSKELE-TAL	CNS/ MENTAL	OPHTH.	OTHERS	TOTAL MARKS
Max-Mks*column	•65	4 • 67	2 • 68	2 • 69	2 • 70	2 • 71	2 • 72	1 • 73	15•74-75
SYMPTOMS	0								
	2 • 76	6 • 77	3 • 78	3 • 79	4 • 80	2 • 81	3 • 82	2 • 83	25•84-85
CLINICAL SIGNS									
	• 86	8 • 87	4 • 88	4 • 89	4 • 90	2 • 91	0 • 92	2 • 93	30•94-95
SPECIALIST OPINION	0								

TABLE 'D'

Investigations

X-RAY: Abnormal X-ray	Collapse.	Incers. Fibro.	Emphysemo.	Opacities.	bronchiectesis	TOTAL	P.F.T. (%deranged).	E.T.T.	URINE SCn. > 1 mg% Smok - Toba -	Smok + Toba -	Smok - Toba +	Smok + Toba +	Corneal Opacity	Fundus	Others	TOTAL MARKS
						15	4	3	4	3	3	2	2	1	1	30
96	97	98	99	100	101	102-3	104	105	106	107	108	109	110	111	112	113-114

DATE:

TOTAL OF TABLES C+D (118–120)

TOTAL OF TABLES A+B+C+D (121–123)

SEAL & SIGNATURE OF EVAULATING DOCTOR:

Please see overleaf for guidlines.

NOTES :— Total maximum marks for post exposure Health Status and Current Health Status are 100 each.

Post Exposure Health Status means the state of health during the period immediately after exposure to gas till the current medical examination.

KEY FOR SCORING: **Post Exposure Health Status.** Scoring is to be done on facts available in the records produced, adjudged by the evaluating doctor.

KEY FOR SCORING · **Current Health Status.**

67	— One mark for each symptom (4)
68	— ½ mark for each symptom (2) to be rounded to whole numbers
69	— ½ mark for each symptom (2), to be rounded to whole numbers.
70	— One mark for 3 symptom (2).
71	— One mark for 3 symptoms or less; two marks for 4 or more symptoms (2).
72	— One mark for 1 symptom, two marks for 2 or more symptoms (2).
73	— One mark
76	— 0-Good; 1-Fair, 2-Poor; (2).
77	— 6 Marks.
78	— 3 marks.
79	— 3 marks.
80	— 5 marks.
81	— 3 marks.
82	— 2 marks.
83	— 1 mark.
87—93	— Marks to be alloted according to severity out of maximum marks alloted.
96—101	— 8 marks for any one positive finding; 12 marks for any two positive; 15 marks for 3 or more positive findings. In this case fifteen marks are to be divided according to the severity of each findngs keeping in view that the total does not exceed 15. The abnormal X-ray column is to be given mark when none of the condtions mentioned is present but there is any other abnormality
104	— 4 marks for 75% derangement; 3 marks for 25-75% derangement; 2 marks for 25% derangement (4).
105	— 3 marks for severe derangment; 2 marks for moderate derangement; 1 mark for mild derangement (3).
106—109	— 4 marks for 1 mg. No smoke-No tobacco; 107—3 marks for 1 mg. Yes smoke-No tobacco0; 108—3 marks for No smoke-Yes tobacco; 109—2 marks for 1 mg Yes smoke-Yes tobacco; (Enter marks in the column applicable)
110—111	— 2 marks; 111-112 — 1 mark each.