



A Proposed Indian Nuclear Risk Reduction Mechanism

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Sanjay Mahindru

INTRODUCTION

The primary concern of every responsible nuclear-armed state is to create a nuclear command, control and communications (NC3) system that meets the “Always/Never Dilemma.”¹ The Always/Never Dilemma highlights a pair of competing imperatives for a nuclear-armed state: that nuclear weapons should always launch when ordered but never without proper authorisation.² To meet the “always” requirement of the dilemma, nuclear weapons must be reliable and must be resilient to attack by an adversary. On the other hand, to meet the “never” requirement, weapons should neither detonate nor be employed accidentally due to errors in design or a faulty early warning system. Nor should they be used without proper authorisation. To satisfy the “always” criterion, the nuclear-armed state must guard against a preemptive decapitating attack to ensure survivability of the NC3 structure and the nuclear arsenal. To satisfy the “never” criterion, the nuclear-armed state must guard against unauthorised, inadvertent or accidental use of nuclear weapons.

The “always” and the “never” criteria are two sides of the same coin. The emphasis on one or the other is a function of the prevailing geopolitical situation in conjunction with the national nuclear deterrence policy. Howsoever, the balance lies between the “always” and “never” dilemma for a nuclear-armed state, there is always a risk that a misguided decision-maker, a poorly designed component in the detonation chain, an erroneous alert of the NC3 system, or a combination of such factors could result in an unwarranted, unauthorised or accidental use of nuclear weapons. This risk needs to be understood and managed.

The 1964 film, *Fail Safe*, an adaptation of a book of the same name by Eugene Burdick and Harvey Wheeler, underscores the catastrophic potential of accidental nuclear war through human error and system failure.³ Live instances like the 1962 Cuban Missile Crisis, the role of Lieutenant Colonel Petrov of the Soviet Air Defence Forces in disregarding the false alarm of a nuclear missile attack in September 1983 and numerous documented instances of accidents while handling the nuclear weapon

¹ Peter D. Feaver, “Command and Control in Emerging Nuclear Nations,” *International Security* 17, no. 3 (1992): 160–87, <https://doi.org/10.2307/2539133>

² Feaver, “Command and Control in Emerging Nuclear Nations,” 163.

³ Eugene Burdick and Harvey Wheeler, *Fail Safe* (McGraw-Hill, 1962); Zhu Junwei, “Nuclear Fail-Safe: An Opportunity for the World,” Center for American Studies, *Grandview Institution*, 24 December 2024, <https://www.chinausfocus.com/peace-security/nuclear-fail-safe-an-opportunity-for-the-world>.

inventories across nuclear-armed states are a reminder that the film may not be too far from the truth.

Since 1945, a combination of prudent leadership, military professionalism, good luck and divine providence has enabled humanity to avoid the use of nuclear weapons. But the continuation of this streak is by no means assured.⁴

This risk of unauthorised, inadvertent or accidental use of nuclear weapons can be managed and reduced at different levels. At the highest level, the risk is inherent in the nuclear weapons doctrine of the nuclear-armed state and the pressures it brings upon the political and military leadership to respond rapidly when under perceived or actual attack. At the next level the risk can be managed through ensuring the upkeep, maintenance and upgradation of the nuclear warheads, delivery systems and NC3 systems. Further, the risk can be assessed and addressed at the equipment component and the detailed procedural levels. In evaluating the risks, we also have to consider the impact of the adoption or exclusion of Emerging and Disruptive Technologies (EDTs) to the nuclear weapons ecosystem and its implications for its robustness and reliability in the future. Such a multi-level approach towards risk reduction can be instituted through a Risk Reduction Review mechanism which covers all the aspects of the nuclear weapons ecosystem.

This policy brief examines the necessity and possible shape of such a Risk Reduction Review mechanism in the context of India's nuclear weapons ecosystem. For most nuclear-armed states, these mechanisms are not publicly declared and tend to work in the background. The paper first establishes the need for such a risk reduction mechanism to be put in place. We then review such risk reduction review systems in vogue in other nuclear-armed states. The US Risk Reduction Review mechanism is the most transparent in its declaration of processes and will be examined in detail in this paper. While other nuclear-armed states also have such mechanisms, relatively less is known of their processes. Next, this paper examines why such reviews are difficult to conduct as regards their aims and structuring. It goes on to explain the unique nature of India's nuclear weapons programme as well as the existing regulatory mechanisms that establish the broad limits within which this Risk Reduction Review structure can evolve. Finally, it offers broad recommendations for a proposed Risk Reduction Review mechanism for the Indian nuclear weapons ecosystem.

⁴ Ernest J Moniz and Sam Nunn, "Biden should do more to prevent the accidental launch of nuclear weapons. Here's how." *The Washington Post*, 17 November 2021, <https://www.nti.org/analysis/articles/biden-should-do-more-to-prevent-the-accidental-launch-of-nuclear-weapons-heres-how>

WHY ARE NUCLEAR RISK REDUCTION REVIEWS ESSENTIAL?

The US Department of Defense (DoD) has identified 32 nuclear weapon accidents, known as “broken arrows”, that occurred between 1950 and 2000.⁵ It would be safe to assume that many more accidents have occurred ever since. Such nuclear-related incidents have been reported in Russia too.

On 27 January 2026, the *Bulletin of Atomic Scientists* (BAS), considering the global geopolitical situation, moved the Doomsday Clock from 89 seconds to 85 seconds to midnight. Major factors in the 2026 review “included growing nuclear weapons threats, disruptive technologies like artificial intelligence (AI), multiple biological security concerns, and the continuing climate crisis”, which contributed to this change.⁶ This is the closest the clock has been to disaster than ever before.

In the words of Jon B. Wolfsthal, Director of Global Risk at the Federation of American Scientists (FAS) and member of the BAS Science and Security Board,

In 2025 ... More states are relying more intently on nuclear weapons, multiple states are openly talking about using nuclear weapons for not only deterrence but for coercion. Hundreds of billions are being spent to modernize and expand nuclear arsenals all over the world, and more and more non-nuclear states are considering whether they should acquire their own nuclear weapons or are hedging their nuclear bets.⁷

Global nuclear risk is higher today, than ever before, in terms of proliferation pressures and a trend reversal in the reduction of the number of nuclear warheads.⁸ If this proliferation is not worrying enough, nuclear arms limitation talks and channels of communications between the established nuclear powers are diminishing to a point where the nuclear arms control mechanisms are on the verge of collapse. The New START (Strategic Arms Reduction Treaty) officially expired on 5 February 2026, bringing an end to the last remaining legally binding framework that constrained the nuclear arsenals of the United States and the Russian Federation, with no active or planned replacement treaty. With growing insecurities, disappearing channels of communications and increasing weapon stockpiles, an inadvertent launch of a nuclear weapon or an accidental detonation could spell disaster.

⁵ “Broken Arrows: How Many Nuclear Accidents Have We Had?” American Experience, *The Public Broadcasting Service*, accessed on 25 April 2025, <https://www.pbs.org/wgbh/americalexperience/features/command-and-control-broken-arrows-how-many-nuclear-accidents-have-we-had/>; Zhu Junwei, “Nuclear Fail-Safe.”

⁶ Sarah Starkey, “PRESS RELEASE: It is 85 seconds to midnight,” 27 January 2026, *Bulletin of Atomic Scientists*, <https://thebulletin.org/2026/01/press-release-it-is-85-seconds-to-midnight/>

⁷ Sarah Starkey, “PRESS RELEASE: It is 85 seconds to midnight.”

⁸ “Role of nuclear weapons grows as geopolitical relations deteriorates,” *Stockholm International Peace Research Institute (SIPRI)*, 17 June 2024, <https://www.sipri.org/media/press-release/2024/role-nuclear-weapons-grows-geopolitical-relations-deteriorate-new-sipri-yearbook-out-now>

Another driver for such risk assessments is obsolescence prevention in ageing nuclear warheads and missiles. Electronic components, intermediate explosives and time-limited materials in nuclear warheads and missiles need to be assessed and replaced to maintain nuclear surety. Almost every nuclear-armed state has recently completed or is in the process of modernising its nuclear arsenal. Russia is nearing the completion of a decades-long effort to replace all of its strategic and non-strategic nuclear-capable systems with newer versions.⁹ The United States is currently conducting a massive nuclear modernisation and sustainment plan at an approximate cost of 1.7 trillion USD.¹⁰ In India's case, the nuclear warheads would range from a decade to two decades in age and will need upgrades to keep up with contemporary technologies in the near future.

In the long term, any nuclear weapon and NC3 system is as good as the technical expertise and capability of the personnel that are responsible for its upgrades, maintenance and upkeep. Risk reduction mechanisms could also be used to assess and plan the availability of qualified human resources that are entrusted with the responsibility of managing these weapons today and in the future. Given that the field is specialised and the pool of experts is small, a mapping of specialised personnel available today and in the future is essential.

Another compelling reason for conducting such risk reduction reviews is to counter the risks posed by EDTs like Artificial Intelligence (AI), cyber operations, space-based capabilities, hypersonic and precision-guided conventional weapons and quantum technology to NC3 systems and deterrence stability. These technologies are believed to be disruptive because they weaken the foundation of nuclear deterrence, primarily survivability and the ability to retaliate. Some others believe that these technologies are disruptive because they erode crisis stability by providing first-mover advantage and elevating the risk of first strike.¹¹ What is especially concerning about EDTs is the rate of spread of applications of the dual-use technologies and the fact that their implications for nuclear decision making and crisis stability are not fully understood. These developments are not happening individually or sequentially; they are being applied near-simultaneously, which makes it difficult to predict the application of any one technology separately and to remove or disengage later.

⁹ Hans M. Kristensen, Matt Korda, Eliana Johns, and Mackenzie Knight, "Russian Nuclear Weapons, 2025," *Bulletin of the Atomic Scientists* 81, no.3, 13 May 2025: 208-237, <https://doi.org/10.1080/00963402.2025.2494386>

¹⁰ "America's Nuclear Weapons Arsenal 2024: Annual Overview Released by the Federation of American Scientists," *Federation of American Scientists*, 5 July 2024, <https://fas.org/publication/nuclear-weapons-2024/>

¹¹ Michal Onderco and Madeline Zutt, "Emerging technology and nuclear security: What does the wisdom of the crowd tell us?" *Contemporary Security Policy* 42, no. 3, 23 May 2021: 286-311, <https://doi.org/10.1080/13523260.2021.1928963>

Given that most countries do not have access to these technologies at the same pace of development, capability asymmetries and imbalances are created. This further fuels the desire of adversaries to bridge technology lags through an increased number of weapons or by further compressing response times. As command and control systems grow more complex and more opaque, the likelihood of misinterpretation or manipulation increases. Without robust oversight, these tools meant to enhance security could instead accelerate the path to unintended nuclear conflict.

A periodic assessment of how such emerging technologies could enhance the probability of unauthorised, inadvertent or accidental use of nuclear weapons is essential. On the one hand, such reviews could be used to assess the risk to our own systems if an adversary adopts such technologies and to devise countermeasures to limit those risks. On the other hand, the review could indicate the risks we may face if we were to induct these technologies into our own systems.

In sum, all these factors underscore the necessity of such risk reduction measures for all nuclear-armed states. The review could examine issues like the vulnerability of a nuclear-armed state's NC3 networks to cyber-attacks resulting in "denial of services" when they are most needed; verifying whether its nuclear crypto codes are post-quantum encrypted so that the adversary does not have visibility of nuclear weapons readiness states; ascertaining whether the state should apply AI only for carrying out computer-based nuclear simulations or should AI be adopted for its NC3 systems to keep them contemporary in their assessment and response time. A periodic and non-parochial assessment through a Risk Reduction Review would assist in examining these options.

Such a review would also serve to demonstrate that the nuclear-armed state understands the risks involved in managing nuclear weapons and to show that it is taking steps towards managing such risks. These actions on the part of a responsible nuclear-armed state would help in strengthening credible nuclear deterrence and enhancing deterrence stability.

Before recommending the structure of this nuclear risk reduction mechanism for India, it would be prudent to examine the global structures and organisations in this field.

US NUCLEAR RISK REDUCTION MECHANISM

The US risk reduction mechanism has been shaped over a period of time by incidents, accidents, internal policy changes and with the evolving geopolitical situation since 1945.

The US mechanism operates at various levels in the Department of Energy-led Nuclear Security Enterprise.¹² It is well understood that a lot of the risk in inadvertent and

¹² For background on the respective roles of the Department of Energy and Department of Defense in management of the nuclear security enterprise; NC3 systems; and nuclear delivery vehicles, see Anya L.

unauthorised launch of nuclear weapons stems from the urgency to respond to counter a preemptive decapitating strike by an adversary. In other words, the policy of retaliation and the stipulated response time have a direct bearing on the degree of risk of inadvertent use. At the highest level, the policy on use of nuclear weapons, the conditions of the response and the tools to assist the decision are conveyed through the Nuclear Posture Review (NPR).

At the next level, the US Nuclear Security Enterprise ensures that the existing warheads, support systems, and infrastructure are maintained and upgraded consistently to prevent obsolescence. This is achieved through the Stockpile Stewardship and Maintenance System (SSMP). The DoD is similarly responsible for managing and updating nuclear delivery vehicles and NC3 systems.

In addition to these reviews, special risk reduction reviews have been ordered through the DoD or by the US Congress to assess risks and offer recommendations to manage them. These Risk Reduction Reviews are more technical in their approach and more independent in their team composition. While the recent NPR and SSMP have been largely public documents, the findings of the 2022-24 Risk Reduction Reviews have not been made public and those from the earlier 1990-92 Review have only been partly declassified. Each of these review mechanisms is examined in some more detail in the succeeding paragraphs.

Nuclear Posture Review

The NPR is a paper of intent and practice that describes the approach to nuclear weapons policy by a US Presidential Administration. It outlines the purpose of nuclear weapons, conditions for their use or non-use and defines the types and numbers of nuclear weapons that will be progressed by the administration. This review also defines the approach of the United States towards extended nuclear deterrence provided to allies and also describes the role of the United States in preventing nuclear proliferation and reducing nuclear risks globally. Though not an operational document, the NPR is used by the DoD, Department of Energy (DoE) and the National Nuclear Security Administration (NNSA) to guide policy, for further planning and budgeting.¹³ The Executive carries out the NPR normally led by the Secretary of Defense in consultation with the Secretary of Energy and the Secretary of State and their staffs, based on the

Fink, "Defense Primer: Nuclear Command, Control, and Communications (NC3)," *U.S. Congressional Research Service*, 26 June 2026, <https://www.congress.gov/crs-product/IF11697>; Anya L. Fink, "The U.S. Nuclear Security Enterprise: Background and Possible Issues for Congress," *U.S. Congressional Research Service*, 15 August 2025, <https://www.congress.gov/crs-product/R48194>; and Hans M. Kristensen, Matt Korda, Eliana Johns, and Mackenzie Knight, "United States Nuclear Weapons, 2025," *Bulletin of the Atomic Scientists* 81, no. 1, 13 Jan 2025: 53-79, <https://doi.org/10.1080/00963402.2024.2441624>

¹³ Christopher Colletta, "The Nuclear Posture Review: What it is and why it matters," *Nuclear Threat Initiative*, 10 January 2022, <https://www.nti.org/risky-business/the-nuclear-posture-review-what-it-is-and-why-it-matters/>

overarching guidance by the President through the National Security Council.¹⁴ The composition of the NPR could include a broader set of officials and experts. Finally, the NPR report is submitted to the US Congress.

The first NPR was conducted by President Clinton in 1993 at the end of the Cold War. This was followed by NPRs in 2001, 2010, 2014 and 2022.¹⁵ The NPR process typically starts in the first year of a Presidential administration. The full NPR report has been largely classified, but an unclassified section or a Press Release giving relevant information has been practiced. The trend of unclassified NPRs was started in 2010 by the Obama administration and has continued through the Trump and the Biden administrations, in 2014 and 2022 respectively. In 2026, it is understood that the Pentagon is conducting a close-hold mini review of US nuclear strategy. While not large enough to be called a formal “Nuclear Posture Review,” it will still have significant implications for how this Administration – and the United States going forward – envisions nuclear deterrence and assurance in a rapidly evolving, increasingly complex nuclear age.¹⁶

Stockpile Stewardship Maintenance Programme (SSMP)

The SSMP was borne of the optimism in the security environment at the end of the Cold War. The first SSMP was promulgated in 2000, marked by rising confidence that major power nuclear confrontation was on the wane. It was a period when the United States sought to lead in reducing nuclear proliferation risks and nuclear instability by exercising nuclear restraint. The SSMP describes how the DoE/NNSA plans to sustain the stockpile without underground explosive testing, while meeting production targets, and modernising and creating infrastructure for upgrading and maintaining capabilities. It also includes DoE/ NNSA planning to bring together the results of past nuclear tests with enhanced capabilities for non-nuclear testing of many kinds and advanced computer simulations. In addition, and more importantly, it outlines the effort to retain a workforce that is qualified to maintain deterrence through to the future.¹⁷ Alas, the era

¹⁴ Eryn MacDonald, “Five Things Everyone Should Know About the Nuclear Posture Review,” The Equation, *Union of Concerned Scientists*, 4 October 2021, <https://blog.ucs.org/emacsdonald/five-things-everyone-should-know-about-the-nuclear-posture-review/>

¹⁵ Courtney N. Stewart, “Should the Nuclear Posture Review be Conducted More Frequently?” *Center for Strategic and International Studies*, 1 October 2010, <https://www.csis.org/analysis/collection-papers-2010-nuclear-scholars-initiative>. This 2010 paper suggests that the US Congress should consider instituting a permanent mandate requiring the NPR every four years.

¹⁶ Madelyn Creedon, Eric S. Edelman, Franklin C. Miller, Vipin Narang & Keith B. Payne, “Trump’s Nuclear Review,” *Real Clear Defense*, 26 May 2026, https://www.realcleardefense.com/articles/2026/05/26/trumps_nuclear_review_1184598.html

¹⁷ In the 1990s, various factors compelled a reassessment of the confidence in the US nuclear deterrent. Historically, reliance was on an integrated system with evolving designs and substantial production capabilities, supported by a strong laboratory complex capable of diverse tests. Disruptions led to a “confidence crisis.” In response, a new strategy, known as stockpile stewardship, emerged. It aimed to rejuvenate the nuclear enterprise by enhancing laboratory capabilities, modernizing production processes, and developing advanced methods for better stockpile management and sustainment. See:

when SSMP was first devised has now passed. A new world order has not emerged; instead, the US-led security orders in Europe and Asia are hotly contested by Russia and China. Cooperation among the major powers has waned, while competition and rivalry have intensified.¹⁸ While the intent and purpose of SSMP is still essential, the US debate around its nuclear warheads today is increasingly on whether or not to expand the size of the deployed force and design and manufacture new warheads in response to these threats.

Risk Reduction Reviews

The Risk Reduction Reviews (colloquially called Fail-Safe Reviews) aim to identify risks that contribute to the unauthorised, inadvertent or mistaken use of nuclear weapons including through false warning of attack, and to institute measures to strengthen safeguards against these risks. The Risk Reduction Reviews differ from NPR and SSMP in that they are not conducted at fixed intervals. Only two Risk Reduction Reviews have been conducted by the United States to date, in 1990-92 and 2022-24, and the reviews have been independent and external to the US Nuclear Security Enterprise.¹⁹ The two Risk Reduction Reviews have been mandated by the DoD and US Congress, respectively.²⁰ The review is, however, independent and conducted at an appropriate security classification level, with significant input from the private sector, scientific community, government experts and military specialists representing a diverse range of expertise and perspectives. In addition, the review mandate encompasses technical, procedural, and policy recommendations for unilateral US actions and steps that the United States could pursue with other nuclear-armed countries.²¹

The Risk Reduction Review can be supported by a consortium of Federally Funded Research and Development Centers comprising personnel not directly related to the US nuclear force and supportive elements, as occurred for the 2022-24 review. In a way, the Risk Reduction Review is a more technical review that includes a review of the maturity and implications of the technology being applied or likely to be applied to the

George Miller, "Stockpile Stewardship: What Were We Thinking? How Did It Work Out?" in *Stockpile Stewardship in an Era of Renewed Competition*, ed. Brad Roberts, April 2022: 6, https://cgsr.llnl.gov/sites/cgsr/files/2024-08/CGSR_Occasional_Stockpile-Stewardship-Era-Renewed-Competition.pdf

¹⁸ Brad Roberts, "Introduction," in *Stockpile Stewardship in an Era of Renewed Competition*, 4.

¹⁹ Julia Berghofer writes, "For the 2022 review, the deputy assistant secretary of defense contracted the Federally Funded Research and Development Centres of the Aerospace Corporation and MITRE Corporation, as well as the Johns Hopkins University Applied Physics Laboratory, to act as the independent assessment team. This partnership adds an independent element to the review, preventing it from becoming an in-house job". See: Julia Berghofer, "How to Strengthen Nuclear Failsafe," *The National Interest*, 4 February 2025, <https://nationalinterest.org/feature/how-strengthen-nuclear-failsafe>

²⁰ Julia Berghofer, "How to Strengthen Nuclear Failsafe." Berghofer writes, "The National Defense Authorisation Act for the Fiscal Year 2022 (NDAA) called for an independent review of the safety, security, and reliability of U.S. nuclear systems."

²¹ "The Fail Safe Review," *Nuclear Threat Initiative*, 25 January 2023, <https://www.nti.org/analysis/articles/the-failsafe-review/>

Nuclear Security Enterprise, nuclear delivery vehicles and NC3 systems. The Risk Reduction Review conducted in 1990-92 made notable technical suggestions that included the need for Permissive Action Links (PALs) for launch of nuclear weapons, making a case for post launch destruction mechanisms and procedural suggestions like the institution of the “Two-Man Rule” for all actions.²²

RISK REVIEW MECHANISMS OF OTHER NUCLEAR-ARMED STATES

There is scant information available in the public domain on the risk reduction and failsafe organisations of the other nuclear-armed states. While some information is available on the likely structures of such organisations in the United Kingdom and France, countries like Russia and China do not disclose any such mechanism.

The United Kingdom has a Strategic Systems Performance and Analysis Group (SSPAG) whose role is to help assure the effectiveness of the nuclear deterrent through a programme of analysis, assessments and audits of key capabilities and operations.²³ A paper published by the former commander of the British Navy, Rear Admiral John Gower in 2016 gives an understanding of the role of the SSPAG and emphasises that “every element of vulnerability, actual or potential, is identified, analysed and reported upon.”²⁴

The French are slightly more transparent than the British about their nuclear safety and security procedures. In the Code de la Défense, the French Government provides the public with an explanation of some of the procedural (not substantive) principles that it applies to ensure the safety, security, and reliability of the Force de Frappe.²⁵ The relevant part of the Code, framed as *contrôle gouvernemental* (governmental control), also describes the different levels of responsibility in the nuclear weapons system. Other than the British, the French also have a feedback mechanism with the Parliament, which allows French legislators to ask questions about the national nuclear deterrent.²⁶

China’s No First Use (NFU) nuclear policy, at least ostensibly, plays a crucial role in reducing the pressure to retaliate first or early. This itself has the potential to lower the risk of inadvertent use of nuclear weapons. Sparse information has been available on China’s nuclear risk reduction mechanisms till recently. However, for the first time, the

²² Zhu Junwei, “Nuclear Fail-Safe.”

²³ “DNO-SSPAG Modelling Analyst,” *Destination Nuclear Careers Portal*, <https://destinationnuclearcareersportal.co.uk/jobs/defence-nuclear-enterprise-mod-civil-service-dno-sspag-modelling-analyst-148567>

²⁴ John Gower, “Concerning SSBN Vulnerability - recent papers,” *BASIC*, 10 June 2016, <https://basicint.org/blogs-rear-admiral-john-gower-cb-obe-06-2016-concerning-ssbn-vulnerability-recent-papers/>

²⁵ “Defence Code [Code de la défense],” Legifrance, last updated on 1 September 2026, https://www.legifrance.gouv.fr/codes/texte_lc/LEGITEXT000006071307/

²⁶ Julia Berghofer, “How to Strengthen Nuclear Failsafe.”

White Paper on “Arms Control, Disarmament, and Non-proliferation in the New Era” released by the PRC in November 2025 introduced explicit fail-safe language.²⁷

CHALLENGES IN CONDUCTING RISK REDUCTION REVIEWS

The two major challenges in the conduct of a productive Nuclear Risk Reduction Review are, firstly, the proper structuring of the Review regarding its aims; and secondly, the optimal composition of the teams that would conduct these reviews.

For correct structuring, the purpose of the review should be clearly defined. The review should not be aimed at fault-finding or finger-pointing for errors or delays and should not have an ulterior motive like cost-cutting or human resource reduction. The purpose must be to identify potential risk areas in existing structures, procedures and in the technology being used down to the component level.

The Risk Reduction Review mechanism should not be seen as a transparency exercise and confidentiality should be maintained. The aim of the review should not be to pressure the existing nuclear ecosystem, and the selection and implementation of the recommendations should be left to the discretion of the Nuclear Command Authority (NCA). The overarching principle of the entire review mechanism must be national interest and deterrence stability.

The composition of the team for a genuinely independent review is critical for the proper conduct and final acceptance of the findings of the review. The members need to be non-partisan and sufficiently dissociated from the incumbent design, production and stowage hierarchy. Structuring of reviews should accommodate the numerous silos of information separated by the need for secrecy across different departments involved in the processes.

DISTINCT FEATURES OF INDIA’S NUCLEAR PROGRAMME

To propose a nuclear risk reduction mechanism in the context of India, it is important to first understand the distinct features of India’s nuclear programme and India’s journey to becoming a nuclear-armed state, which will shape such an initiative.

²⁷ “China Releases White Paper on Arms Control in New Era,” *Ministry of Foreign Affairs, People’s Republic of China*, 27 November 2025, https://www.fmprc.gov.cn/mfa_eng/xw/wjbxw/202511/t20251127_11761653.html. A relevant extract of the White Paper states that China is: “Attaching great importance to the safe management and use and effective control of nuclear weapons. China has strict laws and regulations and reliable technical means to implement safety management throughout the entire process of nuclear weapons storage, transportation and training. These effectively prevent any risk of an unauthorized or accidental launch of nuclear missiles, and ensure that the nuclear force is kept absolutely safe and reliable. The command of nuclear forces in China is highly centralized under a streamlined and efficient process, which ensures that unit operations are carried out in the strictest and most accurate compliance with the orders of the Central Military Commission.”

First, it must be clearly appreciated that in India the civilian nuclear programme preceded the military programme by almost four decades. The nuclear weapons programme gains immensely from the decades of experience of the civilian programme in handling nuclear material as well as nuclear and radiation safety. The experience of the civilian nuclear programme will continue to influence the nature of the proposed nuclear weapons-related “Nuclear Risk Reduction Mechanism” in India.

Second, India’s path to nuclear weapons capability has been highly chequered. Although an early entrant in the field of nuclear technology through the *Atoms for Peace* initiative, the Pokhran-I (PNE) test in 1974 brought India to bear technology-denial regimes that left India grappling with technological challenges, sanctions, and the imperative to raise a nuclear option on its own.²⁸ These challenges compelled India to rely on its own scientific and technological resources and they severely embittered the Indian nuclear and strategic community.

The Indian decision to conduct a second set of nuclear tests in 1998 was borne from the compulsion of the tightening of the non-proliferation order, with the Nuclear Non-proliferation Treaty (NPT) being extended indefinitely and the Comprehensive Test Ban Treaty (CTBT) threatening to eliminate an Indian nuclear option. Earlier attempts by the Indian government to conduct nuclear tests were thwarted because the preparations for nuclear tests were discovered or due to internal political pressures. The 1998 nuclear tests had to be conducted amid great secrecy to ensure that India is not permanently consigned to nuclear inferiority, especially vis-à-vis China. Given this background, it is only to be expected that the Indian nuclear community operates in an atmosphere of extreme secrecy.

Consequently, any Indian “Nuclear Risk Review Mechanism” will draw on the mature civil regulatory experience and the structure and findings of such a review mechanism are likely to be confidential.

EXISTING NUCLEAR COMMAND AND REGULATORY STRUCTURES IN INDIA

To make recommendations on a proposed “Nuclear Risk Review Mechanism” for India which will include the likely proposing, approving and implementation agencies, an understanding of India’s nuclear command and regulatory structures is essential.

India’s nuclear command and control structure is well-documented in the Prime Minister’s Office Press Release of 4 January 2003, titled as the “Cabinet Committee on Security Reviews Progress in Operationalizing India’s Nuclear Doctrine.”²⁹ Through this press release, India established the Nuclear Command Authority (NCA). The NCA

²⁸ Manpreet Sethi, *Nuclear Strategy: India’s March Towards Credible Deterrence*, (Knowledge World, 2009), 268.

²⁹ Prime Minister’s Office, “Cabinet Committee on Security Reviews Progress in Operationalizing India’s Nuclear Doctrine,” *Press Information Bureau*, 4 January 2003, <https://archive.pib.gov.in/release02/lyr2003/rjan2003/04012003/r040120033.html>

consists of the Political Council (PC) and the Executive Council (EC). The Prime Minister chairs the PC. The PC is the sole body that can “authorise the use of nuclear weapons.” The National Security Advisor chairs the EC. The EC provides inputs for decision-making to the PC and executes the directives given by the Political Council. Within the NCA, the Strategic Planning Staff (SPS) and representatives from the armed services, the Defence Research and Development Organisation (DRDO), the Atomic Energy Commission (AEC), and the Ministry of External Affairs (MEA) provide strategic inputs on the quality and reliability of India’s nuclear weapons and delivery systems, foreign intelligence, global arms control and disarmament initiatives, and long-term planning for the arsenal.³⁰

In addition, a separate Strategic Armaments Safety Authority (SASA) advises the NSA and the NCA on the safety and security of India’s nuclear and delivery assets.³¹ Operating directly under the NCA, SASA is tasked with reviewing and updating procedures related to the storage and transfer of nuclear armaments, including those deployed on submarines. Its responsibilities encompass all matters concerning the safety and security of India’s nuclear and delivery systems at all locations. The authority functions under the direct command of the NCA, ensuring stringent control and oversight over India’s strategic armaments.³²

While the specific composition of SASA is not publicly detailed, it is understood to include representatives from various entities involved in nuclear strategy and safety. These likely encompass personnel from the Strategic Forces Command (SFC), the Department of Atomic Energy (DAE), DRDO, and the Bhabha Atomic Research Centre (BARC), among others. This multidisciplinary composition ensures comprehensive expertise in managing and securing India’s nuclear assets.

The proposed “Nuclear Risk Review Mechanism” will need to be placed within this existing nuclear command and regulatory structure.

³⁰ Gaurav Kampani, “India’s Evolving Civil-Military Institutions in an Operational Nuclear Context,” *Carnegie Endowment for International Peace*, 30 June 2016, <https://carnegieendowment.org/research/2016/06/indias-evolving-civil-military-institutions-in-an-operational-nuclear-context?lang=en>

³¹ Gaurav Kampani, “India: The Challenges of Nuclear Operationalization and Strategic Stability,” in *Strategic Asia 2013-2014: Asia in the Second Nuclear Age*, eds. Ashley J. Tellis, Abraham M. Denmark and Travis Tanner (National Bureau of Asian Research, October 2013). The reference to Strategic Armaments Safety Authority (SASA) is originally to be found in Shyam Saran, “Weapon that has more than symbolic value,” *The Hindu*, 4 December 2021, <https://www.thehindu.com/opinion/lead/Weapon-that-has-more-than-symbolic-value/article12121573.ece>

³² Shyam Saran, “Is India’s Nuclear Deterrent Credible?” *Air Power Journal* 8, no. 2 (April-June 2013), <https://capsindia.org/wp-content/uploads/2022/09/Shyam-Saran.pdf>

RECOMMENDED NUCLEAR RISK REVIEW MECHANISM FOR INDIA

There can be little disagreement that, as a responsible nuclear-armed state balancing the “Always/Never dilemma,” India needs to formalise a Nuclear Risk Review Mechanism. The experience of the other nuclear-armed states, as discussed earlier, is indicative of the scope and necessity for such a mechanism. An isomorphic transfer of mechanisms from other nuclear-armed states will not be prudent given the unique evolution of each system. The Indian mechanism will therefore need to operate within the existing regulatory and nuclear command and control structures of the country.

The review structure would need to be multilayered as it will need to address doctrinal issues and procedural intricacies through to technical issues at the weapon design and equipment component levels. The frequency of the reviews should be reasonable, such that they do not overwhelm the existing organisations and spaced such that there is sufficient time for the application of the changes proposed to be examined and implemented.

This review mechanism will only be effective if it has a statutory status and is ordered by the NCA. The findings of the reviews could be submitted to the PC of the NCA. Confidentiality of the reviews could be decided by the PC of the NCA. Press releases regarding the commencement and completion of each review will at least ensure that the conduct of the reviews is publicly known.

PROPOSED REVIEWS AT DIFFERENT LEVELS

Doctrinal Review

At the doctrinal level, India, perhaps, has the most unambiguous written nuclear policy. However, the policy will be 25 years old in the next two years, that is, in 2028. A lot has changed in the world, both geopolitically and technologically, since the Indian Nuclear Doctrine was formally released in 2003. In India’s neighbourhood, continued nuclear sabre-rattling by Pakistan to narrow the window of India’s response to their proxy terrorist actions, the growth of the Chinese and Pakistani nuclear weapons inventories and the enhanced probability of collusion between China and Pakistan make India’s nuclear dilemma a “three-body problem.”³³ These factors need periodic consideration. The implications of EDTs on the doctrine and an internal evaluation of the

³³ The three-body problem in physics is a classic problem in celestial mechanics, describes the motion of three-point masses interacting gravitationally. While Newton’s laws of motion and universal gravitation provide the framework, finding analytical solutions for the problem’s trajectories is generally impossible. The complexity arises from the interplay of gravitational forces between all three bodies, making it a challenging problem to solve precisely. The reference here is to the three bodies; India, China and Pakistan, and the problem of predicting the future trajectories of this nuclear-armed state triad. For reference of the physics “three-body problem”, see: Govind S. Krishnaswami and Himalaya Senapati, “An Introduction to the Classical Three-Body Problem: From Periodic Solutions to Instabilities and Chaos,” *Resonance*, (January 2019), <https://www.cmi.ac.in/~govind/cv/publications/gsk-papers/3-body-reso-2019.pdf>

quantification of the “credible minimum deterrence” could also form part of this doctrinal review.³⁴

The doctrinal review could be conducted based on tasking by the PC of the NCA once every five years.³⁵ The PC could convene such a review early in its incumbency so that the ecosystem gets the maximum period to implement the directives and align to the thought process of the NCA. The review could be conducted by a team selected by the SASA and the findings presented to the PC through the EC of the NCA. The members of such a review should be from a cross-section of academics, scientists and military veterans, non-incumbents, and with previous experience in the field of nuclear doctrine or nuclear weapons and NC3 systems. The findings of the Doctrinal Review would be kept confidential.

Force Infrastructure Review

Having managed a nuclear NC3 system and a nuclear inventory for the better part of two decades, India must already have a version of a “Stockpile Stewardship Programme” in place. It could be operating as a periodic “upkeep and upgrade” exercise or a maintenance schedule. However, as the NC3 networks, warheads and missile systems start ageing, it may be prudent to institutionalise the practice of stockpile stewardship as an annual activity. This programme could be technical in nature, with obsolescence management, design reviews, life extension and upgrades being the primary focus. The exercise could be conducted under the aegis of the SASA by a standing body comprising members from DAE, DRDO and SFC. The members of this standing body will need to be incumbents and represent their respective organisations. The annual assessment could be presented to the EC of the NCA. A “Force Management Report” would also remain confidential, with a non-confidential release being made of its having been conducted, if necessary.

Fail Safe Review

At the next level, Fail-Safe Reviews – which cater for an independent assessment of the nuclear weapons ecosystem – could be conducted under orders of the PC of the NCA. The report of the findings should be presented to the PC through the EC of the NCA. The team selected by the SASA could assess the nuclear ecosystem from the perspective of the procedures in force, currency of technology in use and impact of EDTs on existing systems. It could also analyse the technical aspects of the live practice firings and NC3 exercises conducted as well as incidents or accidents that may have

³⁴ The draft doctrine leaves the decision on the actual size and composition of the nuclear arsenal to threat perceptions from the strategic environment, technological imperatives and the needs of national security. See: Manpreet Sethi, “India’s Nuclear Doctrine: The Basis for Credible Deterrence,” *Air Power Journal* 2 no. 2, (April-June 2007): 36-37, <https://capsindia.org/wp-content/uploads/2022/10/Manpreet-Sethi-3.pdf>

³⁵ The aim of the suggestion of 5 years is to ensure that each government looks at the Doctrine at least once in their period in office.

been reported in the intervening period. With no fixed periodicity, the Fail-Safe Review could be convened as required by the PC.

CONCLUSION

As a responsible nuclear-armed state, India needs to constantly balance the “Always/Never Dilemma.” India is unique in its declaration of an unambiguous nuclear doctrine and in its desire for deterrence stability despite a trying geopolitical neighbourhood. India believes that the NFU policy should be globally accepted as a practical means to reduce the risk of inadvertent use of nuclear weapons under pressure of response timelines. However, the risks arising from the dynamic geopolitical situation, introduction of destabilising EDTs, management of ageing components, need for timely replacement and newer designs of warheads and delivery systems, gaps in established SOPs as well as the availability of trained and dedicated human resource to handle these systems need to be reviewed at periodic intervals. The institution of a multilayered “Nuclear Risk Review Mechanism” ranging from the nuclear doctrinal review, obsolescence prevention, through to equipment design and procedures would be a viable step to mitigate these risks and a visible demonstration of India’s commitment to regional deterrence stability.

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ABOUT APLN

The **Asia-Pacific Leadership Network (APLN)** is a Seoul-based organization and network of political, military, diplomatic leaders, and experts from across the Asia-Pacific region, working to address global security challenges, with a particular focus on reducing and eliminating nuclear weapons risks. The mission of APLN is to inform and stimulate debate, influence action, and propose policy recommendations designed to address regional security threats, with an emphasis on nuclear and other WMD (weapon of mass destruction) threats, and to do everything possible to achieve a world in which nuclear weapons and other WMDs are contained, diminished, and eventually eliminated.



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