NATIONAL INSTITUTE FOR PUBLIC POLICY

Section I. Minimum Deterrence: Nuclear Numbers and Nuclear Danger

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Section I. Minimum Deterrence: Nuclear Numbers and Nuclear Danger

Introduction

A dominant theme among Minimum Deterrence proponents is that the United States is taking an unnecessary risk by keeping "excess" nuclear weapons in its arsenal, which they assert, "are susceptible to accident, theft or inadvertent or unauthorised use."[1] As one Minimum Deterrence proponent claims, "The more nuclear weapons and material there is around the world, the greater the chances weapons or material could be stolen by terrorists and the greater the risks of unauthorized, miscalculated, or accidental use of nuclear weapons."[2] The mere existence of these weapons, they argue, increases the nuclear danger to the United States, and the United States should take measures to reduce their number. Another example of this claim is the assertion that: "The U.S. and Russian stockpiles are on track to decline for at least the rest of this decade. As their numbers come down, so does the risk of nuclear war."[3]

Minimum Deterrence proponents, therefore, argue that the best way to reduce these nuclear dangers is to reduce the number of nuclear weapons themselves. Nuclear weapons, they argue, are part of a "complex, tightly coupled and largely automated system subject to normal, systemic and human error," which, they warn, "will, as science tells us, inevitably fail, and fail catastrophically, with unprecedented and unjustified loss of civilian life."[4]

On the surface, the asserted direct correlation between the number of nuclear weapons and the number of nuclear accidents, or crises, seems inherently logical. Minimum Deterrence proponents typically point to this correlation, and claim that "these weapons offer far more risks

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[1] James E. Doyle, "Why Eliminate Nuclear Weapons?," *Survival: Global Politics and Strategy*, Vol. 55, No. 1 (February 2013), pp. 15-16.

[2] Kingston Reif, "The Nuclear Posture Review Implementation Study," fact sheet, Center for Arms Control and Nonproliferation, updated February 11, 2013, available at http://armscontrolcenter.org/issues/nuclearweapons/articles/fact_sheet_the_nuclear_posture_review_implementation_study.

[3] Joseph Cirincione, *Nuclear Nightmares: Securing the World before it is too Late* (New York: Columbia University Press, 2013) p. 52.

[4] Doyle, "Why Eliminate Nuclear Weapons?," op. cit., pp. 15-16.

than benefits."[5] The apparent presumption is that reducing the number of nuclear weapons will necessarily decrease the risk of an accident involving a nuclear weapon.

This section examines the available data to test the proposition that there is a positive correlation between the number of nuclear weapons and the number of nuclear weapon accidents or crises involving nuclear weapons. Examining this argument is imperative because the assertion that the number of nuclear weapons is related directly to the probability of accidents and crises is a mainstay in the Minimum Deterrence narrative, and a central rationale for its recommended policy of deep nuclear reductions. The first part of this section presents a review of the Minimum Deterrence narrative concerning the correlation between nuclear numbers and nuclear accidents and crises. The second part of this section summarizes previous work on this subject which examined U.S. and Soviet data. The third part of this section examines the U.K. record of nuclear weapons accidents, and whether those events had any apparent relation to the number of U.K. nuclear weapons at the time.

As a related check on this Minimum Deterrence narrative, the fourth part of this section will examine the relationship between India-Pakistan crises and the number of nuclear weapons each country had at the time. The final section will summarize the findings, and compare them to Minimum Deterrence claims and recommendations. This report expands on the earlier work of *Minimum Deterrence: Examining the Evidence*. The authors chose to analyze the United Kingdom for this purpose because enough open-source material exists to address the relevant issues. The authors also chose to examine India and Pakistan's strategic relationship because there is sufficient data on their mutual crises to examine the linkage between crises and nuclear weapon numbers outside of the Cold War context.

[5] Barry Blechman, "Why We Need to Eliminate Nuclear Weapons – And How to Do It" as found in: Barry Blechman and Alexander Bollfrass, eds., *Elements of a Nuclear Disarmament Treaty* (Washington, D.C.: Stimson Center, January 22, 2010), pp. 8-9, available at http://www.stimson.org/images/uploads/ research-pdfs/Chap_1_Blechman__Formatted.pdf.

Minimum Deterrence

Minimum Deterrence proponents typically explain the dangers of the current U.S. force size by declaring that "excess" nuclear weapons (a term that is usually undefined or simply identified as all weapons above the ceiling they advocate, such as 100, 500, or 1,000),[6] "increase the nuclear danger without contributing to national or the world's security."[7]

What then are the policy prescriptions advanced by Minimum Deterrence proponents that are intended to reduce nuclear dangers, specifically accidents and crises? The most common prescription is that the United States can and should dramatically reduce its nuclear arsenal to achieve greater safety. The theme of reducing nuclear danger is almost always mentioned as the principal benefit of reducing the number of nuclear weapons in the U.S. arsenal.[8]

Summary of Findings from 2013 *Minimum Deterrence: Examining the Evidence*

Earlier work on the relationship between nuclear numbers and nuclear accidents and crises first appeared in *Minimum Deterrence: Examining the Evidence* in 2013. It examined the available data on U.S. and Soviet nuclear accidents and crises during the Cold War, and compared those numbers to the number of nuclear weapons each country had at the time of those accidents and crises. This comparison was intended to illustrate whether higher numbers of nuclear weapons

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[6] Tom Z. Collina, "President Needs Flexibility on Nuclear Arms Reductions," *Arms Control Today*, Vol. 4, Issue 8, (July 26, 2013), available at: http://www.armscontrol.org/issuebriefs/Presidents-Need-Flexibility-on-Nuclear-Arms-Reductions%3FTOPIC%3DNUK_REDUC.

[7] Hans M. Kristensen, Robert S. Norris, Ivan Oelrich, *From Counterforce to Minimal Deterrence: A New Nuclear Policy on the Path Toward Eliminating Nuclear Weapons* (Washington, D.C.: Federation of American Scientists and the National Resources Defense Council, April 2009), p. 3, available at http://www fas.org/pubs/_docs/ Occasional Paper7.pdf.

[8] See for example, Ivan Oelrich, "The Next Steps in Arms Control: Eliminate the Counterforce Mission," *The Bulletin of the Atomic Scientists*, Vol. 68, No. 1 (January 2012), pp. 84-85; James Cartwright, et al, *Global Zero U.S. Nuclear Policy Commission Report: Modernizing U.S. Nuclear Strategy, Force Structure and Posture* (Washington, D.C.: Global Zero, May 2012), p. 2, available at http://www.globalzero.org/files/gz_us_nuclear_policy _commission_report.pdf; and Doyle, "Why Eliminate Nuclear Weapons?," op. cit., pp. 15-16; and Blechman and Bollfrass, *Elements of a Nuclear Disarmament Treaty*, op.cit., p. 21; Ivo Daalder and Jan Lodal, "The Logic of Zero: Toward a World Without Nuclear Weapons," *Foreign Affairs*, Volume 87, No. 6 (November /December 2008), p. 84; and Steven Pifer and Michael O'Hanlon, "Moscow Should Stop Stonewalling on Arms Cuts," *The Moscow Times*, July 3, 2013, available at http://www.themoscowtimes.com/opinion/article/moscow-should-stop-stonewalling-on-arms-cuts/482605 html.

actually increased the risks as claimed in the Minimum Deterrence narrative. The historical data showed no evidence of any such correlation for U.S. or Soviet inventories.[9]

In this earlier study, accidents were defined using Department of Defense (DoD) standards, which included: non-nuclear detonation, burning of a nuclear or non-nuclear component, radioactive contamination, loss of a nuclear weapon, or a public hazard. By this definition, a DoD report in 1981 confirmed that there had been 32 accidents between 1950 and 1980. Incidents, by comparison, are often less-serious events that involved, or may have involved, nuclear weapons which were not damaged; rather, the incidents usually involved the transporting vehicle carrying the nuclear weapons being slightly damaged.[10] *Minimum Deterrence: Examining the Evidence* combined both "accidents" and "incidents" under the term "nuclear accidents" for this analysis.

Using this definition of "nuclear accidents" for both the United States and the Soviet Union, the previous study included a graphic, reproduced here in Figure 1 below, that plots nuclear accidents against the total number of nuclear weapons each nation had in its arsenal at the time. The figure shows that as the number of nuclear weapons rose for both nations over the decades, the number of accidents varies between zero and twenty, irrespective of the number of weapons at any period of time.

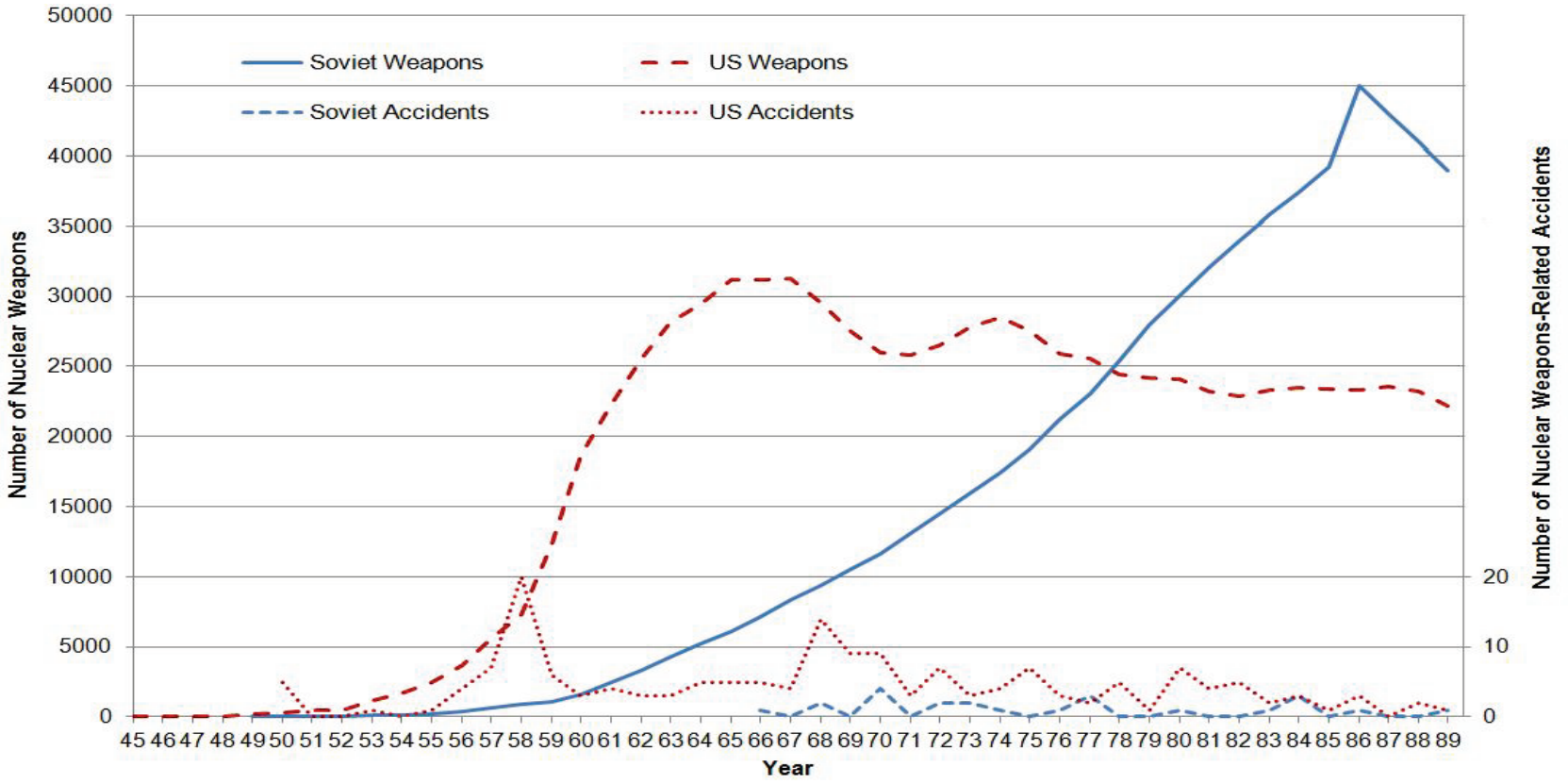
As evidence of this lack of a positive correlation, the report notes that, "the United States had the same number of accidents, five, in 1950, 1964, and 1982, while the numbers of weapons for each of those years varied considerably – roughly 300, 29,000 and 23,000 respectively."[11]

[9] Keith B. Payne and James Schlesinger, *Minimum Deterrence: Examining the Evidence*, (Fairfax, VA: National Institute Press, 2013), pp. 51-56.

[10] Payne and Schlesinger, *Minimum Deterrence: Examining the Evidence*, op. cit., p. 52.

[11] Ibid., p. 53.

Figure 1: Nuclear Numbers and Nuclear Dangers



Events Involving Increased Readiness of Nuclear Forces

The same absence of a positive correlation appeared when the number of nuclear weapons was compared to the number of crises between the United States and the Soviet Union. These crises were defined as events where one or both sides increased the readiness of their nuclear forces. During the 1980s, at the peak of the combined number of nuclear weapons in each nation's arsenal, there was only one crisis (during NATO's Able Archer Exercise), while the 1950s and 1960s saw four and five crises respectively, when each nation's combined arsenal size was much smaller.

U.K. Nuclear Numbers and Nuclear Dangers

The U.K. Ministry of Defence describes the nuclear deterrent in its 2010 Strategic Defense and Security Review as the "minimum effective nuclear deterrent" and "the ultimate means to deter the most extreme threats."[12] Minimum Deterrence advocates likewise describe the United Kingdom as the country that "has moved the furthest toward establishing a minimum nuclear deterrent…"[13] U.K. policy and posture exhibits multiple characteristics of a Minimum Deterrent force: low nuclear warhead numbers, a submarine-based monad, a reduced alert rate, and a reduced role for nuclear weapons in defense policy.[14]

The United Kingdom has separate definitions for an "accident" involving nuclear weapons versus an "incident" involving nuclear weapons. In 1992, Sir Ronald Oxburgh, Chief Scientific Adviser to the Ministry of Defence, authored a report (hereafter referred to as the "Oxburgh Report") which detailed seven accidents and twelve incidents involving U.K. weapons. Any incidents involving American weapons on U.K. soil were not included in the report. The Oxburgh Report began its list of accidents and incidents in 1960, though the United Kingdom deployed its first nuclear weapon in 1953.[15] The Oxburgh Report defines an "accident" as "an

[12] U.K. Ministry of Defence, *Securing Britain in an Age of Uncertainty: The Strategic Defence and Security Review*, (London: The Stationary Office, 2010) p. 37, available at http://www.direct.gov.uk/prod_consum_dg/groups/dg_digitalassets/@dg/@en/documents/digitalasset/dg_191634.pdf.

[13] Hans M. Kristensen and Robert S. Norris, "British Nuclear Forces 2011," *Bulletin of the Atomic Scientists*, Vol. 67, No. 5 (2011) p. 89.

[14] Ibid., pp. 89-94.

[15] It is unknown whether Sir Ronald Oxburgh used this starting point because there were no accidents or incidents from 1953-1960, or for other reasons such as insufficient data.

unplanned occurrence involving the destruction of, or damage, or suspected damage to, a nuclear weapon which has resulted in actual or potential hazard to life or property, or which may have impaired nuclear safety."[16] The Oxburgh Report refines the term "accident" by specifying two categories: "Category 1: in which there are reasonable grounds for concluding that no release of radioactive material has occurred," and "Category 2: in which a release of radioactive material has been detected, or the nature or severity of the occurrence is such that the possibility of a release cannot be excluded."[17] The Ministry of Defence is quick to add that, "There has never been a Category 2 accident involving a British nuclear weapon."[18] The Oxburgh report also defined an "incident" as "an unplanned occurrence which did not constitute an accident … but which need[ed] to be reported in the interests of safety, or because it [was] likely to attract the attention of the public or the media."[19]

In addition to the Oxburgh Report, this section also draws on U.K. nuclear weapons accidents data compiled in Shaun Gregory's book, *The Hidden Cost of Deterrence: Nuclear Weapons Accidents*.[20] While these two listings agree on nearly all of the dates of accidents and incidents, in a few instances one may not record an accident while another includes it, and vice versa. As such, all accidents and incidents (hereafter referred to as simply "accidents") from both data sets are included in the following chart.[21] These two data sets represent the most comprehensive list of U.K. nuclear accidents openly available.

Figure 2 shows a hypothetical illustration of what the U.K. experience with nuclear weapons and nuclear weapons accidents would look like according to the Minimum Deterrence narrative. If it

[16] U.K. Ministry of Defence, "Nuclear Weapons Accidents – FOI Reference: 03-02-2005-145211-024," Ministry of Defence – Directorate of Safety and Claims, February 16, 2005, Annex A, p. 1, available at http://webarchive nationalarchives.gov.uk/20121109140344/http://www.mod.uk/NR/rdonlyres/A4733622-431B-4FF4-8B74-136F953D9672/0/03022005145211024_nuclear.pdf.

[17] U.K. Ministry of Defence, "Nuclear Weapons Accidents – FOI Reference: 03-02-2005-145211-024," op. cit., Annex A, p. 1.

[18] Loc. cit.

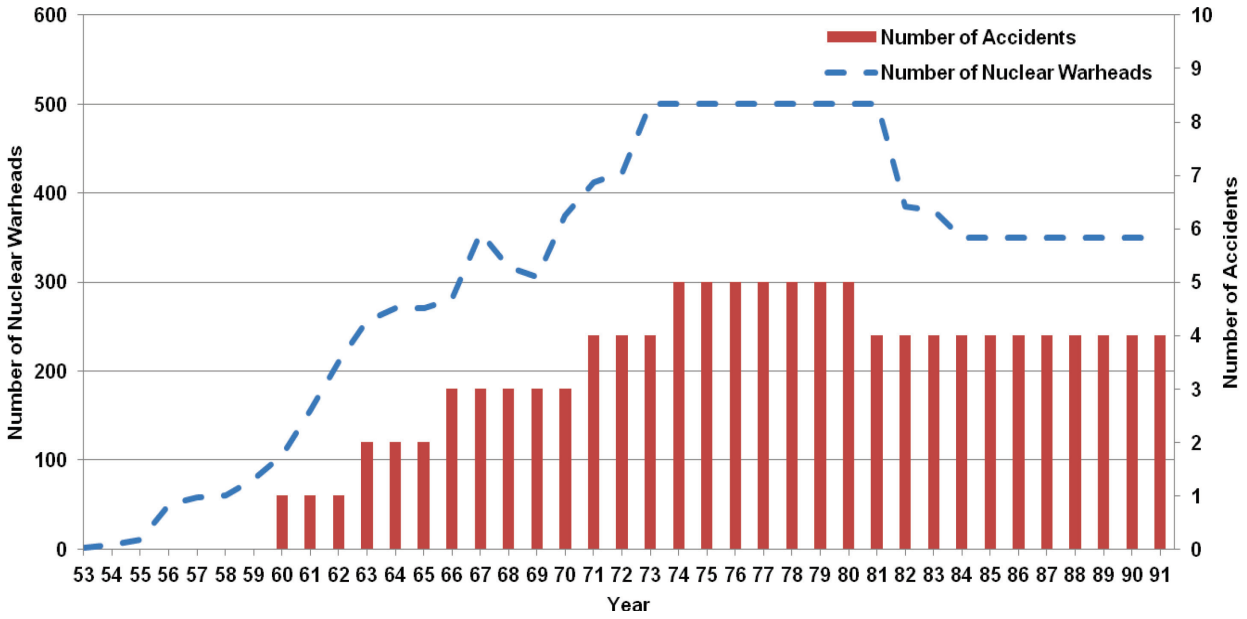
[19] Ibid., Annex A, p. 3.

[20] Shaun Gregory, *The Hidden Cost of Deterrence* (London: Brassey's (UK), 1990).

[21] The only exception is Shaun Gregory's inclusion of some post-1969 Vulcan bomber, Jaguar aircraft, and Tornado aircraft accidents and incidents. After 1969, none of these aircraft carried nuclear weapons regularly or transported them in peacetime. As such, this data set only takes into account those accidents and incidents where the transporting craft was most likely carrying, and was capable of carrying during regular operations, a nuclear weapon.

were true that the number of accidents rises commensurately with the number of weapons, then there should be a clear visual parallel in the figure where the number of accidents rises and falls proportionately with the number of weapons. Put simply, as the number of weapons rises, accidents should rise; and as the number of weapons falls, accidents should occur less often. However, the actual data, presented in Figure 3, does not resemble the hypothetical case.

Figure 2: Illustrative U.K. Experience under Minimum Deterrence Assumptions



Instead, what Figure 3 below shows is that, in reality, there is no observable correlation between nuclear numbers and nuclear accidents.

Figure 3: U.K. Nuclear Warheads and Nuclear Accidents

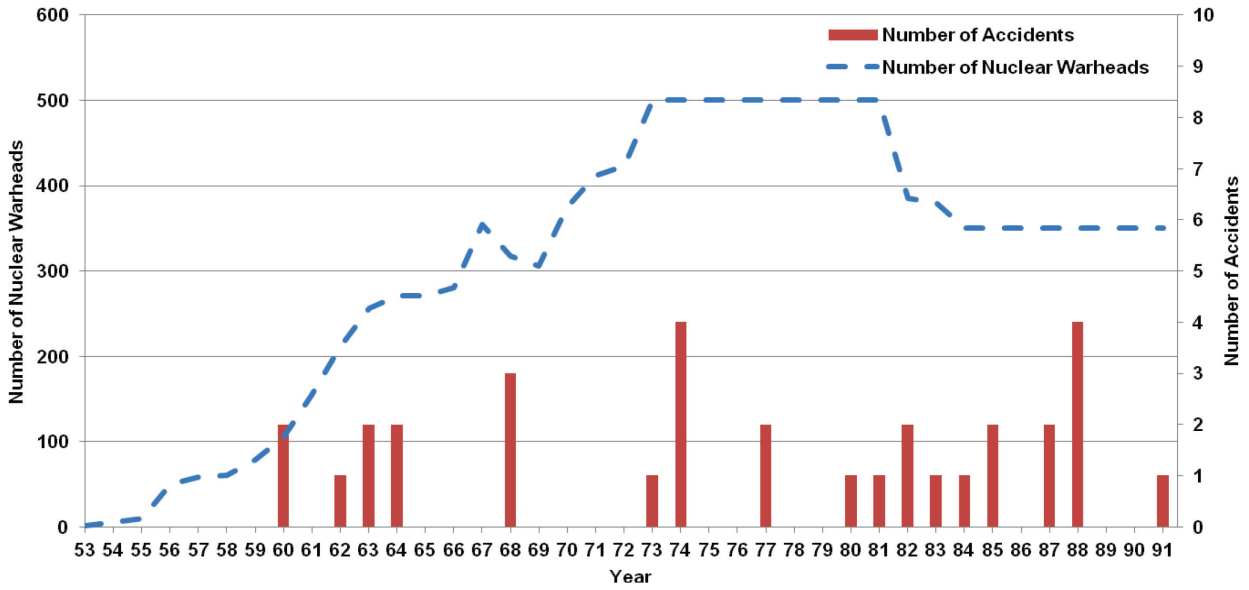


Figure 3 presents a striking picture of how, historically, the relationship between the size of the U.K. nuclear stockpile and the number of accidents differs from the Minimum Deterrence narrative: the size of the U.K. nuclear stockpile has not affected the number of accidents. Minimum Deterrence statements on the supposed correlation would suggest that during the years when the U.K. stockpile had its greatest number of warheads, there would be a corresponding rise in the number of accidents. However, as the data above show, the United Kingdom maintained its largest warhead arsenal during the 1970s, yet there were only seven accidents or incidents during that decade. In contrast, there were ten accidents during the 1960s and 14 accidents during the 1980s, both decades where the overall nuclear numbers were substantially lower than the 1970s. And while the United Kingdom experienced a spike in nuclear accidents and incidents, four, in 1974, at the height of its force numbers historically, it also experienced the same number of accidents in 1988, when its force numbers were approximately 25% lower. Also of note, after a relatively high number of accidents in 1974 and 1988, there were no recorded accidents or incidents in the following two years, further demonstrating the absence of any trend corresponding to the number of nuclear warheads.

In fact, of the 39 years covered in this study, there were 17 years that saw one or more accidents, and 22 years when no recorded accidents or incidents happened. As the graphics illustrate, there is no positive correlation between the number of weapons and the number of accidents, as

defined: a rise in accidents is not consistently found during the years when the U.K. stockpile was increasing, and a dip in the number of accidents is not consistently found during a reduction in the number of U.K. nuclear weapons.

One might assume that the United Kingdom would experience fewer accidents when it shifted to a submarine-based force from a bomber-heavy force, which retained more delivery vehicles that could suffer weather and human error-caused incidents. However, the data does not support this conclusion either. While the nature of accidents changed after 1969, when the Royal Navy began deploying nuclear-powered ballistic missile submarines (SSBNs) and assumed the bulk of the responsibility for nuclear weapons deployments,[22] the number of accidents remained relatively constant. Accidents and incidents simply shifted from events involving weapons load carriers and aircraft crashes, to missile transfers and submarine collisions. The type of accident changed but the number of accidents did not. Even after retiring the last of the WE 177 bombs in 1999 and completing the transition to a submarine-based monad, there have been multiple incidents involving U.K. SSBNs, one of the most serious being the *Vanguard* and French *Le Triomphant* collision in 2009.[23] Incidents appear to be related to delivery vehicles, and not the number of warheads. While there is no comprehensive or official list of accidents and incidents since 1991, there have been multiple media reports concerning U.K. SSBN groundings and minor collisions, which suggest the trend of small accidents and incidents continues into the present.[24]

The above data regarding the U.K. experience can be compared to the U.S. experience during the same time period. A few examples are helpful in this regard. In 1960, the United States experienced three accidents or incidents while maintaining a force of over 18,000 nuclear warheads. The United Kingdom, on the other hand, experienced two accidents during 1960 when it maintained a force of only 105 nuclear warheads. The U.K. nuclear force was barely one half

[22] Royal Air Force, "RAF Timeline 1960-1969," United Kingdom Ministry of Defence, available at http://www.raf.mod.uk/history/rafhistorytimeline196069.cfm. Also, while nuclear bombs such as "Red Beard, "Blue Steel," and the WE 177 A/B/C remained in service for the Royal Air Force and Royal Navy (the WE 177 until 1999), these bombs were not regularly deployed in peacetime after the late 1960s. The "responsibility" for regular deployment shifted from aircraft to submarines. On the composition and history of the U.K. nuclear force, see Robert S. Norris, Andrew S. Burrows, and Richard W. Fieldhouse, *British, French, and Chinese Nuclear Weapons* (Boulder, CO: Westview Press, 1994), pp. 53-66.

[23] Kristensen and Norris, "British Nuclear Forces 2011," op. cit., pp. 94-95.

[24] Loc. cit.

of one percent of the size of the U.S. force, but experienced nearly as many accidents. Lest it be thought that these accidents followed because U.K. strategic forces were still in their infancy and British personnel were inexperienced with handling nuclear weapons, this study will consider some further examples that took place well after the initial stages of the U.K. nuclear weapons program:

- In 1974, the United States experienced four accidents or incidents while maintaining a force of 28,537 warheads. The United Kingdom experienced the same number of accidents (four) in 1974, yet only had a force of 500 warheads. Numerically, the entire U.K. force made up just 1.8% of the U.S. force at the time.

- In 1977, the United States experienced two accidents or incidents while maintaining a force of 25,542 warheads. The United Kingdom experienced the same number of accidents (two) in 1977, yet only had a force of 500 warheads. Numerically, the entire U.K. force made up just 2% of the U.S. force at the time.

- In 1985, the United States experienced one accident or incident while maintaining a force of 23,368 warheads. The United Kingdom experienced two accidents (twice as many as the United States in the same year) with a force of only 350 warheads. Numerically, the entire U.K. force made up just 1.5% of the U.S. force at the time.

- In 1988, the United States experienced two accidents or incidents while maintaining a force of 23,205 warheads. The United Kingdom again experienced twice as many accidents (four) as the United States in the same year, with a force of only 350 warheads. Numerically, the entire U.K. force made up just 1.5% of the U.S. force at the time.[25]

While it is true that the United Kingdom's total number of accidents and incidents is lower than the U.S. total, it is a comparison of two completely different force structures, doctrines, and personnel. To account for these differences and still judge each country's nuclear safety record properly, another metric is needed.

This comparison between the United States and the United Kingdom's accidents and incidents experience can be taken one step further by normalizing the data and comparing the average number of accidents and incidents for each country per 1,000 warheads. This number will be called the "accident rate." While counting the number of times a country experiences a nuclear accident or incident is useful for tracking weapon safety over time, it does not give a good

[25] All data collected in, Payne and Schlesinger, *Minimum Deterrence: Examining the Evidence*, op. cit., p. 53.

indication of whether one country's safety practices are more effective than another's. Thus, the "accident rate" provides a useful estimate with a standard denomination.

To arrive at the accident rate, the authors multiplied the number of accidents by 1,000 and then divided the product by the number of warheads for that year. For example, if a country experienced 4 nuclear accidents or incidents while maintaining a force of 10,000 warheads, its accident rate would be .4 (accidents per 1,000 warheads).[26] If Minimum Deterrence assumptions are correct, a smaller force should have an accident rate that is proportionally lower than a larger force.

[26] Critics may correctly point out that the United Kingdom never reached a force of 1,000 warheads; therefore judging their accident rate using that metric is unfair. However, the accidents per 1,000 warheads ratio could just as simply be accidents per 100 warheads. As a consequence though, the U.S. numbers would be a decimal place smaller and even harder to conceptualize.

The following table presents the average "accident rate" for the United Kingdom.

Years	Average Accident Rate per 1,000 Warheads	Range of Accident Rates during Decade	Range of Number of Nuclear Weapons
1950-59	0*	0*	0 – 78
1960-69	4.84	0 – 19.05	105 – 306
1970-79	1.40	0 – 8	375 – 500
1980-89	3.75	0 – 11.43	350 – 500

* The United Kingdom experienced no recorded accidents or incidents during this time period, therefore the accident rate is zero.

The U.K. accident rates vary significantly year to year, however, a 10-year average smoothes out some of the variance. For example, in the 1960s, the United Kingdom experienced zero accidents in some years and multiple accidents in other years, including a peak of three in 1968. In 1960, the United Kingdom had an accident rate of 19.05 per 1,000 warheads because of its relatively high number of accidents and low number of warheads. In other words, even though the United Kingdom had a much lower warhead level than the United States at the time, it experienced more accidents per number of warheads. Readers may note that the U.K. accident rate actually increased from the 1970s to the 1980s. Various factors could be responsible for this trend and this analysis was not able to determine the causal factors. For comparison's sake, it is useful to look at the U.S. accident rate during the same time periods as the United Kingdom.

The following table presents the average "accident rate" for the United States.

Years	Average Accident Rate per 1,000 Warheads	Range of Accident Rates during Decade	Range of Number of Nuclear Weapons
1945-49	0*	0*	0 – 170
1950-59	2.36	0 – 16.72	299 – 12,298
1960-69	0.20	0.11 – 0.47	18,638 – 27,552
1970-79	0.18	0.04 – 0.35	24,138 – 28,537
1980-89	0.12	0 – 0.29	22,217 – 24,104

* The United States experienced no recorded accidents or incidents during this time period, therefore the accident rate is zero.

The historical data represented in the above table show a steady decline in the U.S. accidents per 1,000 warheads rate over four decades. The disproportionately high accident rate during the 1950s is partially explained by the particularly disastrous year of 1958 when the United States experienced 20 accidents or incidents with a comparatively smaller force of about 7,000 warheads. Yet even with such a spike in accidents and incidents, the second decade of the U.S. nuclear program compares favorably to the second decade of the U.K. nuclear program. In fact, the U.S. accident rate per thousand warheads is much smaller than the U.K. accident rate in most cases.

The Question of Correlation

There appear to be multiple possible reasons why there is no direct correlation between the number of nuclear accidents or incidents and the number of warheads a nation has during any period of time. Some accidents occurred due to simple human error: a Land Rover reversing direction and hitting a nuclear weapon load carrier (U.K., April 1973), or a crane operator bumping a missile against some trailer supports (U.K., December 1987). Other accidents happened due to mechanical defect or failure: brake failures on nuclear weapons load carriers (U.K., 1960, 1963, 1985), or the rear trailer of a nuclear weapon transport becoming unhitched (U.K., 1963). Still other accidents happened during routine transport: nuclear weapons load carriers in traffic accidents (U.K., 1960, 1983, 1987, 1988) or during a weapons transfer (At sea, 1982). Nuclear weapons accidents and incidents can even occur via the involvement of private vehicles: a minor collision between a non-U.K. vessel and a moored U.K. vessel (Hong Kong, 1988). And while these accidents occurred at different times, in different circumstances, and in different places, the common theme is the same: the nuclear warhead itself did not malfunction. The problem almost always involved either human error or mechanical error related to the delivery vehicle, unrelated to the number of nuclear weapons.

The question remains: what causes nuclear weapons accidents if it is not the number of weapons themselves? While it is outside the scope of this study to examine this question in detail, a few preliminary points can be advanced. First, it seems that the delivery vehicle type and operational procedures can make a difference in the number of nuclear weapon accidents. As shown above,

U.K. and U.S. accident rates appear to have been lower (temporarily in the U.K. case) after the late 1960s when U.S. Strategic Air Command (SAC) ended its peacetime airborne nuclear alerts and the United Kingdom halted "routine movement of operational nuclear weapons by air…"[27]

Certain types of accidents, such as bomber crashes, were reduced by ending peacetime airborne alert and the U.K. policy of reducing the movement of nuclear weapons "to the minimum consistent with military requirements."[28] A recently declassified Sandia National Lab report observes: "Since accidents usually occur during human operation of equipment, most of the accidents have taken place during ground- and airborne-alert operations. Of the 32 [U.S.] accidents, 29 have been with weapons which were in Air Force custody. This does not imply a cavalier attitude on the part of the Air Force, but rather that the preponderance of alert-ready weapons have been associated with Air Force systems."[29]

Finally, the U.S. experience shows that lessons learned can indeed reduce the number of nuclear weapons accidents.[30] Nevertheless, one conclusion that can be deduced from the evidence is that even with the broadest possible definition of accidents and incidents, there is no discernable positive correlation between the number of nuclear weapons and the number of nuclear accidents: the apparent historical record is contrary to the Minimum Deterrence claim that reducing the number of U.S. nuclear weapons will reduce accidents.

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[27] Gregory, *The Hidden Cost of Deterrence*, op. cit., p. 26.

[28] Loc. cit. An example of two such accidents that may have been avoided via the policy of de-alerting are: 1) A B-47 on alert at Greenham Common USAF Base in England was struck by an incoming aircraft while sitting on the runway. 2) A B-52 carrying nuclear weapons collided with another aircraft over the Spanish town of Palomares in 1966.

[29] R. N. Brodie, *A Review of the US Nuclear Weapon Safety Program – 1945 to 1986 (U)* (Albuquerque, NM: Sandia National Laboratories, February 1987), p. 13, available at http://www2.gwu.edu/~nsarchiv/nukevault/ebb475/docs/doc%206%20sandia%201986%20(1).pdf.

[30] R.N. Brodie notes in his review of the U.S. Nuclear Weapon Safety Program: "Through May 1986, the US has had 32 such accidents, all now acknowledged to the public. Thirty-one of these accidents occurred either in 1968 or before." Brodie, *A Review of the US Nuclear Weapon Safety Program – 1948 to 1986 (U)*, op. cit., p. 13. See also, pp. 15-20.

A Note on Recent Incidents

Recent mishaps involving U.S. strategic forces include: accidentally shipping sensitive missile components to Taiwan (2006), conducting an unauthorized nuclear weapons transfer within the United States (2007), leaving a blast door open against regulation (2013), and cheating on job-proficiency tests (2013). With the exception of the 2007 unauthorized weapons transfer, these episodes would not constitute "accidents" or "incidents" involving a nuclear warhead as they are defined by the United States and the United Kingdom; yet, this is not cause to dismiss them as irrelevant or unimportant. Indeed, the Department of Defense, under both the Bush and Obama Administrations, conducted investigations into the root causes of these events. The findings have been strikingly similar.

The late former Secretary of Defense James Schlesinger led a task force to investigate the causes of the 2006 accidental shipping of missile components and the 2007 unauthorized weapons transfer. The Task Force's product, *Report of the Secretary of Defense Task Force on DoD Nuclear Weapons Management Phase I*, cited multiple reasons for the failures within the Air Force: "Lacking a complete understanding of the importance of the nuclear mission, the Air Force has experienced instances where personnel have failed to maintain discipline in following procedures, and some Airmen do not view the nuclear mission as vital,"[31] and "Air Force leaders failed in their leadership responsibilities to shift priorities and adjust policies and resources in ways needed to maintain robust nuclear stewardship, resulting in the inattention that led to the Minot-Barksdale and Taiwan incidents."[32] The Schlesinger Task Force acknowledged that "nuclear weapons play a less central and visible role in U.S. national security strategy than in the past," but their role is nevertheless "an indispensible contribution to the security of the United States and its allies."[33] The Schlesinger Task Force summarized the Air Force's two-fold failures:

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[31] James R. Schlesinger, Chairman, Secretary of Defense Task Force on DoD Nuclear Weapons Management, *Report of the Secretary of Defense Task Force on DoD Nuclear Weapons Management Phase I: The Air Force's Nuclear Mission* (Washington, D.C.: Department of Defense, September 2008) p. 3, available at http://www.defense.gov/pubs/phase_i_report_sept_10.pdf.

[32] Loc. cit.

[33] Ibid., p. 29.

> First, in the years following the end of the Cold War, senior Air Force leaders devalued nuclear capabilities. Second, they failed to acknowledge and did not anticipate the full consequences of their decisions, especially in the air-breathing leg of the nuclear triad. Although the size and variety of Air Force nuclear capabilities declined in accordance with national priorities, it was incumbent on the Air Force leadership to retain the enduring institutional underpinning that gives nuclear weapons their effectiveness as a deterrent. Senior Air Force leaders failed to adjust policies, shift priorities, or support key nuclear assets, thus contributing to the decline of the nuclear mission.[34]

Importantly, the Schlesinger Task Force concluded that these events took place amidst a large reduction in the number of operationally deployed warheads, which "did not result in a proportional reduction in the complexity of the nuclear enterprise…"[35] In fact, contrary to Minimum Deterrence assertions, the Schlesinger Task force found that accident reduction does not follow from "reliance on fewer delivery systems and warheads."[36]

Only a few years after the Schlesinger Task Force report was published, issues surfaced again in the Air Force with allegations of improper behavior at a secure missile base (2013) and cheating on job-proficiency exams (2013). Secretary of Defense Hagel ordered a review of these incidents and Secretary of the Air Force Deborah Lee James responded with a preliminary report on why these events occurred, echoing many of the points made in the Schlesinger Task Force report. Secretary James' report explains that, "Nuclear Airmen perceive the nuclear mission is no longer valued by either the Nation or the Air Force."[37] She goes on to say that this feeling is particularly strong in the ICBM force, "as public debates question the utility of the nuclear force in general and ICBMs in particular."[38]

Secretary James' report also notes that, "the perception that those outside the mission do not value their work has had a corrosive effect on the force"[39] leading Airmen "to view service in the

[34] Schlesinger, *Report of the Secretary of Defense Task Force*, op. cit., p. 29.
[35] Ibid., p. 25.
[36] Loc. cit.
[37] Deborah Lee James, "Subject: Report on Nuclear Deterrence Mission," Info Memo to Secretary of Defense, (Washington, D.C.: Secretary of the Air Force, March 27, 2014), p. 1.
[38] Loc. cit.
[39] Ibid.

nuclear mission as a 'dead-end' career."[40] Secretary James in separate interview explained that while senior Air Force leadership "has stressed the priority of the nuclear mission over the last several years,"[41] "we didn't always put our money where our mouth is when it comes to saying this is the No. 1 mission."[42] The report to the Secretary of Defense also noted that there was a "diminished understanding of deterrence across both the nuclear enterprise and the overall Air Force, even among senior leaders."[43] These findings from the Bush and Obama administrations on the causes of the mishandled situations listed above are markedly similar.

Ironically, the policies recommended by Minimum Deterrence proponents may in fact contribute to the prospect of accidents by lowering the priority attributed to nuclear weapons. Secretary James observed that, "While Air Force senior leadership has stressed the priority of the nuclear missions over the last several years, these words appear to ring hollow to the nuclear force in the face of the national debate…"[44] Secretary James continues: "Much of the current debate has focused on reducing the role of nuclear weapons in national security and on reducing nuclear forces."[45] And, indeed, Minimum Deterrence proponents consistently identify the goal of devaluing of nuclear weapons and reducing the role and size of the U.S. nuclear arsenal. In an effort to cut the number of nuclear weapons the United States retains, Minimum Deterrence proponents declare that the role of nuclear weapons should be "minimized,"[46] or "drastically reduce[d],"[47] until their purpose becomes a "self-cancelling mission."[48] They hope to "minimize the salience"[49] and "lessen the legitimacy"[50] of nuclear weapons. According to the Schlesinger Task Force and Secretary James' report, these Minimum Deterrence recommendations regarding

[40] Ibid, Tab A, p. 3.

[41] Ibid, Tab A, p. 2

[42] As quoted in, Robert Burns, "Why nukes keep finding trouble: They're really old," *Associated Press*, July 8, 2014, available at http://bigstory.ap.org/article/why-nukes-keep-finding-trouble-theyre-really-old.

[43] James, "Subject: Report on Nuclear Deterrence Mission," Tab A, p. 3.

[44] Ibid., Tab A, p. 2.

[45] Loc. cit.

[46] Kristensen, Norris, and Oelrich, *From Counterforce to Minimal Deterrence*, op. cit., p 22.

[47] Bruce G. Blair, et al., *Toward True Security* (Cambridge, MA: Union of Concerned Scientists, February 2008), p. 1, available at http://www.ucsusa.org/assets/documents/nwgs/toward-true-security.pdf.

[48] Kristensen, Norris, and Oelrich, *From Counterforce to Minimal Deterrence*, op. cit., p 22.

[49] Sidney D. Drell and James E. Goodby, *What are Nuclear Weapons For? Recommendations for Restructuring U.S. Strategic Nuclear Forces* (Washington, D.C.: Arms Control Association, October 2007), p. 1, available at http://www.armscontrol.org/pdf/20071104_Drell_Goodby_07_new.pdf.

[50] Kristensen, Norris, and Oelrich, *From Counterforce to Minimal Deterrence*, op. cit., p 21.

the U.S. nuclear force would appear to contribute to the difficulty of maintaining a highly skilled force needed to prevent the mishandling of nuclear weapons.

Summary

Despite having one of the smallest national nuclear arsenals, a low standing alert rate, and a qualified Minimum Deterrence policy, the United Kingdom experienced higher accident rates than the United States and its nuclear numbers played no apparent role in the total number of accidents during any time period. There is no evidence from the first four and a half decades of the U.K. nuclear weapons program to support the Minimum Deterrence assertion of a positive correlation between the number of nuclear weapons and the number of nuclear weapons accidents or incidents. It is ironic, therefore, that Minimum Deterrence proponents often hold up the U.K. force as an example of the preferred nuclear posture. Its record of accident rates compared to the United States, according to the available evidence, does not suggest that a Minimum Deterrence type-force is preferable to the current U.S. force size if the goal is to reduce the number of accidents or incidents.

India-Pakistan Nuclear Weapon Numbers and Crises

Minimum Deterrence proponents also often assert that a Minimum Deterrence nuclear force would reduce the possibility of nuclear crises or provide more stability in a crisis because its inherently low nuclear numbers would not be provocative. The following is a sampling of Minimum Deterrence quotes on this issue:

- "Moreover, during those crises the existence of nuclear weapons escalated the level of tension and put decisionmakers in situations where the probability of miscalculation and human error was increased. This raises the possibility that the traditional view of nuclear deterrence as a crisis stabiliser may be incorrect."[51]

- "As nuclear arsenals in India and Pakistan grow, so do the risks of war by design, miscalculation, or accident."[52]

[51] Doyle, "Why Eliminate Nuclear Weapons?," op. cit., p. 13.

[52] Cirincione, *Nuclear Nightmares: Securing the World before it is too Late*, op. cit., p. 129.

- "Nuclear weapons might have some transitional missions on the way toward zero, but the number needed to fulfill basic nuclear deterrence is not large and excess weapons increase the nuclear danger without contributing to national or the world's security."[53]

- "The U.S. and Russian stockpiles are on track to decline for at least the rest of this decade. As their numbers come down, so does the risk of nuclear war."[54]

To test these Minimum Deterrence claims, in *Minimum Deterrence: Examining the Evidence*, the authors reviewed the number of crises when the United States and the Soviet Union increased the readiness level of their nuclear forces and compared those findings to the number of nuclear weapons each nation had at the time. The review found no apparent positive correlation. It appears that neither the number of weapons nor the trend of the stockpile (growing or shrinking) had a perceivable effect on the number of crises where the nuclear readiness level changed. For example:

> Six events took place during a period (1956-1962) when the U.S. nuclear arsenal grew rapidly and the smaller Soviet arsenal also increased, although at a slower rate. But there was the same number of events, two, in 1958, when the United States had a little over 7,000 weapons and the Soviet Union had somewhat fewer than 1,000, as there was in 1961-1962, when the U.S. count exceeded 20,000 weapons and the Soviets had roughly 3,000. While the alert of some Soviet nuclear forces during the 1968 Moscow-led invasion of Czechoslovakia occurred as the number of Soviet nuclear weapons was increasing, the U.S. nuclear alert the next year, which was intended to give an impetus to the Vietnam peace negotiations, took place when the number of U.S. nuclear weapons was declining.[55]

As further evidence for the lack of a positive correlation, the United States and the Soviet Union increased the readiness level of their nuclear forces more often in the 1950s and early 1960s, when the combined arsenals sizes were relatively smaller than in the late 1960s, the 1970s and 1980s, when the combined arsenal sizes were relatively larger.[56]

This section expands on these earlier findings by reviewing recent crises between India and Pakistan to assess the asserted linkage between weapon numbers and the probability of acute crises. This section reviews the seven crises India and Pakistan experienced from the time when

[53] Kristensen, Norris, and Oelrich, *From Counterforce to Minimal Deterrence*, op. cit., p. 3.

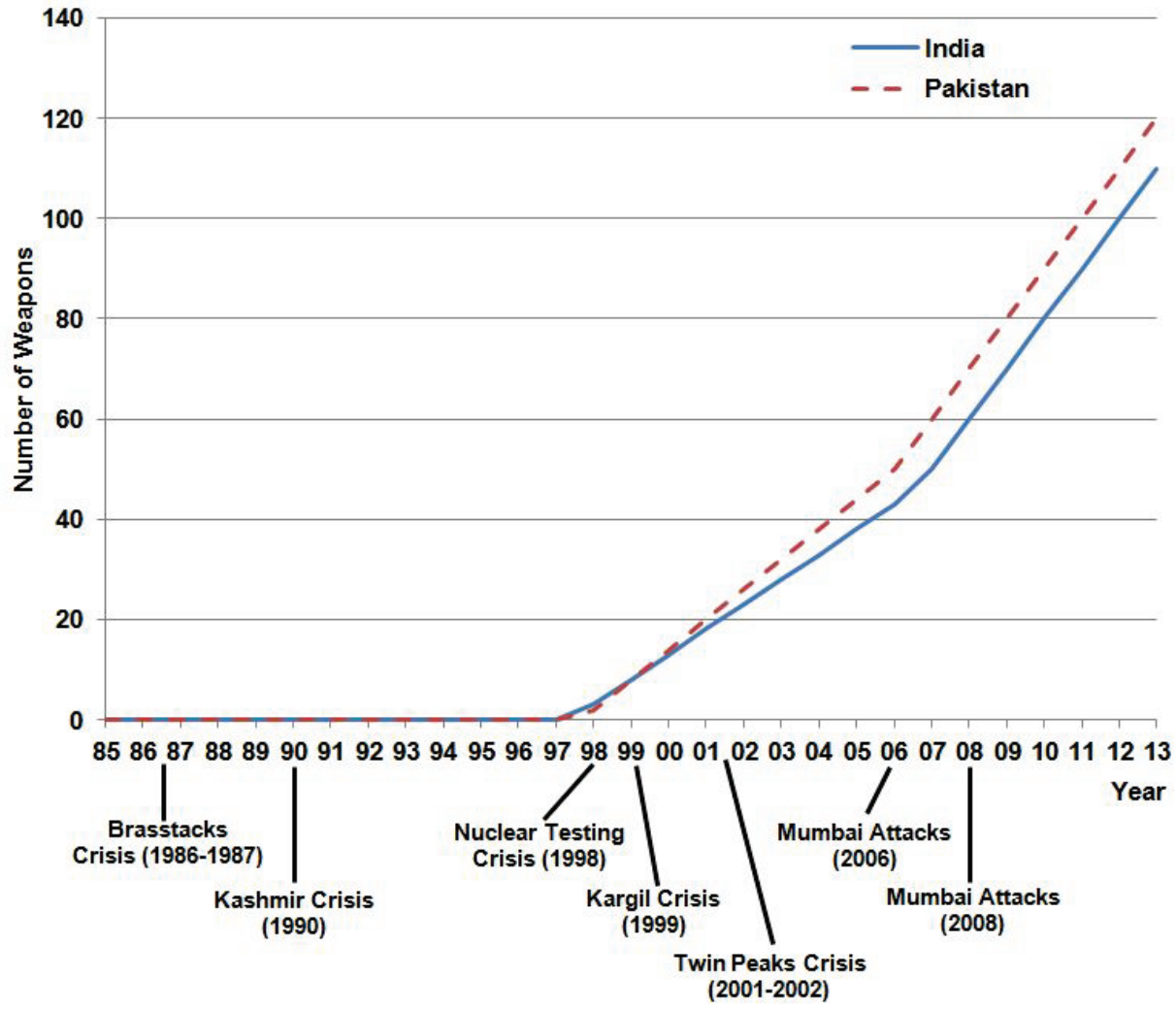
[54] Cirincione, *Nuclear Nightmares*, op. cit., p. 52.

[55] Payne and Schlesinger, *Minimum Deterrence: Examining the Evidence*, op. cit., p. 52.

[56] Ibid., p. 53.

their nuclear weapons programs were reaching the initial capability to produce weapons until the present day: the Brasstacks Crisis (1986-1987), the Kashmir Crisis (1990), the Nuclear Testing Crisis (1998), the Kargil Crisis (1999), the Twin Peaks Crisis (2001-2002), the 2006 Terrorist Attack in Mumbai, and the 2008 Terrorist Attack in Mumbai. Figure 4 below shows each crisis India and Pakistan experienced from 1985 until the present, along with the number of weapons. Each crisis will is examined in greater detail following Figure 4.

Figure 4: India and Pakistan Nuclear Numbers and Nuclear Crises



There are two important points to note here. First, during the first five crises, India and Pakistan either had only a latent weapons capability and never more than 30 deliverable weapons. Second, the two Mumbai terrorist attacks were not crises where nuclear use was explicitly threatened, but

rather they were crises, many have argued, precipitated by Pakistan's use of its "nuclear shield" to provide cover for terrorist strikes against India supported by Pakistan. This was the same tactic Pakistan used only a few years earlier in previous crises. The number of nuclear weapons that Pakistan had during 2006 and 2008 appears to have made no difference in its strategy.

As Figure 4 illustrates, there appears to be no positive correlation between the number of nuclear weapons and the number of crises that India and Pakistan experienced. In fact, the first two crises happened when each country had only a nascent nuclear capability. Also, India and Pakistan's arsenal size was no greater than 20 weapons for the Nuclear Testing Crisis (1998), the Kargil Crisis (1999) and the Twin Peaks Crisis (2001-2002). And, as discussed below, there is very little evidence that either Pakistan or India seriously considered readying their nuclear forces during the two Mumbai attacks in 2006 and 2008.

The Brasstacks Crisis, 1986-1987

In 1986, India began very large military exercises named *Operation Brasstacks* (alternatively spelled Brass Tacks). These exercises alarmed the Pakistani leadership who misperceived the Indian maneuvers as the pretext for war, so they in turn began their annual military exercises close to the border region. India and Pakistan eventually cut their military-to-military hotline as both sides signaled their respective resolve to each other. With the help of U.S. intermediaries, however, the crises de-escalated as both sides withdrew from the border.[57] Both countries, at the time, had nascent nuclear capabilities. Sumit Ganguly and S. Paul Kapur state that, "Although neither country possessed a nuclear arsenal or had tested nuclear weapons, both India and Pakistan probably could have assembled nuclear devices in short order if the need to do so had arisen."[58] Also, A.Q. Khan, considered by many to be "the Father of the Pakistani bomb," confirmed to a journalist in a story, published after the crisis, that Pakistan indeed had an operational weapon at the time of the crisis.[59]

[57] Summary of events recounted in Mark Fitzpatrick, *Overcoming Pakistan's Nuclear Dangers* (London: Routledge, 2014), pp. 51-54.

[58] Sumit Ganguly and S. Paul Kapur, *India, Pakistan, and the Bomb: Debating Nuclear Stability in South Asia* (New York: Columbia University Press, 2010) p. 19.

[59] Fitzpatrick, *Overcoming Pakistan's Nuclear Dangers*, op. cit., p. 53.

The Kashmir Crisis, 1990

By 1990, Pakistan had become quite adept at supporting separatist groups in the Kashmir and Punjab regions without triggering an overwhelming response by India. Local politics in those regions became violent when India disbanded the State Assembly and rushed military units to quell the uprising. Pakistan countered by deploying its own military units to the India-Pakistan border and a stand-off ensued. At this time, both Indian and Pakistani air forces went on alert, while Pakistan may have started transporting its nuclear weapons for its American-made F-16s.[60] After multiple bilateral and multilateral meetings, the crisis ended with a mutual withdrawal.[61] One analyst contends, "Both sides had a covert nuclear capability, known to the other side,"[62] however it is unclear exactly how many weapons each side had at the time.

The Nuclear Testing Crisis, 1998

On May 11, 1998, India tested three nuclear weapon devices followed by two more tests on May 13.[63] In response, Pakistan tested five nuclear devices on May 28, 1998, followed by an additional test on May 30.[64] This event is included in this study even though there is disagreement as to whether it should be classified as a "crisis" since there was no imminent threat of violence voiced by either side.[65] In fact, before the tests, India and Pakistan were enjoying a period of "relative stability," and "In the wake of the 1998 tests, many observers believed that this relatively peaceful trend would continue."[66] Since both countries retained

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[60] Fitzpatrick, *Overcoming Pakistan's Nuclear Dangers*, op. cit., p. 55.

[61] Summary of events in this crisis are taken from Fitzpatrick, *Overcoming Pakistan's Nuclear Dangers*, op. cit., pp. 54-56.

[62] Fitzpatrick, *Overcoming Pakistan's Nuclear Dangers*, op. cit., p. 55.

[63] Federation of American Scientists, "Nuclear Weapons: India," updated November 8, 2002, available at https://www.fas.org/nuke/guide/india/nuke/.

[64] Federation of American Scientists, "Nuclear Weapons: Pakistan," updated December 11, 2002, available at https://www.fas.org/nuke/guide/pakistan/nuke/.

[65] The following two sources describe the 1998 nuclear tests as crises: The University of Maryland Center for International Development and Conflict Management, International Crisis Behavior Project, available at http://www.cidcm.umd.edu/icb/dataviewer/; and Michael Krepon and Julia Thompson, eds., *Deterrence Stability and Escalation Control in South Asia* (Washington, D.C.: Stimson Center, 2013), p. 14. The following two sources did not list the 1998 nuclear tests as a crisis: Ganguly and Kapur, *India, Pakistan, and the Bomb*, op. cit., pp. 46-54; and Fitzpatrick, *Overcoming Pakistan's Nuclear Dangers*, op. cit.

[66] Ganguly and Kapur, *India, Pakistan, and the Bomb*, op. cit., pp. 46-47.

fewer than 10 warheads by the end of 1998,[67] it would strain credulity to believe that the number of nuclear weapons caused or worsened the crisis.

The Kargil Crisis, 1999

The Kargil Crisis was precipitated by Pakistani paramilitary forces crossing the Line of Control (LoC) and taking up positions in Indian territory during the winter of 1998. By May 1999, Indian forces mounted a large counterattack using artillery and air power, though they were careful not to cross the LoC. After two months of fighting, however, Pakistani Prime Minister Nawaz Sharif agreed to a withdrawal of his troops in July 1999.[68]

The Kargil Crisis became all the more serious because just one year before, India and Pakistan had tested their nuclear weapons at nearly the same time. As one analyst notes, "between 26 May and 30 June Indian and Pakistani officials and leaders exchanged direct or indirect nuclear threats no fewer than 13 times, almost evenly divided."[69] There are multiple reports that both India and Pakistan readied their nuclear forces for use during the crisis; however leaders of both countries officially deny it.[70] According to one report, at the end of 1999, India and Pakistan both possessed eight warheads each.[71]

The Twin Peaks Crisis, 2001-2002

The Twin Peaks Crisis actually constitutes two crises where one fed into the other. The first part of the Twin Peaks Crisis began when terrorists attempted a massacre at the Indian Parliament on December 13, 2001. Some Indian security personnel were killed in the attack, and as a response, India launched *Operation Parakram*, which mobilized half a million troops on the India-Pakistan

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[67] Hans M. Kristensen and Robert S. Norris, "Global Nuclear Weapons Inventories, 1945-2013," *Bulletin of the Atomic Scientists*, Vol. 69, No. 5 (September 2013), p. 78.

[68] Summary of events can be found in: Fitzpatrick, *Overcoming Pakistan's Nuclear Dangers*, op. cit., pp. 56-59; and The University of Maryland Center for International Development and Conflict Management, International Crisis Behavior Project, available at http://www.cidcm.umd.edu/icb/dataviewer/.

[69] Fitzpatrick, *Overcoming Pakistan's Nuclear Dangers*, op. cit., pp. 57-58.

[70] Ibid., pp. 58-59.

[71] Kristensen and Norris, "Global Nuclear Weapons Inventories, 1945-2013," op. cit., p. 78.

border. Pakistan answered by also mobilizing its military on the border, which resulted in a tense stand-off. The crisis was temporarily de-escalated when Pakistani President Pervez Musharraf outlawed some terrorist groups operating in Pakistan while U.S. Secretary of State Colin Powell helped convince India not to invade. The peace was short-lived however, because Pakistani terrorists attacked an Indian army base in Jammu on May 14, 2002. It was only through more intense U.S. diplomatic intervention and Pakistani promises to "permanently" end terrorist activity on the border that the crisis eventually ended.[72]

Again, however, there is little official word from either government about the role that nuclear weapons played in the crisis.[73] Secretary of State Colin Powell recalled his actions during the crisis in a recent interview:

> "And I remember, during a crisis between India and Pakistan (in 2002), calling the Pakistani president (Pervez Musharraf) and saying to him, "You and I both know you couldn't use these [nuclear weapons]. You want to be the country or the leader who, for the first time since August of 1945, has used these weapons? Go look at the pictures again, of Hiroshima and Nagasaki! And you want to do this, or even think about it?"
> Of course, the answer from the Pakistani president was, "No, no, no, no." The same was true of India. And they stepped back, and the crisis was over."[74]

As one analyst notes, "Unlike previous crises, nuclear saber-rattling was overt and direct from the beginning and throughout the stand-off. Both countries had conducted ballistic-missile tests and deployed nuclear-capable missile systems."[75] By the end of 2002, India reportedly possessed 23 nuclear weapons while Pakistan possessed 26.[76]

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[72] Summary of events taken from: Ganguly and Kapur, *India, Pakistan, and the Bomb*, op. cit., pp. 54-56; and Fitzpatrick, *Overcoming Pakistan's Nuclear Dangers*, op. cit., pp. 59-63; and The University of Maryland Center for International Development and Conflict Management, International Crisis Behavior Project, available at http://www.cidcm.umd.edu/icb/dataviewer/.

[73] Fitzpatrick, *Overcoming Pakistan's Nuclear Dangers*, op. cit., p. 63.

[74] Colin Powell, "Interview/ Colin Powell: Nuclear Option Suicidal for North Korea," *The Asahi Shimbun*, July 11, 2013, available at http://ajw.asahi.com/article/views/opinion/AJ201307110007.

[75] Fitzpatrick, *Overcoming Pakistan's Nuclear Dangers*, op. cit., p. 63.

[76] Kristensen and Norris, "Global Nuclear Weapons Inventories, 1945-2013," op. cit., p. 78.

The Mumbai Attacks, 2006, 2008

In July 2006, the Pakistan-supported terrorist groups Lashkar-e-Toiba and Jaish-e-Mohammed bombed commuter trains in Mumbai, India, killing approximately 180 people.[77] In November 2008, Lashkar-e-Toiba struck Mumbai again in a coordinated attack over 60 hours that killed over 170 people.[78] There is disagreement on whether to code these two attacks as crises since India took very little military action in response each time, though the means of escalation were available.[79] These crises are included in this section so that all data may be considered.

The common thread in both the attacks is Indian restraint. In response to the 2006 Mumbai attacks, S. Paul Kapur states that "The Indians took no rhetorical or military steps to threaten to attack Pakistan as they did during the 2001-2002 crisis."[80] Likewise, in response to the 2008 Mumbai attacks, "New Delhi refrained from initiating any military action."[81] There is very little credible evidence that either country raised the alert levels for their nuclear forces during or after either attack; and there is certainly no evidence that the number of either country's weapons played any role in their responses to the attacks.

Summary of India-Pakistan: Nuclear Weapon Numbers and Crises

Minimum Deterrence proponents' claim that the more nuclear weapons a country possesses the greater the risk of instability during a crisis and the greater risk of crises. If so, then the examination above should have found that India and Pakistan were less susceptible to crises when their force numbers were low. However, the data above show the opposite. Despite having very low force numbers, India and Pakistan were involved in multiple crises with each other, precisely the outcome Minimum Deterrence proponents claim will be less likely with low or very low force numbers. If the number of nuclear weapons did have a role to play in causing a crisis,

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[77] Ganguly and Kapur, *India, Pakistan, and the Bomb*, op. cit., p. 72.

[78] Fitzpatrick, *Overcoming Pakistan's Nuclear Dangers*, op. cit., p. 64.

[79] Ganguly and Kapur do not code the 2006 Mumbai attack as a crisis, Fitzpatrick only codes the 2008 Mumbai attack as a crisis, Krepon and Thompson code both the 2006 and 2008 attacks as crises, and the Center for International Development and Conflict Management does not code either attack as a crisis.

[80] Ganguly and Kapur, *India, Pakistan, and the Bomb*, op. cit., p. 73.

[81] Fitzpatrick, *Overcoming Pakistan's Nuclear Dangers*, op. cit., p. 64.

then there should be a strong correlation between fewer numbers and fewer crises. What the evidence shows, however, is a much more nuanced view of deterrence at low nuclear numbers. The origin and outcome of crises between India and Pakistan appears to be much more dependent on their domestic security policy, internal political divisions, and outside diplomatic intervention than it is on the number of nuclear weapons.

Further, there are three more reasons to doubt there is a positive correlation between the number of nuclear weapons and the number of crises a nation will experience. First, Indian and Pakistani nuclear forces, as shown in Figure 4, have increased in size at a fairly steady pace for 25 years; yet there appears to be no observable parallel rise in the number of crises between the two countries. India and Pakistan experienced three major crises in five years (1998-2002), however in the following eleven years they only experienced two crises (2003-2013). Despite an approximately 400% increase in India's and Pakistan's nuclear force size since 2003,[82] there appears to be no discernable concurrent rise in the number of crises, as Minimum Deterrence assumptions would predict.

A second possible reason why there seems to be no positive correlation between the number of nuclear weapons and the number of crises is the fact that the trend lines for India and Pakistan's nuclear force sizes and capabilities point upwards, while crises appear to be becoming less common with time. India and Pakistan experienced two crises while maintaining a nuclear capability (Brasstacks and Kashmir), three crises during the initial deployment stages (Nuclear Testing, Kargil, and Twin Peaks), and two crises while expanding their established strategic forces (Mumbai Attacks). It seems that even the rapid modernization[83] of India and Pakistan's nuclear forces since the last crisis in 2008 has not been enough to trigger a crisis, as Minimum Deterrence assumptions would predict.

[82] Kristensen and Norris, "Global Nuclear Weapons Inventories, 1945-2013," op. cit., p. 78.

[83] "India and Pakistan continue to develop new systems capable of delivering nuclear weapons and are expanding their capacities to produce fissile material for military purposes." Stockholm International Peace Research Institute (SIPRI), "16 June 2014: Nuclear forces reduced while modernizations continue, says SIPRI," SIPRI, June 16, 2014, available at http://www.sipri.org/media/pressreleases/2014/nuclear_May_2014; See also, Hans M. Kristensen, "Nuclear Weapons Modernization Programs of Nuclear-Armed States," Federation of American Scientists, May 5, 2014, Slides 13-14, available at http://fas.org/programs/ssp/nukes/ publications1/Brief2014_PREPCOM1.pdf.

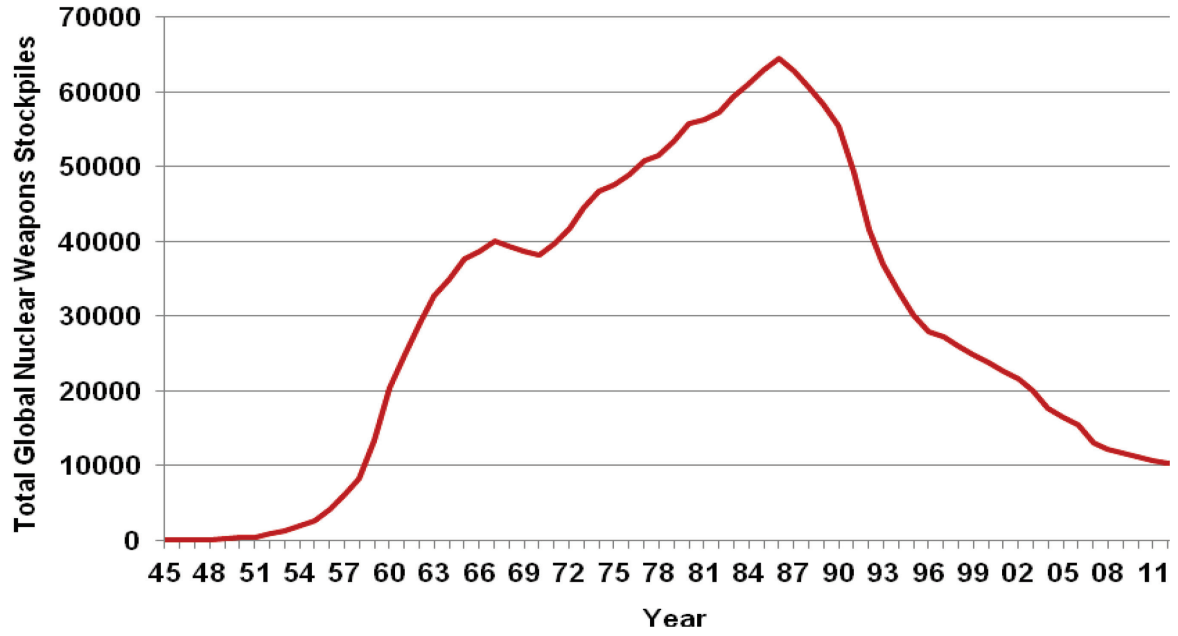
A final reason to doubt that the number of nuclear weapons and crises are correlated is the fact that the most serious crises between India and Pakistan occurred when each nation had fewer than 30 warheads. Both the Kargil Crisis (1999) and the Twin Peaks Crisis (2001-2002) featured overt nuclear threats by each country's leadership as well as increased levels of nuclear forces readiness. Both of these elements were missing, as explained above, during the Mumbai Attacks Crises of 2006 and 2008. In contrast to the assertion that greater numbers of nuclear weapons will cause greater crises, both India and Pakistan reportedly retained only about eight nuclear weapons each in 1999 during the Kargil crisis and 23 and 26 respectively during the Twin Peaks Crisis in 2001-2002.[84] The general Minimum Deterrence claim is, as noted above, that "As nuclear arsenals in India and Pakistan grow, so do the risks of war by design, miscalculation, or accident."[85] If this were true, the data should show that as the number of nuclear weapons increase, the severity and number of crises should also increase; yet the above data appear to indicate this is not the case.

Concluding Thoughts on Nuclear Numbers and Nuclear Dangers

This report's goal was to compare Minimum Deterrence proponents' claims about the correlation between nuclear weapon numbers and nuclear weapons accidents and crises against the available evidence. Using data on three strategic forces: the United Kingdom, India, and Pakistan, the section has shown that the number of nuclear weapons a country possesses is not an indicator of how many nuclear weapons accidents or crises it will have. To reinforce this point, Figure 5 below gives a historical macro view of the global nuclear stockpile.

[84] Kristensen and Norris, "Global Nuclear Weapons Inventories, 1945-2013," op. cit., p. 78.
[85] Cirincione, *Nuclear Nightmares: Securing the World before it is too Late*, op. cit., p. 129.

Figure 5: Total Global Nuclear Weapons Stockpile



Minimum Deterrence proponents often assert the following dichotomy, with minor variations, on the choice the United States faces currently: "But the choice is not between a secure status quo and an uncertain disarmed world. On the contrary, it is between the current world of rising nuclear dangers and an international system that has become more secure by divesting itself of all nuclear weapons."[86] As the above graph shows, however, the total number of nuclear weapons in the world has been declining significantly, and has been doing so since the 1980s. If nuclear weapons dangers and the number of nuclear weapons are so intimately connected, as asserted in the Minimum Deterrence narrative, how then can the current world feature "rising nuclear dangers?"

This general Minimum Deterrence assertion of increasing threat is internally inconsistent with its own assertions regarding a positive correlation between weapon numbers and the risks of accidents and crises. The total global nuclear stockpile reached its apogee in 1986 when the cumulative number of nuclear weapons among all nations was 64,449.[87] During the 1980s, the total number of nuclear weapons was at its zenith, so Minimum Deterrence assertions would

[86] Blechman and Bollfrass, eds., *Elements of a Nuclear Disarmament Treaty*, op. cit., p. 2.

[87] All data in Figure 5 has been derived from Kristensen and Norris, "Global Nuclear Weapons Inventories, 1945-2013," op. cit., p. 78.

dictate that the decade would also see the greatest number of accidents and crises. This was not the case. The post-1986 world has seen a reported 84% decrease in the number of nuclear weapons, but there has been no corresponding reduction in the number of accidents and crises according to the available evidence. And contradicting their own narrative, Minimum Deterrence proponents warn of the increasing risk of accidents and crises, even while the number of nuclear weapons has been reduced by 84%.

This report's survey of the available historical evidence has produced several supportable conclusions. First, by comparing the size of the U.K. stockpile from 1953-1991 to the number of accidents and incidents it experienced in the same time period, we are able to provide credible evidence contrary to the argument that greater nuclear weapon numbers entails a greater risk of accidents. This finding is in line with the conclusions found in *Minimum Deterrence: Examining the Evidence*. Second, by examining the number and nature of the crises India and Pakistan experienced, it is apparent that the number of nuclear weapons that each side possessed was not a determinative factor in the number or severity of crises that each experienced. This finding too is in line with the conclusions found in *Minimum Deterrence: Examining the Evidence*.

Nuclear dangers should be a real concern in any strategic environment, but available historical data suggests that the number of nuclear weapons is not the proximate cause of accidents or crises, perhaps because many other factors determine such nuclear dangers. In the case of accidents, one contributing factor appears to be the lowering of the priority attributed to nuclear weapons – a policy advocated by Minimum Deterrence proponents.