

## Chemical, biological, radiological and nuclear training issues in India: A fresh perspective

Mudit Sharma

Commanding Officer, Air Force Institute of NBC Protection, Air Force Station, Arjangarh, New Delhi - 110 047, India

**Address for correspondence:**  
Dr. Mudit Sharma,  
E-mail: [muditsharma@hotmail.com](mailto:muditsharma@hotmail.com)

### ABSTRACT

Appropriate training is the key to the right level of preparedness against any disaster, and Chemical, Biological, Radiological and Nuclear (CBRN) disasters are no different. The presence of contamination precludes rescue operations to commence soon after the event and it takes a systematic approach to detect and decontaminate the CBRN hazard. Achieving such interventions poses a critical challenge because humans do not possess any inborn, natural sensors with which to recognize these dangers early enough. This requires special training besides the right tools to achieve the objective. CBRN training in India has evolved over the years as a pure military-related concept to a disaster-level response training involving the first responders. The complex nature of CBRN agents requires a methodical and systematic approach to counter the response successfully, and the training for this necessitates adoption of proven modern principles of education management, like training needs analysis, operational research, etc. Simulation as a training and planning offers repeatability, controllability and the possibility for evaluation and is being successfully used in some advanced countries for training responders in the relatively unknown and mysterious domain of CBRN disaster management training. There is also a perceived need to integrate and standardize the curricula to suit the respective first responder. It is strongly felt that with the able support of apex agencies like National Disaster Management Authority and guidance of the Defence Research and Development Organisation, the training effort in CBRN disaster management will get the right impetus to achieve a stature of a modern, progressive and mature endeavour. This will enable India to develop a strong CBRN defence posture very much in line with the country's emerging status globally as a technological power.

**KEY WORDS:** CBRN curriculum, CBRN disaster management, CBRN simulation facility, National Disaster Response Force (NDRF), quick reaction team, quick reaction medical team, training need analysis

Received : 01-07-10  
Review completed : 01-07-10  
Accepted : 02-07-10  
DOI: 10.4103/0975-7406.68510  
J Pharm Bioall Sci 2010;3:275-80

With India becoming a major player in the world economy, there is an emergent need to also have a sound security mechanism of its own. With the world unlikely to have a conventional battle between enemies, the likelihood of use of non-conventional weapons becomes a practical reality. The consequences of Chemical, Biological, Radiological and Nuclear (CBRN) emergencies may stretch national capabilities to their maximum extent. Responsibility for first response remains with individual nations. It is essential that nations build on their resources to respond and mitigate the consequences of an emergency situation to lives, property and the environment.<sup>[1]</sup> In the absence of a documented Nuclear, Biological and Chemical (NBC) warfare battle on the country's soil, India's closest tryst with the ghastly effects of NBC or CBRN weapons was the infamous MIC leak at Bhopal in December 1984, which mimicked leakage of a typical blood agent, in a battle theater or in the present day scenario even by terrorist organisations. It also exposed the country's lack of preparedness against use of a chemical agent used as a warfare

agent, whether by the enemy or any non-state actors/terrorist organization. With the memory of the use of the much-publicized chemical weapons on the Kurds in the eighth decade of the last century fresh in the minds of the defence strategists, India embarked upon a journey toward self-sufficiency and self-reliance in developing defence against these weapons of mass destruction in the mid-eighties. The first step was to develop a systematic training curriculum for its first responders, which, in the earlier days, almost automatically meant the personnel of the defence services. The objective of this article is to acquaint the readers with the various stages in the development of CBRN/NBC training in the country, with the focus being on ameliorating the training limitations by addressing the lacunae in the correct perspective, before offering remedial action.

### Scope

The article will attempt to describe the gradual process of development of the nation's capacity building, involving

various stakeholders in the field of NBC defence with training being the pivot around which all the components of the various programmes are resting. It will try to bring out the strong points and lacunae in the systems as well after analyzing the best practices in the other countries. It will also inform the esteemed readers about the shift in the pattern of the use of such weapons in the present day era of non-conventional warfare, where the availability of these weapons of mass destruction to the various terrorist organizations and non-state actors further compounds the security situation of not only our own country but also that of the whole world. To face such a reality, increasing awareness and developing a structured training programme for various stakeholders becomes a necessary imperative for the stakeholders.

## Pillars of CBRN Defence

The CBRN defence planning is based on the following pillars:

1. Avoidance
2. Detection
3. Protection
4. Decontamination
5. Damage control/consequence management

The actions of an effective response strategy are based on the above principles and the equipment available to carry out the various response actions appropriately. It needs no emphasis to say that the equipping of a force is useful only if it is properly trained on the specific equipment to carry out the specific tasks assigned.

## Existing Training in India

The training for CBRN training basically commenced after the attention of the world was directed at the highly deplorable use of chemical warfare agents by Iraq against the Kurd rebels in the eighth decade of the last century, which brought to the fore the lack of preparedness of our country's armed forces in this unconventional form of warfare. The training was basically to generate awareness among the troops about the basics of the types of the agents and various survival drills associated with these agents. With the gradual availability of some categories of equipment either from the global market or from our own Defence Research and Development Organisation (DRDO) laboratories, the options available to the service personnel gradually started increasing, while also allowing the facets of training to become more focussed. Some DRDO laboratories, viz. Defence Research and Development Establishment (DRDE), Gwalior, Institute of Nuclear Medicine and Allied Sciences (INMAS), New Delhi and Defence Laboratory (DL), Jodhpur, have been painstakingly aiding the training initiative at the Service Training Institutes as well as their own training activities all along. The real thrust for the CBRN training was received in the aftermath of the post-Pokharan-II in 1998, which demonstrated a belligerent posturing by our neighbour on the western frontier causing concern toward a systematic preparation of a defence mechanism against these

Weapons of Mass Destruction (WMDs). To add to this, the Kargil conflict in 1999 created more awareness about the need to have a protective mechanism in place against the CBRN weapons. This obviously created enough stimulus to increase the quantum of training at the three service training centers located at Pune, New Delhi and Lonavala. The 9/11 attacks, which were followed by the anthrax mail scare, further heightened the possibility of a CBRN disaster and made the Ministry of Home Affairs (MHA) wake up to a possible scenario of use of these weapons in the country by terrorist organizations/non-state actors. The discovery of literature pertaining to training of Al-Qaeda cadres in chemical and biological weapons vindicated the fears of the Ministry and prompted it to raise Quick Reaction Teams (QRTs) and Quick Reaction Medical Teams (QRMTs) to respond to contingencies arising out of CBRN weapons on the national soil.<sup>[2]</sup> In the absence of a pool of trained manpower in this particular domain, these teams were to be raised from within the cadres of the three services, and their equipping was entirely sponsored by MHA. This development posed a new challenge for development of a customized training curriculum for the QRTs and QRMTs. The Indian Air Force (IAF) rose to the occasion and commenced the first ever specialized course designed for the QRT, initially for nuclear and radiological emergencies and later for biological and chemical emergencies (BCER). A similar effort has also been started at the Faculty of NBC Protection, College of Military Engineering, Pune, which is the Indian Army's premier CBRN training establishment. The lack of trained pool of personnel from the Central Paramilitary forces was also a cause of serious concern and steps began in the right earnest toward this direction, and training of the CPMF's cadres commenced at various institutions initially at the Defence Services Training Facilities and later at their own training centers which have, over the years, come into their own and are progressively evolving. With the National Disaster Management Mechanism taking a concrete shape, with the formation of National Disaster Management Authority (NDMA) in 2005, the natural evolution was the creation of an exclusive force for fighting CBRN disasters in the realm of the national security. Four battalions of the National Disaster Response Force (NDRF) have been earmarked at the disposal of the NDMA to respond to CBRN contingencies and are standing by at bases with airlift facility.<sup>[3]</sup> The DRDO and Department of Atomic Energy (DAE) and other stakeholders like Ministry of Health, UGC, etc. have been greatly assisting the training initiative of the responders with the help of their resource persons as well as the induction of some of the indigenously developed CBRN defence products.

## Objectives of CBRN Training in IAF

The objectives of the basic training system in IAF is to provide survival drill training to a limited number of air force personnel and specialized NBC training to a small pool of QRT personnel and first responders who would be manning NBC cells at various AF stations. As compared with the earlier days, when the training was sketchy,

especially in the absence of most of the equipment, the present training is focusing on preparing the air warriors toward the goal of becoming confident enough to appreciate the nuances of CBRN warfare/disaster management and, gradually, become self-sufficient to handle the consequence management arising out of a CBRN event, with not only the available equipment but also using improvisations/modifications with a dual aim to protect and survive and sustain the operations. The training at the AF Institute of NBC Protection, New Delhi (AFINBCP), is basically aimed at creating an awareness among the air warriors followed by reinforcing the gained knowledge by carrying out practical training a number of times. These air warriors who are trained are also seen as trainers of trainers at the periphery to increase the basic awareness about the effects arising out of CBRN weapons among the air warriors. The institute has also trained members of CPMFs like CISF and ITBP. The institute took a lead in the field of specialized training by commencing the first ever course intended for the QRT for Response to Nuclear and Radiological Emergencies (RNER) in 2003. This was performed with the active collaboration of the Radiation Safety Services Division (RSSD) of the prestigious Bhabha Atomic Research Centre (BARC). This was in consonance with the philosophy of the National Disaster Management mechanism, which mandated the emergency response to Nuclear and Radiological Emergencies to the DAE and Ministry of Defence (MOD). Continuing in the same league, the institute also embarked on the journey to conduct specialized courses for BCER with the active participation of DRDE, Gwalior, and National Institute of Communicable Diseases (NICD) – now rechristened as National Centre of Communicable Diseases (NCDC) – from 2007 onwards. The much-desired practical knowledge imparted by means of innovative mock exercises and table-top exercises has won praises not only from the experts of the collaborating institutions but also from members of the NDMA. The institute prides itself on the fact that with the miniscule faculty at its disposal, it has also conducted training sessions for a number of other categories of persons like schoolchildren, families, scientists, other stakeholders like NDRF commanders, etc., with a greater emphasis on the practical training, which has been appreciated by all the participants.

### Designing the CBRN Curriculum

It is indeed a challenge to design the correct curriculum for the training of different categories of service personnel/civilians who come for training at any CBRN training facility. The stakeholders must comprehend the context of CBRN response in relation to current national and international security concerns. They must also comprehend the significant changes in the current security environment and its implications for first responders and the extent to which the modern society depends on critical infrastructure and implications for first responders. The course content must be customized for the participants, taking care of their basic qualifications as well as the organizational aspirations and

expectations. A proper “Training needs Analysis” needs to be carried for each category of training to ensure optimal uptake/absorption of knowledge at the training facility.<sup>[4]</sup> Ideally, a pre-course questionnaire needs to be furnished to the participants, which would give an objective idea about the training expectations of the category of the training participants. The course curriculum could be modified accordingly based on the responses in the questionnaire. Apart from the usual lectures, interactive sessions and practical demonstrations must be included with the equipment available at the training facility. The course should also include an all-inclusive survival drill session utilizing the protective equipment that has been displayed/demonstrated. The uptake of the disseminated knowledge will be truly demonstrated when the participants are subjected to some form of assessment, which must include, besides an objective type of examination, a viva voce form of assessment in respect of the equipment and the practical aspects of training. The training must also include some form of simulation training, e.g. exposure to a lachrymating agent designed to mimic a chemical warfare agent. A post-course feedback is extremely valuable to improve on the quality of the course after carrying out an introspective analysis based on the genuine inputs. Thus, an ideal CBRN First Responder Training Program should be designed to:

- 1) provide standardized course content across the country, allowing for interoperability between agencies and jurisdictions.
- 2) build on existing, credible CBRN resource material, given that the body of knowledge surrounding this subject is continually expanding and changing in terms of equipment and response protocols.
- 3) maximize training coverage using distance-based tools and provide sustained support to address ongoing training needs.
- 4) develop the competence and confidence of first responders who may be faced with responding to a CBRN attack.
- 5) increase the knowledge of those outside the first-responder population who need to know how to recognize a CBRN attack.

### Mainstreaming/Integrating the CBRN Training

As times have gone ahead, the sphere of CBRN training has been continually evolving based on the technology development and the ever-changing security scenario. From the days of predominantly chemical defence corps, the present-day CBRN response force is fairly well equipped to handle the full spectrum of contingencies arising out of any of the CBRN weapons. In fact, some countries have even gone ahead and superimposed the CBRN response force with the Explosive Disposal Response teams and have coined the acronym CBRNe response to such a force. It is clear that, as compared with a warfare threat alone in the past, these agents pose a serious and significant threat to the interior/internal security as well and require the gearing up of the usual first responders like the Fire and Rescue personnel

and the Police Services in the field of CBRN response with the right training and equipment. However, such a thought process has not fully evolved in our country even though the formation of the CBRN-specific NDRF battalions is the right step in that direction. The inadequacies of Delhi Police to respond to such incidents was glaringly evident in the not-so-distant-past in the Mayapuri radiological exposure to Co<sub>60</sub> in March–April 2010, forcing the Government to order basic radiation detection equipment for the police services.<sup>[5]</sup> Responding to the emerging threat, some police services have started getting their personnel trained against this unconventional threat.<sup>[6]</sup>

Thus, it can be seen that there is a real and imperative need to integrate the CBRN response with the regular emergency response, which is the responsibility of the Police Services/Fire Services/Paramilitary Forces/Civil Defence in the homeland security scenario. The Defence services are to be utilized only as a last resort in a real-time CBRN emergency. The next step would be to integrate the “explosive” response part and rechristen it as CBRNe response, with specialization of constituent teams in various response actions in the aftermath of any CBRNe contingency.

### Limitations/Shortfalls in Training

Notwithstanding the fact that the Indian CBRN training has shown tremendous growth in the last two decades, there are a few limitation/shortfalls in the sphere of CBRN training that need to be addressed for effective uptake of knowledge. Annotated below are a few important observations/lacunae with suggested recommendations for remedial action:

- a) Inadequate practical training: Some of the institutions are alleged to be too theoretical in their endeavour of disseminating knowledge. But, CBRN training is supposed to be a highly experimental form of learning and involves a fair amount of practical training. This also requires adequate equipping of these training institutions with the appropriate equipment.
- b) Standardisation of CBRN training at training establishments: It should be the endeavour of all training establishments to have uniformity in their training curriculum. It would be advisable to follow the NATO Handbook on the International CBRN Training Curriculum on minimum standards and non-binding guidelines on training to first responders to achieve a sense of uniformity in the training syllabus.<sup>[1]</sup>
- c) Integration of civil–military CBRN training: This calls for a regular review and appreciation of the security situation of the country as well as the new technology available for the principles of CBRN Defence. Periodic Civil Military Liaison on this aspect is also recommended.
- d) Correct selection of course participants: It is felt that the understanding of the concepts and finer nuances of CBRN defence become easier if the course participants have a science background in their 10 + 2 curriculum. This could also probably reduce the training duration and thus increase the throughput of the training establishments. This would also improve the efficacy of the responders in a CBRN scenario.
- e) Lack of simulation facilities: Simulation is a proven method for training and planning (cf flight simulators), offering repeatability, controllability and the possibility for evaluation.<sup>[7,8]</sup> With respect to the often-invisible and, for human senses, unnoticeable dangers of CBRN incidents, simulation allows dangerous situations and materials to be replaced by harmless ones. Mixed and augmented reality software plays a key role in such simulations.<sup>[7,9]</sup> CBRN training in India lacks in these unique simulation facilities for improving the experiential learning process of course participants. This applies especially to the aspects pertaining to the medical management of CBRN casualties.<sup>[7,9]</sup> This is being followed at a number of institutions the world over and involves the use of different variety and levels of simulators.
- f) Training of quality assurance personnel: Being a fairly technology-intensive field, CBRN response requires the equipment to be in a perfect condition, and this obviously requires an enhanced quality assurance set-up and simultaneous training of their personnel to be an integral part of all training facilities. This will also ensure quicker turnaround of the equipment at the quality assurance establishments.
- g) Lack of live agent training: The training establishments do not possess live agent training, especially in the context of the chemical agents. This aspect needs to be addressed to improve the confidence levels of the first responders to handle actual chemical events. Relevant inputs need to be sought from the Czech Republic and Sweden, where live agent training is imparted and which are considered as the “centres of excellence” for CBRN defence for the NATO forces.
- h) Inadequate training of medical personnel: At present, there are hardly any facilities for exclusive training of medical personnel, and the courses designed are primarily for other first responders. It is suggested that special courses for medical personnel (including paramedics) be planned for the appropriate capacity building.
- i) Motivation for personnel as a career option: At present, there are limited career openings in the field of CBRN defence, especially for other ranks in the services and CPMFs. With no exclusive cadre of CBRN personnel, opting for a career in this field becomes a tough choice. Thought needs to be given by the government to come out with more vacancies/career options purely for this field. A Public Private Partnership (PPP) model could also be sought as the requirement for the services may arise in the industries too.
- j) Conduct of refresher courses: In the absence of very many live experiences, as in the case of fire emergencies, etc., CBRN disaster preparedness needs regular and periodic conduct of refresher courses/exercises/Information Education Communication (IEC) activities to enable the responders to keep abreast with the latest developments in the field of CBRN defence.



- k) Strengthening of the state/district-level CBRN training: While the efforts of CBRN training at the national level are praiseworthy, the same needs to be replicated at the state and district level to enable the first responders to acquaint themselves with the nuances of CBRN response. The platform of the existing State Training Institutes (STIs) may be suitably utilized to achieve this objective.

## Way Ahead: The Future of CBRN Training

Besides the suggestions offered in the preceding paragraphs, here are some more futuristic options to ensure that the CBRN training becomes state-of-the art and the quality of the response is appropriate.

- i) International exchange: At present, there is no official collaborative practice between any of the training facilities and any of the international institutions engaged in the field of CBRN defence training. To make these facilities truly world class, it is suggested that international exchange programmes be planned with some of these centers of excellence to enable existing institutions to become centers of excellence themselves.
- ii) Use of realistic simulators: A new generation of highly sophisticated computer-driven modelling and simulators, using virtual reality and closed immersion models, are available in the international market, which realistically allow trainees to manage complex and high-risk situations in a life-like setting. This generation includes both sophisticated CBRN responsive mannequin platforms, with the tactile and visual appearance of a living person, as well as virtual reality devices and simulators. The INMAS and AFINBCP have embarked upon a research project on a similar basis for the management of radiological and nuclear casualties.
- iii) Formation of the National Institute of CBRN Mitigation and Training: Under the aegis of DRDO and NDMA, it is proposed to begin a new chapter in the field of CBRN defence training, in the form of an apex center, which will be christened as the *National Institute of CBRN Mitigation and Training* (NICMT), as a center of excellence. A number of issues brought out above can easily be addressed with the formation of this institute.
- iv) Introduction of CBRN defence as a component of basic disaster management at schools/colleges: To ensure that the awareness levels are more broadbased, it is recommended that CBRN defence be introduced as a topic in schools and colleges as part of the disaster management curriculum.<sup>[10]</sup>
- v) Involvement of the industry/chambers of commerce: With the threat of CBRN disaster looming large, the industry also needs to be prepared and involved. The various chambers of commerce may act as catalysts in this endeavour to develop a practical model of PPP.
- vi) Introduction of newer concepts and management principles in education: There is a need to adapt newer principles of management in the field of CBRN defence,

with special reference to education management, to be introduced in training e.g. Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model and the Accomplishment-Based Curriculum Development (ABCD) model. These methods incorporate adult learning principles and active learning using a blended approach that consists of web-based distance learning, formal classroom instruction and field training. Assistance of centers of excellence in the field of management as well as distance education, viz. Indian Institutes of Management (IIMs) and Indira Gandhi National Open University (IGNOU) may be resorted to develop unique and innovative training programmes.

## Conclusion

CBRN defence training has really evolved over the past couple of decades in India and, notwithstanding the difficulties faced by the virtually minuscule fraternity of professionals associated in this arena, the number of people trained has gradually risen to a significant number. With the proactive involvement of the National Disaster Management Authority and other stakeholders in the expert field of CBRN disaster management, the future of CBRN training surely appears to be very bright in India. This optimism will surely go a long way to ensure that the first responders of our country will respond to CBRN contingencies in the most professional manner, should they arise at all. There is, however a requirement to objectively improve the training scenario nationally in an integrated and comprehensive manner and certain changes based on international best practices like Training Need Analysis, simulation facilities and latest education management techniques like ADDIE and ABCD, etc need to be incorporated in the curriculum, as suggested in the aforementioned paragraphs, to bring the CBRN training in India truly at par with the International standards to achieve the ultimate objective of a CBRN-resilient India.

## References

1. The International CBRN Training Curriculum: Minimum Standards and Non-Binding Guidelines for First Responders Regarding Planning, Training, Procedure and Equipment for Chemical, Biological, Radiological and Nuclear (CBRN) Incidents. Issued by Operations Division, NATO Civil Emergency Planning, Civil Protection Committee 2002.
2. National Disaster Management Authority: Guidelines for Chemical disasters Available from: <http://ndma.gov.in/ndma/guidelines/Chemical-Disaster> [Last accessed on 2010 Jun 17].
3. "NDRF battalions to be trained by NDMA in disaster management" reported in the Indian Express. Available from: <http://cities.expressindia.com/fullstory.php?newsid=250884> [Last accessed on 2007 Aug 14].
4. Soni NK, Kumar V, Vij R, Chawla R, Goel R, Silambarasan M, *et al.* Training Need Analysis of Armed Forces personnel for medical management of nuclear and radiological emergencies (2008) ; Proceedings of First World Congress on Disaster Management (WCDM-2008) pp 369-72.
5. All's not well in India's junk metal capital. Available from: <http://news.rediff.com/report/2010/apr/25/all-is-not-well-in-indias-junk-metal-capital.htm> [Last accessed on 2010 Apr 25].
6. A batch of cops ready to handle chemical, n-terror, reported in

■ Sharma: CBRN training issues in India: A fresh perspective

- Indian Express. Available from: <http://www.indianexpress.com/news/a-batch-of-cops-ready-to-handle-chemical-nterror/620300/1> [Last accessed on 2010 May 18].
7. Vardi A, Levin I, Berkenstadt H, Hourvitz A, Eisenkraft A, Cohen A, *et al*. Simulation –based Training of Medical Teams to Manage Chemical Warfare Casualties. Non-Conventional Warfare Medicine. Isr Med Assoc J 2002;4:540-4.
  8. Hendrickse AD, Ellis AM, Morris RW. Use of simulation technology in Australian Defence Force resuscitation training. JR Army Med Corps 2001;147:173-8.
  9. Freeman KM, Thompson SF, Allely EB, Social AI, Stansfield SA, Pugh WN. A virtual reality patient simulation system for teaching emergency response skills to U.S navy medical providers. Perhaps Disaster Med 2001;16:3-8.
  10. National Disaster Management Authority: Guidelines- Nuclear and Radiological Emergencies (released in February 2010). Available on Website: [www.ndma.gov.in](http://www.ndma.gov.in), NDMA, Govt. of India.

**Source of Support:** Nil, **Conflict of Interest:** None declared.

