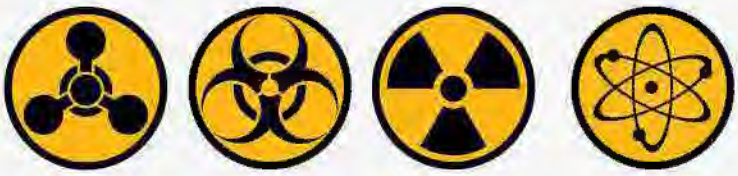
CBRN

Emerging Threats & Challenges



Seminar Report

CBRN:Emerging Threats & Challenges/SeminarReport/30-31/01/2023

CLAWS is registered under the Societies Registration Act, 1860 and is a membership-based organisation. It is governed by a Board of Governors and an Executive Council. Chief of the Army Staff is the Patron of CLAWS. Vice Chief of the Army Staff is the Chairman of the Board of Governors and Director General Strategic Planning, Integrated Headquarters of Ministry of Defence (Army) is President of the Executive Council.

Vision

To establish CLAWS as a leading Think Tank in policy formulation on Land Warfare, National Security, Military Technology and Strategic Issues.

Objectives

- To function as an independent Think-Tank.
- To promote study and research.
- To promote and further intellectual thinking.
- To undertake research projects.
- To organise webinars, seminars, lectures, workshops, conferences, courses and other such intellectual activities.
- To train and assist scholars to undertake strategic studies and research.

Mandate

The mandate of CLAWS encompasses research on national security challenges, including conventional military operations and sub-conventional warfare. CLAWS also focuses on conflicts in the region and security related developments in countries on India's strategic frontiers, particularly those in the South Asian region.

Collaborations

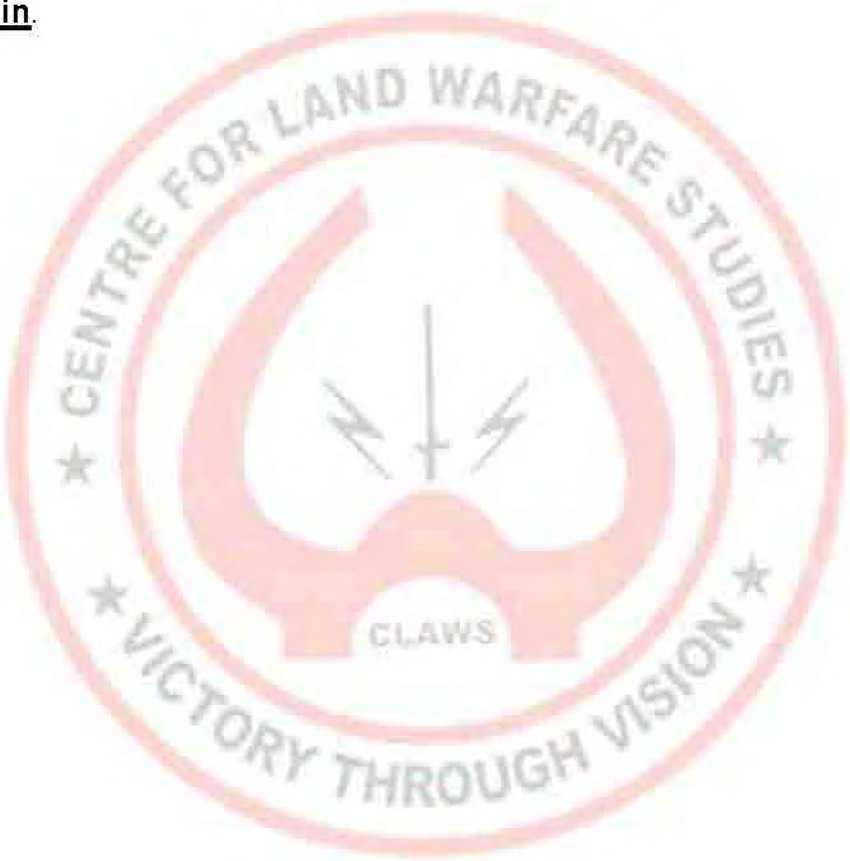
The CLAWS Outreach Committee engages with Think Tanks and universities worldwide. As a result, joint publications have been undertaken with Woodrow Wilson International Centre for Scholars, USA and Bangladesh Institute of Peace and Security Studies (BIPSS), Dhaka and an Annual Dialogue with Nepal Institute for International Cooperation and Engagement (NIICE), Kathmandu.

MoUs with regard to academic collaboration have been signed with US Army War College, NIICE, Indian Institute of Technology (Delhi), OP Jindal Global University (Sonipat, Haryana), Christ University (Bengaluru) and several other institutions.

To further enhance Professional Military Education (PME) of Army Officers, CLAWS has signed MoUs with Manipal Academy of Higher Education (MAHE) and Central University of Gujarat, to conduct PhD programme for Army Officers.

CLAWS Activities

CLAWS organises seminars, webinars and conferences, round-table discussions, workshops and guest lectures and undertakes research projects on national security issues, especially those pertaining to land warfare. CLAWS disseminates the results of its research to its members, armed forces, policy-makers, the strategic community and academia. To encourage young scholars to express their views on strategic issues, CLAWS organises the Field Marshal Manekshaw Essay Competition (FMMEC) annually. CLAWS' activities and research can be viewed at its website **www.claws.in**.



The Centre for Land Warfare Studies (CLAWS), New Delhi, is an independent think-tank dealing with national security and conceptual aspects of land warfare. CLAWS conducts research that is futuristic in outlook and policy-oriented in approach.

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CENTRE FOR LAND WARFARE STUDIES
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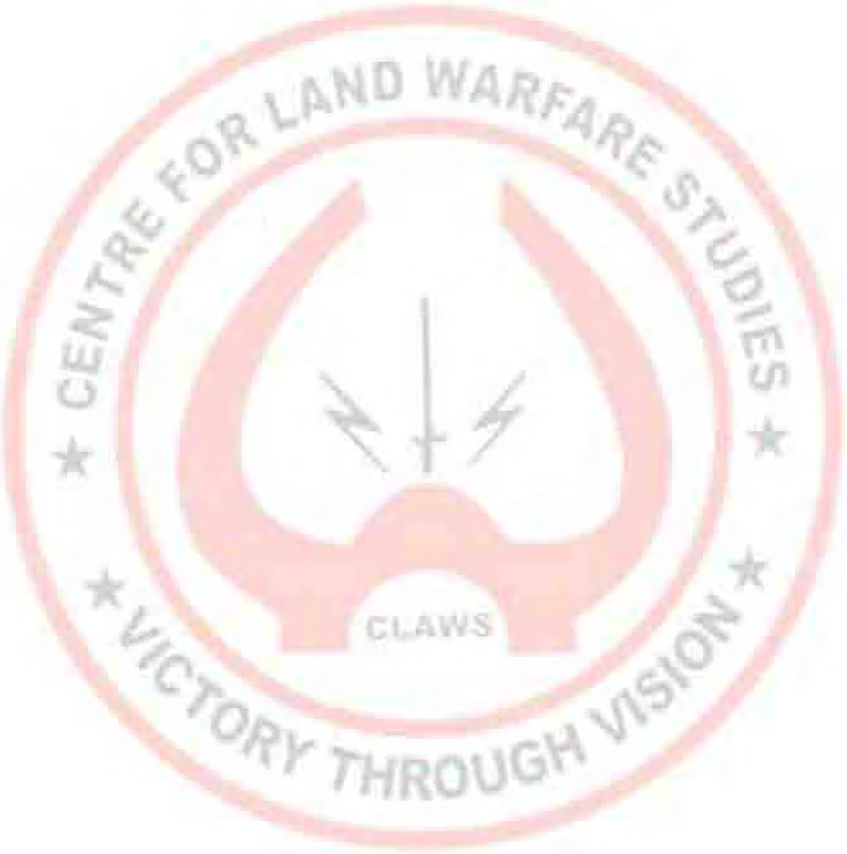
CENTRE FOR LAND WARFARE STUDIES
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CLAWS SEMINAR ON
CBRN: EMERGING THREATS AND CHALLENGES

INTRODUCTION

The Centre for Land Warfare Studies (CLAWS) organised the seminar on "**CBRN: Emerging Threats and Challenges"** on 30-31 January 2023 at Manekshaw Centre, New Delhi.

Objective of the Seminar

The objective of the seminar was to debate CBRN threats with a special focus on identifying use cases to examine measures for improving the preparedness of administrative and logistics functioning of the Indian armed forces and other government bodies. Overall, the seminar was undertaken to familarise Tri-service officers with the emerging CBRN treats and their military implications.

Discussion Theme

The issues were deliberated upon in three sessions on specific aspects to generate insights and recommend adoption of CBRN safety measures in the Indian armed forces and other government bodies. The aspects covered were:-

- Emerging nuclear threats and challenges.
- Chemical and biological threats in the current global environment
- CBRN defence strategies to mitigate threats

Action Plan and Recommendations

The detailed recommendations based on the deliberations conducted during the seminar with eminent speakers in the field are enumerated in this report.

EXECUTIVE SUMMARY

After the end of Cold War, the discourse on threats posed by nuclear weapons witnessed a decline globally. The Biological Weapons Convention had already been agreed to in 1972 and the Chemical Weapons Convention (CWC) came into force in 1997. The world seemed to have put the issue of chemical, biological, radiological, and nuclear (CBRN) weapons behind it, but somehow, the situation still continues to remain dynamic and evolving.

The use of Chemical Weapons (CW) in recent years by both states (alleged use of highly-toxic Sarin nerve agent by Syria in 2017), and non-state actors (such as the Islamic State used Iraqi prisoners as human test subjects in experiments with chemical and possibly biological weapons, around 2014) has shown how difficult it is to achieve their complete abolition. More recently there have been allegations against Russia about having used chemical weapons in Mariupol, against Ukrainian forces.

The alleged use of CBRN weapons in assassinations and attempted assassinations has brought to attention the dangers they pose globally. The possible CW usage in clandestine operations (Novichok nerve agent) in the UK and recurrent use of chemicals by ISIS (use of mustard gas in Syria) reflect new dimensions of threats emanating from these weapons.

CBRN thus presents challenges that call for global collaboration. Threats emerging from CBRN must be managed, reduced, and ended across international boundaries. A comprehensive plan for Crisis Prevention, Crisis Response, and Consequence Management must be developed using an integrated CBRN approach that combines international and national CBRN efforts. This requires the use of a comprehensive strategy that enables all stakeholders to set and achieve shared objectives in a collaborative manner while functioning independently.

CONCEPT NOTE

CBRN has remained a front-runner amongst all strategic issues globally in the recent past. Major contributors to the growing concern have been COVID-19, alleged employment of chemical weapons by a few countries despite international conventions, and renewed focus on nuclear weapons today.

The catastrophic effects of a tiny pathogen during the COVID-19 pandemic have converted the ages old 'Gun vs Bread' debate into a 'Missile vs Microbe' paradigm. In the nuclear domain, Russia-Ukraine war, North Korea's unabated tests and China's nuclear weapons expansion seems to have encouraged other vulnerable nations to no longer acquiesce to non-proliferation regimes and seek nuclear weapons in their own national interests. Chemical weapons have also gained limelight due to a few targeted attacks and their alleged use in the ongoing war.

The technological breakthroughs in the CBRN domain and weapon delivery means, due to disruptive technologies like Artificial Intelligence, Drones and Hypersonic Weapons, have increased the security challenges manifold. The trans-national terrorism and hybrid nature of current conflicts further complicates the global security environment.

Therefore, considering the catastrophic impacts of a CBRN contingency and our unique security environment, India needs to develop capabilities for defending its national interests and its citizens from CBRN threats.

SUMMARY OF RECOMMENDATIONS

Doctrinal Issues

- Need for a doctrine/ strategy doc to prepare again CBRN threats.
- Defining role of stakeholders in enhancing CBRN capabilities.
- Clear identification of considerations for policy formulation.
    - **Nuclear**
        - Build global consensus and collaboration on CBRN
        - Constant tracking of CBRN policy tracks of adversaries
        - Review our qualitative upgradation.
        - Seriously examine non-state actors' use of dirty bombs.
        - National policy on radioactive waste management.
    - **Chemical Considerations**
        - Assess possible use of drones for spread of chemical threats.
        - Craft policy on chemical theft and sabotage.
    - **Bio Weapons Considerations**
        - Control on R&D.
        - Biosecurity strategy.
        - Upgrade laws on genetic data theft and its illegitimate use.
    - **Protection of Citizens.** Develop capabilities to protect citizens and spread awareness on the subject.

Surveillance and Intelligence

- **Against Bio Weapons.** Track non-state actors' capabilities to develop produce and stockpile biological and toxin weapons.
- **Access Control.**
    - Surveillance of high containment labs and preventing access of non-state actors to it.
    - Bio-surveillance of ports and airports, develop cyber intelligence and monitoring activities in area of interest.

Development of Technologies, Preparedness and Automation

- Development of appropriate technology for detection.
- Use of AI for threat mitigation.
- Have legal and regulatory mechanisms against CBRN threats.
- **Need for Planning.** A comprehensive plan for CBRN crisis prevention, response and consequence management of CBRN threats.
- **Preparedness.**
    - Collaboration by all the stakeholders to function independently.
    - Empowerment of R&D standards for interoperability, scalability and performance.
    - Capacity Building and infrastructure development for preparation, handling and testing of scheduled chemical and high-risk biological agents.

Recommendations for Capability Development

- Assessing of CBRN threats based on vulnerability.
- Preparedness assessment.
- Identifying product/ technology requirement.
- Inventory management of CBRN items.
- Training on scenario-based response.
- Medical management of CBRN emergency.

Strategy to Combat Weapons of Mass Destruction (WMD)

- Strengthen non-proliferation,
- Counter-proliferation,
- Consequence management.

KEY TAKEAWAYS AND RECOMMENDATIONS

1. Detailed deliberations on important aspects of CBRN threats and challenges provided an insight on the immense work required in the fields of R&D, logistics and technical support. Key takeaways include use cases, a roadmap and recommendations for national preparedness against CBRN threats.

Doctrinal Issues

2. **CBRN Doctrine/ Strategy Document.** The first and most important step is to come out with a Doctrine/ Strategy document for preparedness against CBRN threats. This should be articulated in terms of Mission, Objectives, Scope and Roadmap for the adoption of relevant technologies in armed forces and other government bodies.

3. The role of stakeholders in enhancing CBRN capabilities should be outlined clearly:-

(a) Identify operational requirements.

(b) Identify products/technologies.

(c) Frame specifications for products.

(d) Estimate the scale of requirement.

(e) Design trial directives based on operational requirement, which incorporates incremental modification and spiral development of products such as instruments, chemicals and antidotes for CBRN attack.

(f) Guide the development process of products from design to induction.

4. **Strategic Issues for Consideration of Policy**:-

(a) Indian diplomacy should aim to build global consensus and collaboration against CBRN threats.

(b) India may have to periodically review its CBRN doctrine based on emerging threats, while keeping track of shifts in CBRN doctrines of our adversaries.

(c) **Nuclear Aspects.**

(i) Indian NFU is apt and relevant for the present environment.

(ii) Nuclear deterrence is an important tool, when in the global security scenario nuclear proliferation is likely. India needs a debate on its nuclear doctrine.

(iii) The Credible Minimum Deterrence definition needs a relook.

(iv) China's nuclear expansion seeks parity with the US but seriously affects India.

(v) India must work on qualitative upgradation to mitigate contemporary and future threats.

(vi) Adversary's Ballistic Missile Defence needs monitoring, while exploring options to build capability in causing unacceptable damage.

(d) Dirty bomb employment by non-state actors is a possibility.

(e) **Chemical Aspects**

(i) The effectiveness of OPCW organization needs evaluation.

(ii) Non-state actors may employ modern means like drones or innovative means like letters, and innocuous looking items to spread toxins/pathogens/chemicals.

(f) **Bio-Weapons Aspects.**

(i) Dual use R&D is of concern globally.

(ii) Countries like USA, Russia, China are undertaking researches on dangerous pathogens.

(iii) Bio disasters are difficult to localize.

(iv) India must develop a bio security strategy.

(v) Oversight on R&D is a must.

(vi) Genetic data theft is a major concern and India must make appropriate laws against them.

(g) **Protection of Citizens**

(i) India must invest in developing capabilities to protect its citizens eg. protective suits and shelters for population.

(ii) Spread awareness in general population.

Surveillance and Intelligence

5. Chemical availability of training context on internet and new materials make development of chemical weapons easy. This may be an easier option for non-state actors. Therefore a control of chemical trade along with restrictions on hosting of

such information on the internet are a must. An internet surveillance of suspected sites and organisations should be undertaken.

6. **Biological**

(a) Keep track of non-state actors' capability to develop, produce and stockpile biological and toxin weapons.

(b) Keep track of neighbours and study migratory birds for their role in influenza virus transmission.

7. **Access Control**

(a) Bioterrorists could design a new virus or bacteria to create new resistant pathogenic strains or organisms, to attack specific sub-populations", hence, there must be lookout for such activities.

(b) Keep track of all High-Containment Lab activities and prevent access of non-state actors to those assets.

(c) Regularly update inventories of various vaccines with storage locations.

(i) Identify and select personnel who need to access them;

(ii) Establish control and accountability for VBM;

(iii) Documentation of internal and external transfer within and between facilities;

(iv) Certify inactivation and/disposal of the material.

(d) Use drones and other methods for air sampling to detect the presence of harmful pathogens.

(e) Need for increased funding for intelligence initiatives, bio-surveillance, and bio-surveillance.

(f) Need for a sound bio-threat intelligence system integrated into existing intelligence networks.

(g) Biosurveillance at ports and airports, cyber intelligence and monitoring of local health and suspicious activities in areas of interest in the neighbourhood.

Development of Technology

8. The threat of biological and chemical terror acts remains a growing worldwide concern. Hence there is a need to develop appropriate technology for detection of chemical and biological warfare agents, with early identification intended for use by

first responders. Automation of sensors and responders as well as field equipment becomes a pre requisite for an efficient responses to accidents or use of CBRN weapons. Timely employment of equipment such as autonomous air sampling and suitable detection systems will go a long way in reducing harm to the population.

9. **AI and WMD**

(a) Disruptive technologies like AI have revolutionized the field. More lethal chemical can be developed by employing AI within hours. On the other hand, use of AI based equipment can be helpful for saving a large number of lives.

(b) Currently, there are no provisions in international CBRN treaties against the dual use of AI in developing more lethal and deadlier WMDs. While use of AI is beneficial for defensive and protective measures such as early warning ISR systems and early mobilisation of Task Forces, however, its employment for offensive CBRN measures cannot be prevented.

10. **Framework and Preparedness**

There is a need to have legal and regulatory mechanisms for preparing against CBRN threats.

(a) Procurement and distribution of perishable and non-perishable products in time.

(b) Developing a comprehensive plan for Crisis Prevention, Crisis Response, and Consequence Management.

(c) Prepare an integrated model where all stakeholders are enabled with material and financial support to mitigate and respond against CBRN threats. It should facilitate the collaboration of all stakeholders, who function independently.

(d) The defenders would need to sense hazards quickly, as far away as possible, share information faster, take adequate protection measures, and subsequently avoid and minimally use contaminated battle zones.

(e) Strong need for empowering R&D. There should be more focus on research in the domains of standards and interoperability, scalability and performance, and security.

(f) Develop equipment capable of protecting personnel, especially the nominated response task forces of Indian Armed Forces and NDRF.

(g) Develop CBRN capability for:

(i) Assessment of CBRN threats, based on vulnerability and degree of threats.

(ii) Identification of product/technology requirement(s).

(iii) Inventory management of CBRN items.

(iv) Training on scenario-based response(s).

(v) Medical management of CBRN emergency.

11. **Preparedness**

(a) Create a convergence of CBRN defensive preparedness with other emerging technologies like AI, Machine Learning, and Internet of Things (IoT). The intersection of cyberspace on nuclear aspects and deterrence must be analysed in detail.

(b) Disaster relief, emergency preparedness and environment conservation should be considered together.

(c) Preparedness needs to be carefully crafted with respect to the country's No-First-Use policy in the strategic domain.

(d) Drones make CBRN agent delivery easier and have become a real threat. Terrorists have access to drones and can use them to fly over physical barriers and carry out an attack. India should prepare itself against small drones and possess potent counter-drone swarm capabilities.

(e) Improve CBRN early warning detection systems, population alert mechanisms and civilian mass response to First Strike by our adversaries.

(f) National level awareness among the population in dealing with CBRN threats needs enhancement. Resources in terms of PPEs and early warning systems must be worked upon. A great deal of synergy is required between the NDMA, security agencies and all stakeholders in conducting regional and national level awareness campaigns.

(g) Each aspect of CBRN should be dealt with by separate appointments in the armed forces with a branch responsible for comprehensive integration.

12. **Roadmap**

A suggestive roadmap for the next 3-5 years for capability development is as under:-

(a) **Tri-Services CBRN Framework.** This framework would be based on the info sharing infrastructure of the three services integrated into the national matrix.

(b) **Policy and Guidelines.** Tri-Services CBRN Framework would be open for relevant stakeholders. HQ IDS in collaboration with the Service HQ should define policies & guidelines. Any application/use case must comply with such policies and reside on this framework.

(c) **Standardisation.** A sense of standardization must be enabled. The responsibility of the Tri-Services CBRN Framework needs to be vested with a lead service, so that complete infrastructure can be modular and streamlined for training.

(d) **Identify Use Cases.** Need to establish synergy between Academia, R&D, Industry and users to identify the use cases for armed forces and develop a common understanding of CBRN threats.

(e) **Training.** Indian armed forces should do regular simulations in training for different types of CBRN emergencies.

(f) The Armed Forces should review roles periodically and employ latest techniques based on emerging technologies. Each service, CAPF and NDRF, must be assigned preparatory responsibilities.

(g) Indian scientific agencies should be able to test within 12 hours, develop rapid diagnostics and vaccines within 100 days, accelerate therapeutic development and validation, repurpose existing drugs within 90 days and develop novel therapeutics within 180 days, similar to the global practice.

13. **R&D Roadmap for CBRN Defence**

There is a need to indigenously build adequate individual and collective Protective Equipment such as:

(a) Lightweight Individual Chemical Agent Detector.

(b) Broadband Chemical Agent Detector.

(c) Bioaerosol point detection and identification system.

(d) Next-Generation Protective Ensemble.

(e) Universal Decontamination Solution.

(f) Regenerative CBRN filtration system.

(g) Mobile casualty decontamination station.

(h) Medical countermeasure means for radiation and chemical exposure.

Simultaneously, there is a need to accelerate R&D on advance systems/ measures such as:

(a) Aerial CBRN Reconnaissance System,

(b) Wearable CBRN sensors,

(c) Long-range CBRN standoff detection, tracking and mapping,

(d) Ultralight CBRN protective ensemble, and

(e) NBC shelters with high-performance filtration and detection capabilities.

14. **Suggestions Related to Specific Fields**

Chemical Weapons

(a) Since nations are yet to witness a complete abolition of Chemical Weapons, India should keep track of recent use by both state and non-state actors.

(b) Indian chemical industry has witnessed robust growth in the past decade, especially during Covid-19, hence attention should be paid to chemicals having pharmaceutical properties.

(c) India should secure itself against chemical theft or sabotage and monitor the chemical industry production, acquisition, transfer, use and stockpile of all chemicals in the country.

(d) Keep track of dual use chemicals and chemical weapons programme, that involve toxin and weaponisable chemicals.

Radiological Weapons

(a) Nuclear and Radiological security aspects should be reviewed periodically.

(b) Need to focus on issues that need improvement such as detection architecture and response mechanisms.

(c) **Radioactive Waste Management.** Need to promulgate a national policy and strategy for radioactive waste management. Further, open Radioactive Waste Management Centres that will train state/city based (SDRF) to handle such materials.

(d) Increase frequency of routine on-site inspections at Nuclear Power Plants (NPPs) to facilitate more effective regulatory oversight.

(e) Fulfil India's commitment to contributing towards a strong and sustainable global National Security architecture.

15. **Feasibility Study/ Paper.** Feasibility study/ paper on the following issues about the preparedness against CBRN threats:

(a) HQ IDS to conduct a study for preparedness against CBRN threats in each service. Such studies may need to be carried out regularly based on feedback and adaptation to advancements in such technology.

(b) A dedicated paper on CBRN advancements done and challenges faced by China, US, Europe and Russia is suggested to get a comprehensive perspective thereby keeping ourselves abreast.

PROGRAMME SCHEDULE

Time	Topic	Speaker
30 JANUARY 2023 (MONDAY)		
INAUGURAL SESSION		
0930-0945	Opening Address	DG, CLAWS
0945-1000	Keynote Address	DCOAS(Strat)
1000-1040	Group Photograph & Tea	
SESSION I : EMERGING NUCLEAR THREATS AND CHALLENGES		
1040-1045	Introductory Remarks by the Chair	Lieutenant General Balraj Singh Nagal, PVSM, AVSM, SM (Retd) Former Director General, CLAWS
1045-1115	Analysis: China's Nuclear Policy and its Nuclear Forces	Lieutenant General Balraj Singh Nagal, PVSM, AVSM, SM (Retd)
1115-1145	The Rationally Irrational - Nuclear Policy of Pak & its Expanding Nuclear Arsenal	Dr Shalini Chawla Distinguished Fellow, Centre for Air Power Studies
1145-1215	Evolution and Constructs of Nuclear Deterrence, Relevance of nuclear weapons in Contemporary Global Security Scenario	Prof Rajesh Rajgopalan Centre for International Politics , Organisation and Disarmament (CIPOD), School of International Studies, JNU
1215-1245	India's Nuclear Doctrine: Challenges & Continued Relevance	Dr Manpreet Sethi Distinguished Fellow, Centre for Air Power Studies
1245-1300	Q & A Session	
1300-1310	Summing up by the Chair	Lieutenant General BS Nagal, PVSM, AVSM, SM (Retd)
1310	**Lunch & Dispersal**	
31 JANUARY 2023 (TUESDAY)		
0930-0950hr	Overview: Global Nuclear Arms Control Efforts (i.e. NPT, CTBT, MTCR, New STRAT & JCPOA)	Ambassador Rakesh Sood
SESSION II: CHEMICAL AND BIO THREATS IN CURRENT GLOBAL ENVIRONMENT		
0950-0955	Introductory Remarks by the Chair	Dr R Narayanan, Advisor, CWC Implementation, Mumbai
0955-1015	Chemical Warfare: Emerging Threats, International & National Mechanisms	Dr R Narayanan, Advisor, CWC Implementation, Mumbai
1015-1035	Bio-Weapons: Emerging Threats & Relevance of International Conventions	Dr Syed Imteyaz Alam Sc-F, DRDE, Gwalior
1035-1055	BioSecurity: Emerging Paradigm in Post Covid Era	Dr Pragya Yadav, Sc-F, National Institute of Virology, Pune
1055-1115	Q & A Session	
1115-1125	Summing up by the Chair	Dr R Narayanan

Time	Topic	Speaker
1125-1145	Tea Break	
SESSION III : CBRN DEFENCE STRATEGY TO MITIGATE THREATS		
1145-1150	Introductory Remarks by the Chair	Dr SK Vasudeva Ex-Chief Controller (R&D) DRDO, Scientific Consultant (Def Tech)
1150-1210	New Age CBRN Delivery Means & Challenges Thereon	Dr SK Vasudeva
1210-1230	CBRN Threats: Roadmap for Defence Capability Development	Dr DT Selvam Sc-F & Director (PM & SQR)
1230-1250	Terrorism and Disasters: CBRN Perspectives & Mitigation Measures	Dr Reshmi Kazi Professor, Jamia Millia Islamia
1250-1310	Q & A Session	
1310-1320	Summing up by the Chair	Dr SK Vasudeva
1320-1330	Closing Address	Lieutenant General Rashim Bali AVSM, SM, VSM, Director General, Directorate General of Strategic Planning
1330	**Working Lunch & Dispersal**	

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Lieutenant General Balraj Singh Nagal, PVSM, AVSM, SM (Retd) is a Former C-in-C SFC, and has headed the CSPS and CLAWS. He got wounded in the 1971 war and writes on nuclear and strategic issues.

Dr Shalini Chawla is a Distinguished Fellow at the Centre for Air Power Studies (CAPS), New Delhi. She has authored seven books titled: Pakistan's Military and Its Strategy (2009), Nuclear Pakistan (2012), [ed.] India's Sentinel (2014), [ed.] Strategic Advantage of Air Power (2019), [ed.] The 1971 Indo-Pak Air War: Reflections and Projections (2021), [ed.] India's Neighbourhood: Challenges and Opportunities (2022) and [ed.] Pakistan's Security dynamics and Nuclear Weapons (2022).

Dr Rajesh Rajagopalan is a Professor of International Politics at Jawaharlal Nehru University in New Delhi and has published books namely Nuclear South Asia: Keywords and Concepts (co-written with Atul Mishra); Fighting like a Guerrilla: The Indian Army and Counterinsurgency; and Second Strike: Arguments about Nuclear War in South Asia.

Dr Manpreet Sethi, Distinguished Fellow, Centre for Air Power Studies (CAPS), New Delhi, heads its programme on nuclear issues.

Dr R Narayanan has earlier worked at the Organisation for the Prohibition of Chemical Weapons (OPCW) and is acting as an Advisor to the Indian Chemical Council with responsibility of the regional CWC Help Desks.

Dr Syed Imteyaz Alam is a Scientist F at Biotechnology Division of Defence Research and Development Establishment, Gwalior. He has been working in the area of disease proteomics and detection of bio threat agents using tandem mass spectrometry.

Dr SK Vasudeva was the Chief Controller Strategic System till January 2011. He has been Scientific Consultant (Defence Technologies) in the office of Principal Scientific Adviser to Government of India and has been primarily associated with R&D in the field of design and development of special armament systems and their operationalisation. He has made notable contributions in the field of blast resistant structures.

Dr DT Selvam is Director (Project Management) in office of Director General Life Sciences, DRDO and looks after the sanction and implementation of projects in nine labs under the LS cluster of DRDO.

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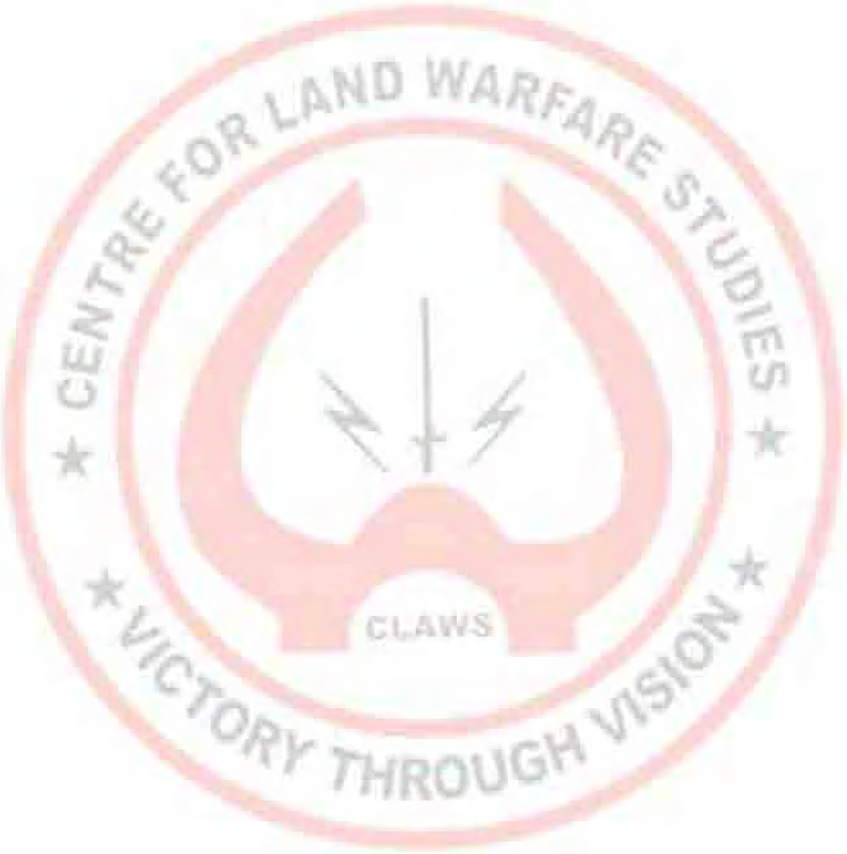
Dr Reshmi Kazi is a professor at the Jamia Milia Islamia, New Delhi, where she teaches arms control and nuclear disarmament.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