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ON THE "THRESHOLD" TEST BAN TREATIES OF 1974-76[1]

In 1974-76, U.S. and Soviet delegations held discussions in Moscow on the conclusion of so-called “threshold” treaties limiting the yield of underground nuclear explosions, conducted either for weapons testing or for peaceful purposes. I was a direct participant in these talks.

Until that time the multilateral 1963 Treaty Banning Nuclear Weapons Tests in the Atmosphere, in Outer Space, and Underwater (known as the Limited Test Ban Treaty, or LTBT) had existed—it is in force to this day—a treaty that was also concluded in Moscow. But that agreement did not ban underground nuclear tests of any yield, and such testing continued to be conducted intensively not only by the United States and the Soviet Union, but also the United Kingdom, France, China, and later India and Pakistan as well.

Today, all of these countries, as is well known, observe a nuclear testing moratorium, but the Comprehensive Test Ban Treaty (CTBT), concluded in 1996, has yet to enter into force. It would therefore be useful for readers to know what treaty obligations exist with regards to the conduct of nuclear tests. Along with the 1963 LTBT, which continues to ban testing in three environments, there are two additional agreements limiting underground nuclear tests, concluded in 1974 and 1976, that continue to be legally in force to this day. How these treaties were formulated will be described in this section of the journal.

THE TREATY ON THE LIMITATION OF UNDERGROUND NUCLEAR WEAPONS TESTS

In past years there were high-yield underground nuclear tests that resulted several times in the release of radioactive materials into the atmosphere that crossed national boundaries, violating the 1963 treaty. On quite a few occasions, the United States and the Soviet Union filed serious claims against each other in this regard. According to data cited in the media, between 1969 and 1973 alone the United States detonated seven devices with a yield of over 150 kilotons.[2] During the same period, the Soviet Union, according to official data, undertook 18 nuclear tests with a yield of over 150 kilotons.[3]

However, by the beginning of the 1970s both the United States and the Soviet Union had essentially completed the development of their highest-yield nuclear warheads, including those for intercontinental ballistic missiles and sea-launched ballistic missiles with multiple, independently targetable re-entry vehicles (MIRVed ICBMs and SLBMs), and the need for extremely high-yield tests was greatly reduced. The idea of limiting the yield of underground explosions to below a certain threshold arose. Both parties needed this agreement for general political reasons as well: to strengthen and further develop the temporary détente between them.

U.S. President Nixon visited the Soviet Union in July 1974; both parties decided that a treaty limiting underground nuclear tests to a certain threshold should be worked out before his arrival. The exact threshold had yet to be determined, but was to be agreed during the per-

sonal summit between the countries' two leaders, Richard Nixon and Leonid Brezhnev. The two countries' delegations were charged with agreeing on a treaty text, leaving a place for the exact amount of the threshold.

The Soviet delegation was headed by Deputy Minister of Medium Machine-Building (Minsredmash) Igor Morokhov, a very energetic and dynamic individual, and included another deputy minister from the same agency who was in charge of the nuclear weapons complex—Aleksandr Zakharenkov—as well as General Aleksandr Osin from the Ministry of Defense and myself, representing the Foreign Ministry, as well as many specialists from a variety of organizations, including the head of the State Committee on Hydro- and Meteorology (Goskomgidromet), Yuriy Izrael. In a naive attempt to hide his actual role, Zakharenkov was introduced as a Kurchatov Institute professor, but he was seated next to the head of the delegation and it was clear to all that he held a very influential post. During the sessions, which took place in the Minsredmash building on Staromonetnyy Lane, Zakharenkov was fairly stern and observed the proceedings with some distrust, but in everyday life he was a very nice person; I got to know him and sometimes took walks with him together on Sundays as we lived in the same part of the city.

The U.S. delegation was headed by U.S. Ambassador to Moscow Walter Stoessel, an extraordinarily pleasant and kindly man. Something quickly drew us together, and I began to visit Spaso House, the residence of the U.S. ambassador, quite frequently. Soon afterwards, though after the conclusion of the threshold treaties, he fell seriously ill. He was transferred to become the ambassador to Bonn (West Germany) in order to be nearer to good doctors, but as it turned out, he had an incurable form of leukemia and it was impossible to save him.

The threshold test ban treaty was formulated fairly quickly (in about three weeks). The protocol to the treaty provided for the exchange of certain data on each party's test sites. The entire text was completed and printed on special "treaty" paper, but a place for the "threshold" was left empty, awaiting the decision of the two nations' leaders. Upon arriving in Moscow, Nixon and Brezhnev were fairly quick to agree to the permissible threshold yields and the treaty was then signed at a Kremlin ceremony.

As far as the threshold values are concerned, the relevant agencies (Minsredmash and the Ministry of Defense) pushed to obtain a level of permissible yields that would allow them to undertake tests and fairly powerful explosions. I no longer remember the precise numbers, but they were approximately as follows: one to two explosions with yields of over one megaton, three to four of 500 kilotons, and so on in descending order. But our first sessions with the U.S. delegation already indicated that they were not prepared to discuss concrete numbers, and it was also clear to us that so intricate a framework would require very complex and strict monitoring, to which we were not prepared to agree. Furthermore, it would have been politically difficult to justify to the international community a threshold allowing a one megaton test. Thus, those of us in the delegation decided to put off the question of permissible explosive yield until the meeting of the two powers' leaders.

It seemed to me that the issue would be resolved through an agreement on one threshold value somewhere in the range of a few hundred kilotons—100, 200, or 300—and was not likely to exceed these amounts. As it turned out, the agreement on a single threshold value occurred, as I can see from my diary entry of March 14, 1984, made a decade after the signing of the treaty:

"At a reception at the U.S. Embassy yesterday, March 13, Bill Hyland, Henry Kissinger's former deputy in the National Security Council, described how the agreement on a threshold of 150 kilotons for the 1974 treaty came about.

He said that the U.S. military wanted to establish the threshold at 600 kilotons, but Kissinger sharply objected, believing that this number was too high. It was then decided to propose the level of 200 kilotons to the Russians. This was the number that Kissinger and Gromyko then agreed upon.

But later Kissinger decided that even 200 kilotons was a bit too high. At the meeting between Brezhnev and Nixon, the latter, at the behest of Kissinger, proposed the 150 kiloton level and insisted on this threshold.

Then Brezhnev, Kosygin, and Podgornyy went to another room in the Great Kremlin Palace to discuss Nixon's proposal among themselves. When they returned, Brezhnev agreed to 150 kilotons, but Gromyko, who was also present, continued to insist on 200 kilotons, noting that the Americans had already agreed to

it. Kosygin broke into the conversation and told the Foreign Minister: Sit down and listen. This last detail was told to me by the Soviet interpreter present during the negotiations at the Kremlin."

Since I was not personally present during the final agreement on the threshold value between the two countries' leaders, I cannot guarantee the accuracy of the information Bill Hyland told me, but judging by other information I have received, it seems likely to be fairly reliable.

In order to ensure confidence in the observation of the provisions of the Treaty between the Soviet Union and the United States on the Limitation of Underground Nuclear Weapons Tests, signed on July 3, 1974, the agreement provided for each party's use of national technical means for monitoring, in accordance with universally recognized principles of international law. Furthermore, both parties were obligated not to interfere with the other party's national technical means for monitoring the agreement.

The agreement also provided for consultations between the parties if questions or doubts about the other party's actions were to arise in the process of observing each other's adherence to the treaty. In order to assist in the realization of the aims and provisions of the treaty the parties could, if needed, consult with one another, make requests for information, and provide information in connection with these requests.

There was also a protocol to the treaty, as mentioned above, which was an integral part of the agreement. The protocol governed issues related to the mutual exchange of information about both parties' test sites and nuclear tests that were conducted. Although the 1974 agreement did not ban all underground nuclear weapons tests, instead establishing a simple threshold for particularly powerful blasts, it naturally required no less confidence in the fact that the parties were abiding strictly by their obligations. Each of the parties had to be convinced that the other party was not exceeding the agreed yield threshold and, of course, this was critically important to national security.

In the protocol, the parties committed to exchanging data on test sites on a reciprocal basis, in order to provide for monitoring of the fulfillment of treaty obligations. These tests sites are like field laboratories, equipped with special instruments and complex equipment used to measure the size of explosive indicators and check the correspondence of design parameters to the actual data obtained as a result of the testing of one type of nuclear device or another.

The main way to detect underground explosions and determine their strength is by recording seismic vibrations in the earth's crust with the aid of seismic instruments. However, several factors influence the effectiveness and accuracy of teleseismic devices, first and foremost the type of ground in which the nuclear explosion is taking place. If the explosion occurs in solid rock, granite for example, then it gives one seismic magnitude, while if an explosion of the same strength occurs in sedimentary rock, the indicators will be different. Therefore, in order to ensure the sufficiently accurate recording of seismic signals, one must know the basic geological and geophysical characteristics of the test sites.

The protocol provided for the mutual exchange of the following data: the geographic coordinates of the boundaries of each test site and the boundaries of the various geophysical test areas within them, information on the geology of these test areas, and information on two explosions for calibration purposes at each geophysically distinct tests area at which underground testing of nuclear weapons had and would continue to occur.

The information on explosions for calibration purposes is important for the tuning of seismic equipment and a more precise determination of explosive force via teleseismic monitoring. Data on the power, date, and time of these explosions, as well as their depth and coordinates, had to be provided. Furthermore, the yield of the calibrating explosions had to be as close to 150 kilotons as possible, and no less than 1/10 of this amount, that is, 15 kilotons. As for test areas for which data on two tests for purposes of calibration were not available, data from one test had to be provided and an exchange of data from a second test provided after the corresponding explosion. The conduct of tests exclusively for purposes of calibration was not required.

The protocol also established that the geographic coordinates of underground nuclear tests had to be provided after the conduct of such tests. The exchange of data on tests sites was to take place together with the exchange of the instruments of treaty ratification, although the

parties agreed on a mutual basis to provide each other the possibility to familiarize themselves with this data before the exchange of instruments of ratification.

I would like to note that it was very nice to see, when observing how the technical details in the protocol were discussed and agreed by the relevant specialists on both sides, how close their understanding was of the various aspects of the problems under consideration. The very fact that the treaty protocol included an agreement on the exchange of information about test sites, which had been secret until that time, was an important event that testified to the favorable trends contributing to a reduction in tensions between the two powers. It is indicative that, as has already been noted, all of the negotiations on the treaty and protocol only took about three weeks.

Although the threshold test ban treaty did not immediately enter into force, the parties had already reached an understanding on observing the agreement not to undertake nuclear explosions with yields exceeding 150 kilotons.

THE TREATY ON UNDERGROUND NUCLEAR EXPLOSIONS FOR PEACEFUL PURPOSES

However, the question of peaceful nuclear explosions (PNEs) remained. U.S. and Soviet scientific research and experiments had shown that the use of nuclear explosives was significantly more effective than chemical explosives for the realization of many economic projects. The Soviet Union had envisioned the following possible industrial uses of nuclear explosives: intensifying the development of oil and gas fields; the creation of underground caverns for the storage of natural gas, gas condensate, and petroleum products; the creation of underground storage sites for the burial of harmful industrial wastes; underground exploitation of ore deposits; the elimination of accidental gas and oil gushers; the preparation of mineral deposits for open-pit mining; deep geological sounding; the construction of canals, weirs for hydroelectric plants, and water reservoirs, etc.[4] "Operation Plowshare," the U.S. PNE program, got promising results from explosions used to increase gas output and considered explosions for other purposes, such as digging canals (in particular, they examined the desirability of expanding the Panama Canal or digging a parallel canal through Nicaraguan territory), mining, and creating underground storage caverns.

But before the use of nuclear explosions for industrial purposes could be realized in practice, there were many technical, political, and other difficulties that had to be overcome. First and foremost, ways to apply PNEs that eliminated or, at the very least, reduced the release of radioactivity into the environment to tolerable levels had to be developed.

The peaceful use of nuclear energy is closely tied to the problem of nuclear nonproliferation. After all, any nuclear device, whatever its purpose or the perfection of its design, has important features in common. The main feature common to all nuclear devices is that a device of relatively small mass can release an enormous amount of energy in just a few milliseconds. Another distinctive feature of nuclear explosive devices is their relatively small size and weight, which makes it possible to adapt them for military uses with the aid of various means of delivery. Thus, devices designed for peaceful nuclear explosions are not essentially different from devices designed for military use. But the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) does not ban PNEs. To make it possible for non-nuclear weapon states to make use of peaceful nuclear explosions, the NPT includes language stating that states parties will cooperate to ensure that "any potential benefits could be made available to non-nuclear-weapon States... by way of nuclear explosion services provided by nuclear-weapon States... and conducted under the appropriate international observation and international procedures called for in Article V and in accordance with other applicable international obligations." In other words, this meant that the nuclear states could use their nuclear devices to help non-nuclear states to obtain the benefits of PNEs.

Another great difficulty related to the use of PNEs had to do with the issue of banning nuclear weapons tests. Here the problem was in ensuring that PNEs would not be used for purposes related to nuclear weapons.

Both the United States and the Soviet Union had nuclear peaceful use programs with civilian purposes: to dig canals, to create underground facilities for the storage of dangerous materials, for geological probes, etc. The Americans were the leaders in this area: 27 explosions were carried out under the "Operation Plowshare" PNE program from 1960-70, during which time 35 nuclear explosive devices were used. The first PNE was carried out in 1961, and the last one in 1973, though the program continued to be funded until 1977. The most powerful explosion was 105 kilotons.[5] However, the United States, as my good friend Gerald Johnson, the director of the program, once told me, was disillusioned by the PNE program fairly quickly, since underground explosions gave but small economic returns and Americans know how to count money, while such explosions (which, after all, were not carried out at special test sites but in various places around the country) could have dangerous environmental consequences.

In 1974, after the threshold nuclear test ban treaty had been worked out, at the suggestion of the Soviet Union it was agreed that a separate agreement on limiting the yield of PNEs should be elaborated. We insisted upon this as the PNE program was still expanding at that time, and therefore the threshold treaty did not apply to PNEs but stated that they would be regulated by a separate agreement, to be negotiated by the parties and concluded "as soon as possible." In fact, since the Americans had already curtailed their program we were really only negotiating about limits on Soviet explosions. This was justified, since a peaceful nuclear explosion cannot be distinguished from a military explosion, and that means that test explosions to enhance nuclear weapons could be passed off as PNEs. However, it was important for Moscow that it reach an agreement that allowed the Soviet Union to continue its PNE program.

In total, the Soviet Union carried out 124 peaceful nuclear explosions, during the course of which 135 nuclear devices were used. The first Soviet PNE was exploded in 1965, and the last one in 1988. Most of the explosions had small yields, but some reached 80-140 kilotons. Group explosions were also carried out. For instance, in 1971 a group explosion (three nuclear charges of 15 kilotons each) was carried out in Perm region in underground shafts, which resulted in the ejection of soil, as part of an experiment in digging canals.[6]

However, working out a new treaty limiting PNEs proved to be extremely complex. The negotiations in Moscow, which took place in the same building on Staromonetnyy Lane, lasted for one and a half years (from October 1974 through May 1976); moreover, we met quite often. As before, our delegation was headed by Deputy Minister of Medium Machine-Building Igor Morokhov, and he was the ideological inspiration behind the negotiations, but he was often absent due to his duties at the ministry, and during his absence I had to bear this heavy burden. Our delegation also included experts that were very familiar with the conduct of PNEs, including All-Russian Scientific Research Institute of Technical Physics (VNIITF, in Snezhinsk) representative Vadim Simonenko. The U.S. delegation was headed by Walter Stoessel; his deputy was Bob Buckheim.

In the end we both concluded an agreement and agreed on a verification protocol. The parties were obligated not to undertake:

- ❑ Individual peaceful nuclear explosions with a yield of over 150 kilotons;
- ❑ Group explosions with an aggregate yield of over 1.5 megatons; moreover, where the total yield of such an explosion exceeded 150 kilotons, the explosion would be monitored in order to identify each individual explosion and determine that its yield did not exceed 150 kilotons.

The issue of verification was a critical part of the negotiations. So that the opposite party could be convinced that the threshold yield had not been exceeded, the protocol to the treaty contained a very detailed and fairly intrusive system of monitoring and inspections, which the delegations developed with the participation of experts from both states.

The protocol was an integral part of the agreement. It contained an exceptionally elaborate system of various types of measures, methods, and procedures intended to ensure the observance of the agreement. The monitoring system was based on two methods: on the use of national technical monitoring means and on providing the other party access to the sites of large yield PNE explosions. It should be noted that underground peaceful nuclear explosions,

in contrast to nuclear weapons tests, were not carried out at test sites but in quite unexpected locations. This made using teleseismic equipment to get the necessary data more difficult, since there had been no research on the route through which the seismic waves passed during each explosion.

The rights and tasks of the other party's representatives, who were to have been present during PNEs, were very thoroughly described in the protocol. Representatives could be present during any explosion with a planned total yield of over 150 kilotons. In addition, when the parties agreed that it would be useful, the other party's representatives could also be present during explosions in the 100-150 kiloton range. This might be the case when the parties felt that the special features of a project meant that teleseismic measurements could not be ensured with sufficient reliability, and on-site examination would be desirable. At the same time, the protocol stated that the other party's representatives would have no access to the explosive device or any written or other information about its construction, and would not try to obtain it by any means whatsoever. A Joint Consultative Commission was formed in order to help in the implementation of the treaty and protocol.

The treaty was signed on May 28, 1976 by Leonid Brezhnev and the new U.S. president, Gerald Ford, simultaneously in the two capitals—Moscow and Washington—which was unusual at the time in terms of world practice. Richard Nixon had already left office by that time, as a result of the Watergate scandal, and had been replaced by Ford.

One of the positive results of the U.S.-Soviet negotiations on peaceful nuclear explosions was the creation of a detailed, well-developed monitoring system to ensure adherence to the PNE Treaty. This was completely new in the international legal practice of the time.[7]

However, another 15 years were required for both threshold treaties to enter into force.

THE THRESHOLD TREATIES ENTRY INTO FORCE

Even the intrusive monitoring in both threshold treaties and their protocols, and especially in the protocol on PNEs, was not enough for the U.S. Senate to ratify them. The parties continued to adhere to the treaties for about 15 years, although from time to time they sent each other inquiries asserting that the agreed-upon limits had possibly been exceeded. In many cases this could be explained by differences in the geologic structure of the test sites and, therefore, difficulties in taking teleseismic measurements of the magnitude of an explosion from a distance. These inquiries were made quietly and did not lead to any particular claims by either side. I still have a document, prepared in 1985, that gives the number of these inquiries:

Number of inquiries by the Soviet Union and the United States regarding explosions that exceed the threshold level of 150 kilotons

U.S. inquiries sent to the Soviet Union (1976-1985): 13

1976 – 1

1978 – 1

1979 – 3

1980 – 2

1981 – 1

1982 – 2

1983 – 1

1984 – 1

January 29,1985 – 1

Soviet inquiries sent to the United States (1978-1985): 8

1978 – 1

1979 – 1

1982 – 3

1984 – 2

April 25, 1985 – 1

The treaties formally entered into force only after yet more intrusive monitoring protocols had been worked out in the early 1990s. I was not involved in the preparation of these new protocols, as I was on a foreign assignment at the time. Yevgeny Golovko, Igor Palenykh, and Anatoly Belov undertook this work on the part of the Russian Foreign Ministry.

Originally, it was proposed that fulfillment of the threshold treaties would be monitored via the seismic method, to be supplemented by the exchange of information on test sites and their geological characteristics. However, some of the properties of the seismic monitoring method itself left significant uncertainties in the interpretation of data. Thus, the special geological features of the Semipalatinsk Test Site—the hard rock formations in which the nuclear explosions were conducted—resulted in the fact that the seismic signal there was stronger than from equivalent explosions at the Nevada Test Site. This led to suspicions that the established limit for the release of energy could have been exceeded. The criticism of this monitoring system was so strong in the United States that ratification of the treaties in their initial form proved impossible.

While observing the 1974 and 1976 treaties *de facto*, by the early 1990s the Soviet Union and the United States had come to a mutually acceptable solution to the monitoring problem and developed new protocols. This made possible the joint experiments with explosions that were carried out by both parties at the Semipalatinsk and Nevada Test Sites. Viktor Mikhailov, who later became Russian Minister of Atomic Energy (in 1992), led the work on the U.S.-Soviet monitoring experiment for the Soviets.[8]

Under the new verification protocols, the new system of measures to monitor nuclear tests included such procedures as an exchange of information on test sites and on nuclear testing programs, the possibility of access to test sites during their preparation and the receipt of samples of the relevant rock formations, familiarization with the configuration of the placement of the container with the nuclear device as well as the container itself, in addition to monitoring the release of energy through the so-called hydrodynamic method, by measuring the speed of the shock wave during the test near the point of explosion. The latter made it possible to obtain more accurate data on energy release than through the seismic method and, in addition, help calibrate the seismic measurements. All of these activities were carried out with the participation of personnel from the party that was doing the monitoring, who were given access to the test site. An analogous approach was taken with regards to monitoring peaceful nuclear explosions. It should be noted that in working out the protocols to the threshold treaties of 1974 and 1976 it became clear that it was practically impossible to solve the problem of differentiating weapons tests from peaceful activities. In accordance with these treaties, the two activities would be differentiated in accordance with the following formality: any explosion that took place at a test site would be considered a weapons test, and peaceful nuclear explosions would only be allowed outside of the test sites. Of course, this approach did not exclude the possibility of peaceful nuclear explosions concealing weapons tests.[9]

The new verification protocols to the threshold treaties were signed on June 1, 1990, and the treaties entered into force on December 11, 1990. The threshold treaties, together with their verification protocols, brought the Soviet Union and the United States unprecedented levels of mutual openness in the area of nuclear tests. Favorable conditions for further progress in monitoring a ban on any nuclear explosions had been created.

The conclusion, in 1996, of the Comprehensive Test Ban Treaty (CTBT) should essentially have ended the need for the threshold treaties, although, of course, they continue to be in force.

Moreover, the CTBT has still not entered into force, largely due to the negative attitude that the U.S. Congress and the current Bush Administration have taken of it. China, Israel, India, and Pakistan have not adhered to the CTBT either. But the threshold treaties have played a positive role nevertheless, because they were the first to contain such a serious and thorough system for monitoring and inspecting nuclear explosions. Some of their elements were used in the CTBT.

Notes

[1] The author would like to express his deep gratitude to PIR Center Research Council member Victor Slipchenko for his review of this manuscript and his valuable comments on it.

[2] *International Herald Tribune*, November 21, 1975.

[3] *USSR Nuclear Tests: General Characteristics, Goals, and the Organization of USSR Nuclear Tests,* Viktor Mikhailov, ed. (Moscow: IzdAT, 1997), pp. 157-160.

[4] See *Peaceful Nuclear Explosions,* I.D. Morokhov, ed. (Moscow: 1970), pp. 5-6.

[5] *USSR Nuclear Tests,* op. cit, p. 141.

[6] http://en.wikipedia.org/wiki/Operation_Plowshare; *USSR Nuclear Tests,* op. cit, pp. 177-84.

[7] For more details on the threshold PNE treaty see: R. Mikhailov, "Legal Bases for the Regulation of Underground Peaceful Nuclear Explosions," *Sovetskoye gosudarstvo i pravo* (Moscow: 1977), pp. 92-99. For the texts of both threshold treaties in Russian, see: The Soviet Union and the Struggle for Disarmament: A handbook of documents (Moscow: Politizdat, 1977), pp. 137-41 and 159-83.

[8] It should be noted that during the joint experiment on monitoring the yield of nuclear explosions at the Nevada Test Site in 1988, the agreement called for the yield of the underground explosion being monitored not to exceed 150 kilotons (both there and at the Semipalatinsk Test Site); however, the one in the United States proved to be 180 kilotons. This significantly exceeded the agreed requirements, and as a result a collapsed depression was formed. (interview of Viktor Mikhailov in *Vremya novostey*, December 7, 2005). I might add that the Americans were very upset about this and requested that we not speak about the matter publicly; however, the story has since become public knowledge through the media.

[9] Viktor Slipchenko and Oleg Rozhgov, "The Process of Developing Comprehensive Test Ban Treaty Verification Mechanisms," *Yaderny Kontrol*, No. 4, 2001.