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16 May 1962
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NATIONAL INTELLIGENCE ESTIMATE

NUMBER 11-2A-62

The Soviet Atomic Energy Program

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This estimate was prepared and agreed upon by the Joint Atomic Energy Intelligence Committee which is composed of representatives of the Central Intelligence Agency and the intelligence organizations of the Departments of State, Defense, the Army, the Navy, the Air Force, AEC, NSA, and FBI.

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- The Assistant Director, Federal Bureau of Investigation, the subject being outside of his jurisdiction.

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NATIONAL INTELLIGENCE ESTIMATE

THE SOVIET ATOMIC ENERGY PROGRAM

NIE 11-2A-62

16 MAY 1962

This estimate consists of an up-dating of those subjects in NIE 11-2A-61 about which significant new information has become available, and which merit a re-statement. It includes topics under the following main headings from NIE 11-2A-61, "The Soviet Atomic Energy Program," dated 5 October 1961:

The Soviet Nuclear Reactor Program—Marine Nuclear Propulsion Systems

The Soviet Nuclear Materials Production Program

The Soviet Nuclear Weapon Program—Weapon Development Program and Fabrication and Stockpiling

The reader should refer to NIE 11-2A-61 for information on the following portions of the Soviet atomic energy program: Organization of the Soviet Atomic Program; The Nuclear Reactor Program—Research Reactors, Power Reactors, Nuclear Propulsion Systems for Aircraft, Missiles and Space Vehicles, Nuclear Electrical Propulsion Systems for Space Applications, and Nuclear Auxiliary (Non-Propulsion) Power Supplies; and, The Soviet Nuclear Weapon Program—Nuclear Weapon Research and Development Installations.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

THE SOVIET ATOMIC ENERGY PROGRAM

THE PROBLEM

To review significant recent developments in the USSR's atomic energy program and to estimate the probable future course of that program to mid-1967.

SUMMARY AND CONCLUSIONS

GENERAL

1. In up-dating NIE 11–2A–61 we have incorporated the analysis of data from the extensive nuclear test series conducted between 1 September and 4 November 1961. This analysis has improved our knowledge of Soviet weapon capabilities and reflects major improvements in Soviet weapon technology. Our analysis of new information on Soviet fissionable materials production has led to estimates essentially the same as given in NIE 11–2A–61. However, estimated expansion of future production of plutonium-equivalent will be at a somewhat slower rate than shown in NIE 11–2A–61.

NUCLEAR WEAPONS

Soviet Nuclear Test Program, 1961

2. The recent Soviet Nuclear test series, which consisted of 45 detected tests between 1 September 1961 and 4 November 1961, and one additional test detected on 2 February 1962, was the largest, most intensive and comprehensive ever conducted by the USSR. Although many of the tests were developmental in nature, we believe there were also a number of instances where warheads were detonated in conjunction

with complete weapon system checkouts. Twenty-five tests were detected in the Novaya Zemlya area of the Western Arctic, two each in the Kapustin Yar and Sary Shagan missile test range areas, fifteen at the Semipalatinsk Proving Ground and two underground tests at a newly identified test location 40 miles south of the Semipalatinsk Proving Ground. (*Paras. 37–44*)

Thermonuclear Weapons

3. The Soviets tested at least 19 thermonuclear devices during the 1961 series, 14 of which had yields greater than one megaton. Analysis of these tests indicated that the Soviets have developed a highly sophisticated thermonuclear weapon technology.

4. We believe that JOE 111 (58 MT) was a clean test of the much publicized 100 megaton weapon. [

] (*Paras. 49–53*)

ICBM Warheads

5. We believe that the Soviets second-generation ICBM's (SS–7) are capable of carrying a warhead of about 3,000 pounds. However, a warhead design based on 1961 tests appears to be much more attractive and may well be substituted in the near future. (*Paras. 54–56*)

Missile Range Tests

6. Four tests of the 1961 series were detected in the vicinity of the USSR missile test ranges at Kapustin Yar and Sary Shagan. JOE 98 (200 KT) was probably a test for effects data at an altitude somewhere between 100,000 and 150,000 feet. JOEs 105 and 109 on 21 and 27 October, respectively, were the first very high altitude tests detected in the USSR. Other missiles, in addition to the 1,000 nm missile carrying the nuclear warhead, were involved in each test. The small yield of the test devices (less than 5 KT) plus the nature of the operations suggest that the purpose of these tests was to acquire effects information related to components of the

Soviet ABM system, rather than to acquire data pertaining to the kill effects of a nuclear burst on an incoming missile. (*Paras. 45–48*)

Fission Weapon Developments

7. [redacted] fission tests were detected during the 1961 series with yields ranging from about 2 to 75 kilotons. In addition, JOE 98 (200 KT) and the two underground tests were possibly fission tests. [redacted] (*Paras. 57–59*)

Future Soviet Capabilities

8. Judging by past accomplishments, the Soviets could, with unrestricted testing during the next 5 to 10 years, approach the practical upper limits of performance in both thermonuclear and fission designs.[1] In addition, in the next few years they could greatly increase their store of knowledge concerning the various effects of nuclear weapons and could optimize designs to enhance specific effects. (*Paras. 60–61*)

9. We believe the Soviets are presently conducting research related to the development of a pure fusion weapon; however, we are unable to judge the degree of success the Soviets may have attained. (*Para. 62*)

Nuclear Weapon Fabrication and Stockpiling

10. We have identified nuclear weapon fabrication sites in the Urals at Nizhnyaya Tura and Yuryuzan. A probable third such site is located in Central Siberia near Krasnoyarsk. National stockpile sites are co-located with these three complexes. In addition [redacted] national assembly stockpile sites and [redacted] sites for the Long Range Aviation (LRA) Arctic staging bases have been identified. Nuclear weapon storage sites [redacted] have been identified at Soviet military air bases; [redacted]

[1] See page 14 for the view of the Assistant Chief of Staff, Intelligence, USAF.

[ ] (*Paras. 65–77*)

11. During the post-1958 period [ ] regional storage depots [ ] believed to be for nuclear weapons storage, have been identified. Although the precise function of the regional storage facilities themselves has not been determined, their deployment pattern suggests storage related to military districts possibly including support of ground, rocket, and air defense forces located within these districts. We believe [ ] sites associated with these installations provide nuclear support at least to the ICBM/MRBM/IRBM launch facilities located in their specific areas. (*Para. 78*)

FISSIONABLE MATERIALS PRODUCTION

12. *Uranium-235.* Three gaseous diffusion isotope separation plants are in operation in the USSR; one at Verkh-Neyvinsk in the Urals, one north of Tomsk in Central Siberia, and the third at Angarsk in the Lake Baykal region. A probable fourth gaseous diffusion plant, still under construction, has been located north of Zaozerniy near Krasnoyarsk. A review of all available information leads to a U–235 production estimate which is generally consistent with that made in NIE 11–2A–61. (*Paras. 24–27*)

13. We estimate that the probable Soviet cumulative U–235 production for mid-1962 is 110,000 kilograms and that it is unlikely that actual cumulative U–235 production is less than 60,000 kilograms or more than 130,000 kilograms.[2] We estimate that the mid-1967 cumulative production of U–235 will be 340,000 kilograms and we believe, with a fair degree of confidence, that this production will not be less than 180,000 kilograms or more than 500,000 kilograms. (*Para. 28*)

14. *Plutonium-Equivalent.*[3] Two major plutonium-equivalent production sites have been identified in the USSR, the earlier and larger at Kyshtym in the Urals, and the second

[2] See page 9 for the view of the Assistant Chief of Naval Operations (Intelligence), Department of the Navy.

[3] See footnote 9, page 9.

co-located with the U–235 production complex at the atomic energy site north of Tomsk in Central Siberia. It is probable that the large atomic energy site northeast of Krasnoyarsk includes underground facilities for plutonium production which were put into operation in the recent time period. The existence of plutonium production facilities at the Angarsk fissionable materials production site is a possibility, although there is no evidence supporting such a thesis. (*Paras. 29–30*)

15. We estimate that the value of 14,000 kilograms is the probable value for mid-1962 Soviet cumulative plutonium-equivalent production.[4] Considering the available site data and the possible variations in reactor operation, actual cumulative mid-1962 production could be as large as 21,000 kilograms. It is almost certain that actual production is not less than 10,000 kilograms. (*Para. 31*)

16. Contrary to the estimate in NIE 11–2A–61, available evidence now indicates that no large increase in reactor capacity is taking place at either Kyshtym or Tomsk. It is estimated, however, that future annual plutonium production will increase at a moderate rate through increasing power levels of existing reactors and through new construction. This extrapolation results in a cumulative plutonium-equivalent production of 38,000 kilograms by mid-1967. Even with an extremely high priority effort the cumulative plutonium-equivalent stockpile would not exceed about 50,000 kilograms by mid-1967. On the other hand, the estimated minimum cumulative production by mid-1967 would not be less than about 20,000 kilograms of plutonium-equivalent. (*Para. 32*)

MARINE NUCLEAR PROPULSION SYSTEMS

17. There is now considerable evidence that the USSR is constructing three classes of nuclear submarines. It is estimated that the USSR will have up to 20 nuclear submarines as of 1 July 1962, but it is unlikely that all of these will be operational by that date. (*Paras. 18–21*)

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[4] See page 9 for the view of the Assistant Chief of Naval Operations (Intelligence), Department of the Navy.

DISCUSSION

I. MARINE NUCLEAR PROPULSION SYSTEMS

Nuclear Icebreaker LENIN

18. It has been repeatedly reported that major problems have occurred with the propulsion system of the LENIN. Many reports have stated that the radiation levels in areas adjacent to the reactor compartment have been significantly above design level, indicating inadequate shielding. The Soviets have reported that the leakage from the primary coolant loop system has been greater than anticipated and has necessitated increasing the volume of the radioactive waste tanks. The use of uniflow steam generators probably requires frequent chemical removal of the resulting scale deposits from the tube surfaces. The LENIN's coolant loop is designed to operate at high temperatures and pressures which tend to accelerate the corrosion rate within the system. This rapid rate of corrosion would lead to frequent repairs and equipment replacement which, in fact, have been reported. Thus, it is believed that the Soviets have resorted to operating the LENIN's reactors at less than design pressures and consequently at lower power levels. The layout of equipment and piping was observed to be so poor as to hamper inspection and repairs while at sea. However, the LENIN's voyage into the Far North during the 1961 season indicates that many of the above difficulties may now have been corrected, particularly in view of the prolonged period of modification following the 1960 season.

Nuclear Powered Submarines

19. There is now considerable evidence that the USSR is constructing three classes of nuclear submarines. It is estimated that the USSR will have up to 20 nuclear submarines on 1 July 1962, but all may not be operational by that date. We believe a current construction rate of 6–8 submarines per year has been achieved and we have no reason to believe that the Soviets cannot fabricate the reactors needed to meet this construction program, or possibly even increase the rate of production slightly.[5]

20. Apparently some of the early Soviet nuclear submarines used essentially the same type of pressurized water reactor (PWR) as the nuclear icebreaker, LENIN, for their power system. Additionally, it has been reported that these early Soviet nuclear submarines have encountered problems which are believed to be similar to those experienced by LENIN. If such difficulties have in fact been encountered, and unless they have undergone major modifications, their operational capability may be less than designed. However, there is no evidence to indicate that the more recently constructed nuclear submarines have suffered these difficulties.

21. In addition, although Soviet officials have stated that they have nuclear submarines in the 30-knot category, analysis of present evidence, concerning both the power plant and the hull design, indicates that Soviet nuclear submarines are limited to speeds of about 20 knots. It is likely that an improved Soviet nuclear submarine is under development.

[5] See NIE 11-4-61, "Main Trends in Soviet Capabilities and Policies, 1961–1966," Annexes A and B, dated 24 August 1961; and Memorandum to Holders of Annexes A and B, NIE 11-4-61, dated 10 January 1962.

II. FISSIONABLE MATERIALS PRODUCTION

Soviet Ore Procurement

22. Rather sparse information received over the past year suggests that uranium procurement both from the Soviet Satellites and from within the USSR has proceeded much as estimated in NIE 11–2A–61. The estimated production of uranium ore is sufficient to supply the fissionable materials production estimated hereafter and to permit very substantial stockpiling of surplus uranium. (See Table 1)

Uranium Metal

23. Uranium metal and other feed materials are produced at three locations in the Soviet Union: Elektrostal near Moscow, Glazov just west of the Urals, and Novosibirsk in Central Siberia. (See Figure 1) As discussed in NIE 11–2A–61, there appears to be sufficient feed materials plant capacity in the USSR to process all uranium indicated by the uranium ore estimate as well as to produce the other feed materials and enriched fuel elements necessary for the Soviet atomic energy program.

U–235 Production

24. Three gaseous diffusion isotope separation plants are in operation in the USSR; one at Verkh-Neyvinsk in the Urals, one north of Tomsk in Central Siberia, and the third at Angarsk in the Lake Baykal region. A probable fourth gaseous diffusion plant, still under construction, has been located north of Zaozerniy near Krasnoyarsk. This identification is based on both eyewitness accounts and the construction of 500-KV power lines into the area. (See Figure 1)

Table 1

ESTIMATED SOVIET BLOC RECOVERABLE EQUIVALENT URANIUM METAL PRODUCTION THROUGH 1962

(Metric Tons, Rounded)
(From NIE 11–2A–61)

END OF YEAR	TOTAL ANNUAL	TOTAL CUMULATIVE
Pre 1946 Stocks	300	300
1946	200	500
1947	600	1,100
1948	1,300	2,400
1949	2,400	4,800
1950	3,200	8,000
1951	4,900	13,000
1952	6,000	19,000
1953	8,900	28,000
1954	10,000	38,000
1955	12,000	50,000
1956	14,000	64,000
1957	15,000	79,000
1958	16,000	95,000
1959	17,000	110,000
1960	17,000	130,000
1961	18,000	150,000
1962	19,000	170,000

25. A more detailed description of the first three sites and of the methods by which production is estimated is included in NIE 11–2A–61. The fourth plant at Zaozerniy is described as presently consisting of two long buildings, one about 2800 by 200 feet, the other about 2500 by 200 feet. The Zaozerniy plant thus appears quite similar to the initial stages of the plant at Angarsk as described by an eyewitness source. It is estimated that the Zaozerniy plant will begin operation in 1963.

26. Continued study of the electric power available to the Soviet atomic energy program, as deduced from published Soviet statistics, and of the growth of electric power generating and transmission facilities directly con-

nected to the four sites mentioned above, generally supports the estimates of total U–235 production made in NIE 11–2A–61. Our estimate of total Soviet cumulative U–235 production is presented in Table 2 in terms of cumulative production of uranium enriched to 93 percent U–235 content. It includes the 93 percent-equivalent of materials produced at lesser enrichments. Estimated weapon test and non-weapon uses of U–235 are larger than those estimated in NIE 11–2A–61. These amounts have been subtracted from the values of cumulative U–235 production to give our estimate of equivalent 93 percent U–235 available for weapon uses.

Future U–235 Production

27. Our estimate of future production at the four gaseous diffusion plants is based on gradually increasing efficiencies as older plant sections are modified, and on estimates of future power use as deduced from reports of power plant construction and published statistics on Soviet plans through 1965. We estimate that no new gaseous diffusion plants will be installed through 1965 either in the Urals or in the Tomsk Oblast, although pre-1958 plants in both areas will be modified to improve efficiencies. Soviet plans and other evidence indicate that production of electric power at hydroelectric and thermal power plants directly connected to the Angarsk and Zaozerniy atomic energy sites will rise rapidly between 1963 and 1967. Based on this increasing availability of electric power, it is concluded that the gaseous diffusion plants at Angarsk and Zaozerniy will be constructed at speeds roughly double those observed at Verkh-Neyvinsk in the mid-1950's.

Margins of Error

28. It is estimated that the Soviet cumulative U–235 production for mid-1962 is 110,000

Table 2

ESTIMATED SOVIET FISSIONABLE MATERIALS PRODUCTION

(Cumulative Production in Kilograms, Rounded)

	U–235 (93%)[a][e]		PLUTONIUM EQUIVALENT[b][f]
MID-YEAR	TOTAL	AVAILABLE FOR WEAPON USE	TOTAL
1950	25	25	100
1951	160	160	330
1952	600	500	550
1953	1,550	1,400	1,000
1954	3,350	3,150	1,500
1955	6,300	6,000	2,100
1956	10,500	10,000	2,800
1957	16,500	16,000	3,700
1958	24,000	22,000	4,400
1959	34,500	32,000	5,900
1960	51,000	47,000	8,000
1961	76,000	69,000	11,000
1962	110,000	102,000	14,000
1963	145,000	135,000	18,000
1964	190,000	178,000	23,000
1965	235,000	220,000	28,000
1966	285,000	270,000	33,000
1967	340,000	320,000	38,000

[a] Production of less highly enriched uranium is included as equivalent quantities of 93% material.

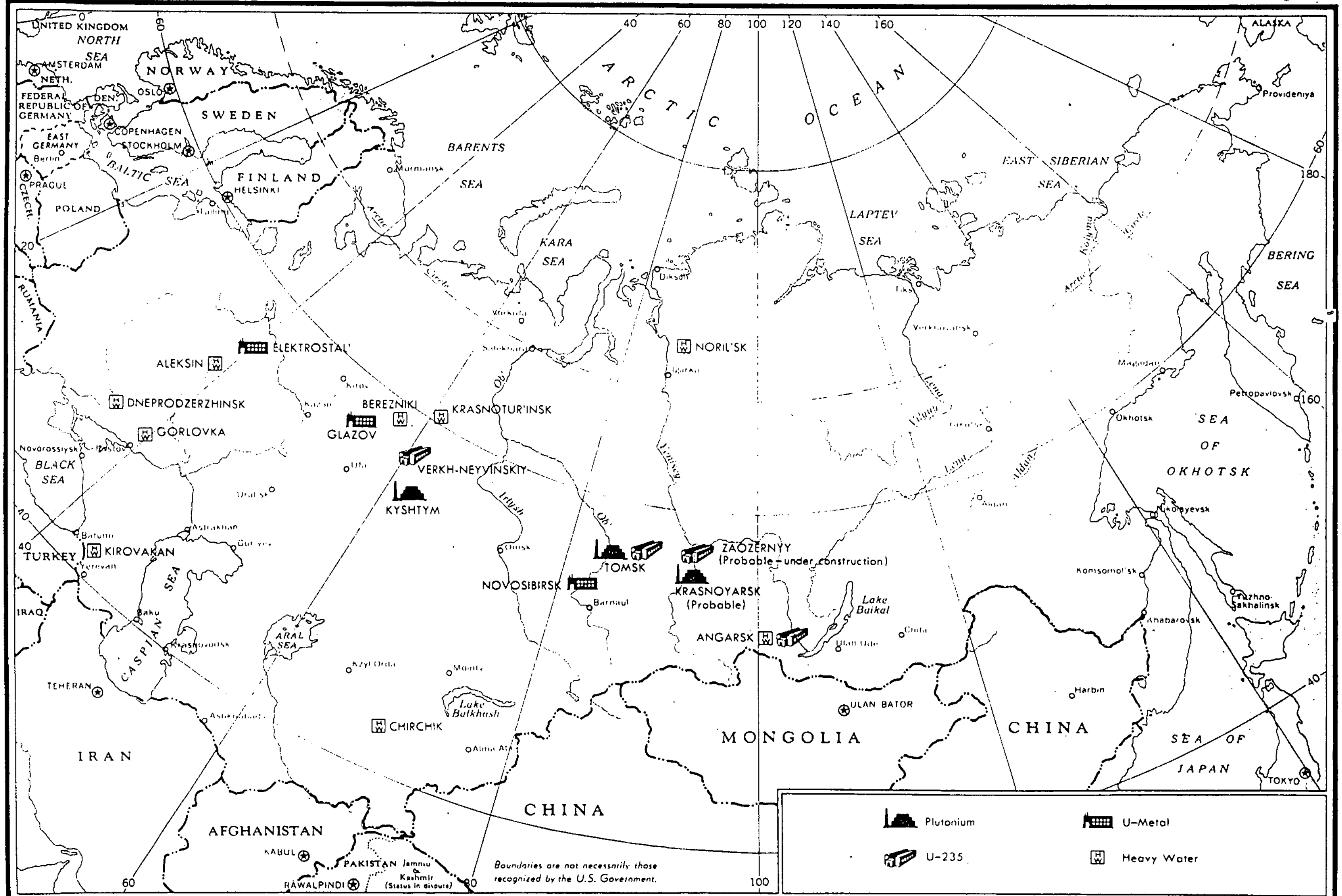
[b] Non-weapon uses of plutonium are expected to be negligible during the period of this estimate.

[e] See page 9 for the view of the Assistant Chief of Naval Operations (Intelligence), Department of the Navy.

[f] See page 9 for the view of the Assistant Chief of Naval Operations (Intelligence), Department of the Navy.

USSR: NUCLEAR MATERIALS PRODUCTION SITES

Figure 1



36195 5-62

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kilograms.[8] (See Table 2) It is unlikely that actual Soviet mid-1962 cumulative U–235 production could be less than 60,000 kilograms or more than 130,000 kilograms. It is estimated that the mid-1967 cumulative production will be 340,000 kilograms and we believe, with a fair degree of confidence, that the actual U–235 production would not be less than 180,000 kilograms or more than 500,000 kilograms.

Plutonium-Equivalent Production [9]

29. Two major plutonium-equivalent production sites have been identified in the USSR, the earlier and larger at Kyshtym in the Urals, and the second co-located with the U–235 production complex at the atomic energy site north of Tomsk in Central Siberia. It is probable that the large atomic energy site northeast of Krasnoyarsk includes underground facilities for plutonium production which were put into operation in the recent time period. The existence of plutonium production facilities at the Angarsk fissionable materials production site is a possibility although there is no evidence supporting such a thesis. (See Figure 1)

30. The cumulative plutonium values are estimated to have an error of plus or minus 20 percent. The error on annual values is much larger, making it difficult to establish in all cases (e.g., the period 1959–61), valid differences in annual production.

31. We estimate that 14,000 kilograms is the probable value for mid-1962 Soviet cumulative plutonium-equivalent production.[10] (See Table 2) Considering the available site data and the possible variations in reactor operations, actual production could be as large as 21,000 kilograms. It is almost certain that actual production is not less than 10,000 kilograms.

32. Contrary to the estimate made in NIE 11–2A–61, available evidence now indicates that no large increase in reactor capacity is taking place at either Kyshtym or Tomsk. It is estimated, however, that future annual plutonium production will increase at a moderate rate consistent with performance during the 1958 to 1962 period through new construction, increasing the power levels of existing reactors, and as a by-product of the nuclear power

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[8] The Assistant Chief of Naval Operations (Intelligence), Department of the Navy, does not concur in the U–235 production estimate. He considers it to be based upon assumptions which he cannot support on the basis of available evidence.

His analysis of the basic gaseous diffusion technology known to have been used by the Soviets and supported by evidence as late as 1959 results in a U–235 production estimate of about 20,000 Kg. as of mid-1962. Allowing for a margin of error, this figure could be increased as much as 50%. This analysis of the basic technology is in accord with the available information[

]The estimate of 20,000 Kg. is consistent with the very limited use of U–235 before late 1955 and can account for the strong emphasis the Soviets placed on improved U–235 economy in their 1961 weapon test series.

[

[ ]

]

[10] The Assistant Chief of Naval Operations (Intelligence), Department of the Navy, does not concur in this cumulative Soviet plutonium production estimate. He believes a mid-1961 value of 9,600 Kg., is in accord with the Soviet expanded reactor program, and that the figure for mid-1962 should be about 11,500 Kg., followed by an extrapolation of the estimate at a materially lower rate than that given in the majority estimate.

and propulsion programs of the USSR. This extrapolation results in a cumulative equivalent plutonium production of 38,000 kg by mid-1967. Even with an extremely high-priority effort, the cumulative plutonium equivalent stockpile would not exceed about 50,000 kg by mid-1967. On the other hand, the estimated minimum cumulative production by mid-1967 would not be less than about 20,000 kilograms of plutonium-equivalent.

Other Nuclear Materials

33. *Lithium.* [ ] It is probable that the USSR has been producing enriched lithium since at least 1954 although the location and capacity of Soviet lithium isotope separation plants are uncertain. Substantial increases in the production and processing of lithium ores for the Soviet atomic energy program in the 1957–59 period coincided with the large-scale production of thermonuclear weapons in the USSR.

34. *Heavy Water.* We estimate that the production capacity of the nine known Soviet heavy water plants is about 100 metric tons per year. (See Figure 1 for plant locations.) This capacity is believed to be ample for the needs of the Soviet atomic energy program.

35. *U–233.* The Soviets showed moderate interest in the procurement of thorium-bearing minerals between 1946 and 1952, but interest and effort appear to have declined. [ ]

36. *Tritium.* Analysis of weapons tests indicates that there has been an increasing demand for tritium in the Soviet weapon program since 1957.

III. THE SOVIET NUCLEAR WEAPON PROGRAM

Weapon Test Program

37. *Soviet Nuclear Test Program, 1961.* Between 1 September and 4 November 1961 [ ] 45 nuclear tests in the Soviet Union (JOE 75–JOE 119). An additional test, JOE 120, was conducted on 2 February 1962. (See Figure 2) Twenty-five tests were held in the Novaya Zemlya area of the Western Arctic, two each in the Kapustin Yar and Sary Shagan missile test range areas, fifteen at the Semipalatinsk Proving Ground, and two underground tests at a newly identified test location 40 miles south of the Semipalatinsk Proving Ground. Although many of the tests were developmental in nature, we believe there were also a number of instances where warheads were detonated in conjunction with complete weapon system checkouts. This series, by far the largest, most intensive and comprehensive ever conducted by the USSR, involved tests conducted underground, underwater, in the atmosphere, and at very high altitudes. The locations, environment yields, and characteristics of the 120 Soviet tests [ ] from 29 August 1949 to 2 February 1962 are summarized in Annex A.

38. The Soviets maintained a vigorous nuclear weapon development program during the period of the moratorium. This conclusion is supported by photographic evidence of: (a) a high level of activity at the Sarova nuclear weapon research and development center, noted in February 1960; (b) the operation of a similar facility at Kasli beginning in mid-1959; and (c) continued research and development activity since 1958 at the Semipalatinsk Proving Grounds. Details of the Soviet nuclear weapon research and development facilities at Sarova, Semipalatinsk, Kasli, Kerch/Bagerovo, Nizhnyaya Tura and

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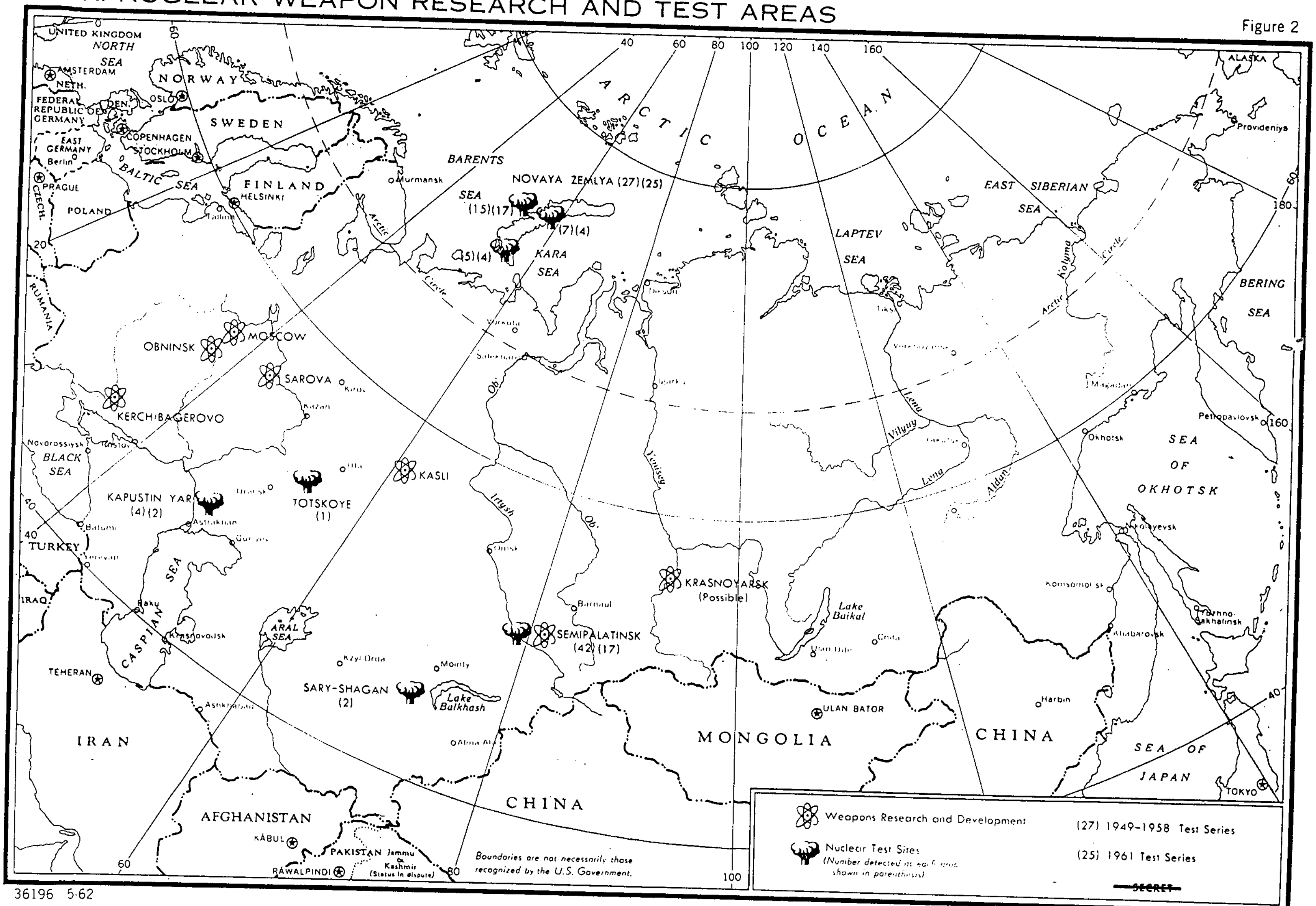
USSR: NUCLEAR WEAPON RESEARCH AND TEST AREAS

Figure 2



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the probable research and development facility at Krasnoyarsk were discussed in NIE 11-2A-61.

Novaya Zemlya Tests

39. As in the past, testing in the Novaya Zemlya area was preceded by an announcement that the area would be closed to foreign and domestic ships and to aircraft while "military exercises with the actual use of various types of modern weapons" took place. This was the first such announcement in which rocket troops, in addition to the Soviet Air Force, and the Northern Fleet, were mentioned as participants. As in the Fall 1958 test series, three different locations within the closed Novaya Zemlya area were used. (See Figure 2) The majority of the high-yield detonations took place a few miles inland from Mys Sukhoy Nos on the west coast of the island; four small-yield tests were held near the southern coast; and on three occasions two devices were detonated within a very few minutes of one another over the east coast of the island north of Matochkin Shar.

40. *Mys Sukhoy Nos Tests.* We believe that the majority of the Mys Sukhoy Nos tests were air drops delivered by bombers. These were JOEs 80, 86, 89, 91, 93, 94, 96, 97, 99, 106, 108 and 111 and included most of the thermonuclear developmental tests. However, we also believe that some of the tests in the low-megaton range (JOEs 83, 87 and 104) were missile-delivered from land-based or seaborne missile launchers located within a radius of several hundred miles of ground zero, and as such, were probably tests of weapon systems using stockpiled warheads.

41. *East Coast Tests.* The 1961 east coast tests (JOEs 112, 113, 115, 116, 118, 119) were unique in Soviet test history because they occurred in pairs, with a very short time interval between the detonations of each pair. The yields ranged from "low KT" to 5 MT, and there was no apparent consistency to the order in which the yields were employed. The 1958 tests on this side of the island had a similar range of yields but were single rather than double shots. We believe that the 1961 east coast tests involved weaponized devices probably delivered by aircraft.

42. *Southern Area Tests.* Four small-yield tests, JOEs 82 (20 KT), 85 (15 KT), 107 (20 KT), and 110 (15 KT), were located in or near the traditional naval test area off the southern coast of Novaya Zemlya. Two of these tests were clearly naval-associated. JOE 107 (20 KT), an underwater test in approximately the same location as the underwater tests of earlier series (JOE 17, September 1955, and JOE 42, October 1957), was probably undertaken to study underwater effects and may also have been a test of a naval weapon system. JOE 110 (15 KT) was detonated on or near the surface of the water and may have been a naval weapon system or effects test. Two air bursts in this area, JOEs 82 (20 KT) and 85 (15 KT), were probably systems tests of tactical weapons.[ ]

Semipalatinsk Proving Ground Tests

43. The 1961 Soviet test series opened at the Semipalatinsk proving ground on 1 September. Of the 17 tests in the Semipalatinsk area (including the 2 February 1962 test), two were underground and 15 were atmospheric detonations. Two of the atmospheric tests were 75 KT devices, and the remainder were 35 KT and below.[ ]It has been reported that the instrumented ground zero, which was under construction when photographed in April 1960, had been used at least once by the end of this series, but we cannot specifically identify this test among those detected.

44. Unique features of the 1961 Semipalatinsk tests were the first underground tests detected in the USSR, JOE 100 (5 KT) on 11 October and JOE 120 (50 KT) on 2 February 1962. These tests apparently were not held within the proving ground itself, but in a rugged hill area about 40 miles to the southwest. Use of this location suggests that they were conducted in a tunnel or tunnels constructed for the purpose. [ ] These tests probably permitted the Soviets to evaluate underground instrumentation techniques for obtaining diagnostic weapons data and to study seismic data obtained from the tests in connection with underground test detection problems.

Missile Range Tests

45. Four tests of the 1961 series were detected in the vicinity of two of the USSR missile test ranges. Two of them took place near the Kapustin Yar rangehead, and two were detonated downrange from Kapustin Yar, not far from the Sary Shagan ABM test complex.

46. The first of the missile range tests, JOE 79 (25 KT) on 6 September, was probably carried into the stratosphere by a missile fired from the SAM test complex at the Kapustin Yar Missile Test Range (KYMTR). Three previous tests had occurred in this area—JOEs 29 (7 KT), January 1957, 73 (3 KT) and 74 (3–9 KT) in November 1958—which suggest that JOE 79 was the latest step in the Soviet development program for a SAM warhead. Effects data from this test may well have been of interest to both Soviet air defense and ABM systems.

47. The second of the KYMTR tests, JOE 98 (200 KT), was probably a test for effects data at an altitude somewhere between 100,000 and 150,000 feet. Although there are serious difficulties with any interpretations of the available data, it is possible that this was also a test of an ABM warhead. (See Paragraph 72)

48. JOEs 105 and 109, on 21 and 27 October, were unique in Soviet test history. Not only were they the first very high altitude tests to have been detected in the USSR, but other missiles, in addition to the 1100 nm missile which carried the nuclear warhead, were involved in these tests. Information available on the two operations suggests that they were virtually identical except for the heights at which the nuclear devices were detonated. It is estimated that JOE 105 was detonated at an altitude of about 160 nautical miles and JOE 109 at an altitude of about 80 nautical miles not far from the Sary Shagan ABM complex. The small yield of the test devices (less than 5 KT) plus the nature of the operations, the missiles involved, and the height of the detonations suggest that the purpose of the tests was to acquire effects information related to components of the Soviet ABM system, rather than to acquire data pertaining to the kill effects of a nuclear burst on an incoming missile.

Weapon Development Program

49. *Thermonuclear Developments*. The Soviets tested [ ] thermonuclear devices during the 1961 series, [ ] The spectrum of tested yields ranged from about 200 kilotons to 58 megatons, with a preponderance of tests in the 1–5 megaton region and an absence of tests between about 5 and 25 megatons. [ ] the Soviets have developed a highly sophisticated thermonuclear weapon technology. [ ]

50. Soviet thermonuclear devices tested during 1961 are discussed below. A few hand-made versions of the very high-yield weapons could be available now or in the near future, but production of significant numbers of weapons based on new or improved designs exhibited in the 1961 test series would probably require a year or more.

51. *Sub-megaton Tests.* Four of the Soviet tests (JOEs 93, 108, 115, and 116) fall in this category with yields between about 200 KT and 850 KT. A fifth, JOE 94 (580 KT), [

]

52. *1–5 Megatons.* Most of the Soviet thermonuclear tests in 1961, as in 1958, fall into the 1–5 MT yield range.

53. We believe that JOE 111 (58 MT) was a clean test of the much-publicized 100 MT weapon. [

]

The Possible Effect of the 1961 TN Tests on Soviet Strategic Missile Delivery Systems

54. A new Soviet ICBM is now under development. No re-entry body weight has been assigned, as yet, to this missile; however, we believe that the Soviets should have no difficulty in providing a suitable warhead. Some of the ICBM's tested during the past year may be designed to carry large payloads, although this hypothesis is not substantiated by the available evidence.

55. *MRBM/IRBM.* The warhead weight for the several Soviet MRBM's and IRBM's is believed to be between 2,500 and 3,000 pounds. Several of the 1961 tests are believed to have been systems tests of weapons using 1958 designs.

56. *350 nm Ballistic Missile.* We believe the warhead now associated with this class of missile, which may be either land-based or submarine-launched, can achieve yields in the low megaton range.

Fission Developments

57. Twenty-four fission tests were detected during the 1961 series with yields ranging from about 2 to 75 kilotons. In addition, the high-altitude test over the Kapustin Yar Missile Test Range (JOE 98) and the two underground tests south of Semipalatinsk were possibly fission tests.

58. Marshal Malinovsky stated on 23 October 1961 that the Soviets have nuclear warheads of as low as "several tens of tons of TNT." [

]

59. JOE 98 (200 KT), the high-altitude test over the KYMTR, presents difficulties in interpretation. [

] Since it would have been desirable to use a device with a known yield in conducting a high altitude test it is likely that the debris or the yield is not representative and JOE 98 was the detonation of a previously tested device for effects purposes.

Future Soviet Capabilities

60. Judging by past accomplishments, the Soviets could, with continued unrestricted testing during the next 5 to 10 years, approach the practical upper limits of performance in both thermonuclear and fission designs. In addition, in the next few years they could greatly increase their store of knowledge concerning the various effects of nuclear weapons and could optimize designs to enhance specific effects.[11]

61. We believe that with continued unrestricted testing the Soviets could increase the yield-to-mass ratio to values approaching the practical upper limits within the next 5–10 years for those thermonuclear weight classes to which they accord development priority.[12]

62. *Pure Fusion Devices.* We believe the Soviets are presently conducting research toward this end. [ ]

Radiological Warfare Munitions

63. Available evidence indicates the Soviets have conducted research applicable to radiological warfare. There is published Soviet research on the biological effects of radiation, on immunization against radiation, and on the synergistic effects obtained by utilizing combinations of radiation and biological organisms. On balance, we believe the Soviets have a limited capability to produce and employ RW agents. However, in view of the complex processing and logistical problems inherent in an RW program, we do not believe they have stockpiled more than token quantities of RW munitions.

[11, 12] The Assistant Chief of Staff, Intelligence, USAF, believes that some of the capabilities listed could be achieved in significantly less than 5 to 10 years if the Soviets accord sufficient priority to a particular class of weapon.

The Soviet Test Detection System

64. The existence of a Soviet test detection system comprising seismic, acoustic, electromagnetic, and debris collection components was confirmed at the 1958 Experts' Conference in Geneva. In addition, the Soviets probably have added to their detection system facilities for measuring telluric currents resulting from high-altitude detonations. We estimate that Soviet capabilities in geophysical detection are reasonably good but not comparable to those of the US. However, it should be noted that their detection capabilities against US tests have been greatly enhanced by the general openness of US testing and through intelligence.

Weapon Production and Stockpiling Sites

65. The USSR has maintained a careful balance between the introduction or modification of delivery systems and a nuclear weapon logistic system including (a) weapon production capacity with associated national reserve stockpile facilities at interior locations; (b) national stockpile and assembly sites situated near major order-of-battle concentrations; and (c) storage sites at military bases within the service area of national stockpile and assembly sites, which provide the necessary support to the operational sites. Changes in the design of stockpile facilities occurred in 1956 and 1958–1959 which appear to have been responsive to major nuclear weapon developments and to the introduction of new strategic delivery systems.

National Fabrication and Stockpile Sites[13]

66. [ ]

[13] Details of fabrication and stockpile sites are given in NIE 11-2A-61. Changes in information over the past year are highlighted in the current text.

[redacted]

67. The Nizhnyaya Tura nuclear weapon complex contains facilities for the fabrication, assembly, and stockpiling of nuclear weapons. It is likely that the earliest series-produced weapons in the Soviet program were fabricated and stored at Nizhnyaya Tura about 1951. This was probably the first stockpile facility in the USSR. The complex was expanded in 1959 with construction of what is believed to be a new fabrication area.

68. The second Soviet nuclear weapon fabrication, assembly, and stockpile complex is located about 24 nm south of Nizhnyaya Tura in the vicinity of Yuryuzan. We believe that the Yuryuzan complex became operational by the end of 1955 or early 1956. [redacted] expansion was under way and a second stockpile area was under construction. It is estimated this addition was available for use by the end of 1961.

69. Another atomic energy site, located north of Krasnoyarsk in Central Siberia, contains a nuclear stockpile facility which may have begun operations in 1957. Other facilities in the complex probably are associated with nuclear weapon fabrication.

National Assembly and Stockpile Sites

70. In addition to the three national stockpile sites co-located with fabrication facilities, national assembly stockpile sites have been identified [redacted] The national assembly-stockpile sites probably contain reserve weapons to support regional and operational storage sites. It is believed that these installations have a weapon modification and retrofit capability but do not have a basic fabrication function.

71. [redacted]

Storage Sites at Arctic Staging Bases

72. [redacted] storage facilities are believed to be located in the vicinity of major Long Range Aviation staging airfields in the Arctic. [redacted]

Airbase Storage Sites

73. Nuclear weapon storage sites utilizing three standard designs have been identified at Soviet military air bases. [redacted]

[redacted]

74. [redacted]

75. [redacted]

[redacted]

76. [redacted]

77. [redacted]

[redacted] Those located near the western border may provide support to Soviet forces deployed in the Satellites.

Regional Depots

78. During the post-1958 period, military regional storage depots have been identified [redacted] Although the precise function of the regional storage depots themselves has not been determined, their deployment pattern suggests storage related to military districts, possibly including support of ground, rocket, and air defense forces located within these districts. We believe [redacted] sites associated with these installations provide nuclear support at least to the ICBM/MRBM/IRBM launch facilities located in their specific areas. [redacted]

Other Operational Storage Facilities

79. We have no firm evidence of the existence of other types of operational storage facilities specifically designed for nuclear weapons. However, it is considered likely that the Soviet Naval Aviation would require nuclear storage at bases where it has deployed AS-2 (KIPPER) missiles. Soviet tactical doctrine and training, and nuclear testing specifically oriented to ground, naval, and air defense requirements, indicate that nuclear weapon storage sites are probably also available to units of the Soviet ground forces and to certain naval surface and submarine forces. Whether these requirements are met by the storage sites listed previously, or by additional undetected facilities is not known.

Soviet Nuclear Weapon Storage in the European Satellites

80. We have no firm evidence that Soviet forces stationed in the European satellites have acquired nuclear weapons. However, an increasing number of reports suggest that the Group of Soviet Forces in Germany (GSFG) are acquiring short-range rockets and missiles (FROG and SCUD) and that the GSFG probably has simulated nuclear weapon employment during maneuvers since 1960.

81. No nuclear warhead storage facilities have been identified in East Germany, nor is there definitive information that nuclear weapons have been deployed to the GSFG. Those rocket and missile-equipped units which have been assigned a nuclear delivery role probably would be supplied from storage sites [redacted] or [redacted] sites near the western border of the USSR.

Operational Implications of Storage Site Design Changes

82. Until 1959, the national stockpile sites and the airfield storage installations were characterized by numerous handling facilities and storage bunkers. On the other hand, the new nuclear weapon storage installations associated with the regional military storage depots and with airfields have simplified and more efficient weapon handling and servicing facilities. We believe that many of the functions, which were accomplished in a variety of structures in the older installations, may now

have been eliminated or may be completed within the storage bunker. These simplifications clearly suggest the development of nuclear weapons which require less servicing, thus resulting in a reduction of response times. [ ]

Nuclear Storage Site Hardness

83. The hardest nuclear storage sites appear to be the national stockpile facilities which contain several buried bunkers with above-ground entrances. In many cases advantage has been taken of natural terrain features such as valleys and hill-sides to further decrease the vulnerability of these bunkers. Similarly [ ] are of heavy concrete construction, semi-buried, earth covered and are probably constructed to minimize the blast effects from a nuclear detonation. No apparent protection is afforded to structures other than storage bunkers at these sites. [ ] airfield sites were not hardened initially, although the new bunkers estimated to have been constructed at these sites probably are hardened. The widespread dispersal of nuclear weapon storage facilities in the USSR and the hardness accorded to the nuclear weapon storage bunkers indicate that the Soviets are providing a high degree of protection to their nuclear stockpile.

Logistics

84. The national fabrication stockpile installations, all of which are located within the interior of the USSR, can operate as self-sufficient complexes, but they do not appear to be intended to support a specific grouping of forces because of transportation and location limitations on an immediate operational basis. Thus, we believe that the stockpile of weapons at these sites represents a national reserve. The national assembly and stockpile sites, though incapable of very rapid deployment of weapons, unless airlift of weapons by helicopter is employed, are believed to provide direct support to, and strategic reserve for, the operational sites. The nuclear weapons initially required for nuclear warfare are believed to be immediately available at operational sites located at or within 100 miles of deployed delivery systems.

ANNEX A

Table 1

EVALUATION OF SOVIET NUCLEAR TESTS (1949–1958)

JOE No.	Date	Location [1]	Burst Height (ft) [2]	Yield (KT) [3]
1	29 Aug 49	Semi	Surface	20
2	24 Sep 51	Semi	Surface	30
3	18 Oct 51	Semi	Air	15
4	12 Aug 53	Semi	Surface	300
5	23 Aug 53	Semi	Air	25
6	3 Sep 53	Semi	Air	8
7	10 Sep 53	Semi	Air	8
8	14 Sep 54	Totskoye 53.1N, 51.9E	1,000 [5] / 1,500	35 / 100
9	3 Oct 54	Semi	Air	4
10	5 Oct 54	Semi	Air	45
11	8 Oct 54	Semi	<few 1,000 [6]	<20
12	23 Oct 54	Semi	Air	90
13	26 Oct 54	Semi	Air	4
14	30 Oct 54	Semi	Air	25
15	29 Jul 55	Semi	Surface	4
16	2 Aug 55	Semi	Air	30
17	21 Sep 55	NZ 70.6N, 54.2E	Underwater	6
18	6 Nov 55	Semi	3,500	200
19	22 Nov 55	Semi	4,500	1,600
20	2 Feb 56	Caspian Sea	Air	6
21	16 Mar 56	Semi	Surface	30
22	25 Mar 56	Semi	Surface	25
23	24 Aug 56	Semi	Tower	60
24	30 Aug 56	Semi	3,300	2,200
25	2 Sep 56	Semi	>1,500	100
26	10 Sep 56	Semi	1,500 / 3,000	90
27	17 Nov 56	Semi	7,800	2,700

See footnotes at end of Table 2.

Table 1 (*Continued*)

JOE No.	Date	Location [1]	Burst Height (ft) [2]	Yield (KT) [3]
28	14 Dec 56	Semi	Air	50
29	19 Jan 57	Kapustin Yar 49.5N, 48.0E	Air	7
30	8 Mar 57	Semi	Air	15
31	3 Apr 57	Semi	Air	70
32	6 Apr 57	Semi	Air	70
33	10 Apr 57	Semi	6,800	1,300
34	12 Apr 57	Semi	Air	30
35	16 Apr 57	Semi	5,000/7,000	750
36	22 Aug 57	Semi	>2,000	500
37	7 Sep 57	NZ 7036N, 5412E	Surface	25
38	13 Sep 57	Semi	Unknown	~20
39	24 Sep 57	NZ 7348N, 5524E	7,000/10,000	3,200
40	26 Sep 57	Semi	Air	8
41	6 Oct 57	NZ 7348N, 5500E	7,000	4,300
42	10 Oct 57	NZ 7036N, 5412E	Underwater	10
43	28 Dec 57	Semi	Air	7 (15)
44	4 Jan 58	Semi Unknown	Unknown	<5
45	17 Jan 58	Semi	Unknown	<5
46	23 Feb 58	NZ 7418N, 5348E	10,500	1,200
47	27 Feb 58	NZ 7418N, 5400E	10,300	2,500
48	27 Feb 58	NZ 7424N, 5336E	10,800	520
49	13 Mar 58	Semi	Air	<10
50	14 Mar 58	NZ 7415N, 5420E	Air	30
51	14 Mar 58	Semi	Air	30
52	15 Mar 58	Semi	Air	10

See footnotes at end of Table 2.

Table 1 (*Continued*)

JOE No.	Date	Location [1]	Burst Height (ft) [2]	Yield (KT) [2]
53	20 Mar 58	Semi	Air	15
54	21 Mar 58	NZ 7400N, 6000E	>7,500	1,000
55	22 Mar 58	Semi	Unknown	20
56	30 Sep 58	NZ 7345N, 5445E	6,800	1,200 }
57	30 Sep 58	NZ 7324N, 5500E	8,500	2,100 }
58	2 Oct 58	NZ 7345N, 5430E	Air	350
59	2 Oct 58	NZ 7338N, 5730E	Air	50
60	4 Oct 58	NZ 7037N, 5445E	Air	5 (10)
61	5 Oct 58	NZ 7037N, 5445E	Air	25
62	6 Oct 58	NZ 7042N, 5455E	Air	2.5
63	10 Oct 58	NZ 7338N, 5415E	Air	200
64	12 Oct 58	NZ 7330N, 5500E	4,500	2,100
65	15 Oct 58	NZ 7400N, 5500E	7,600	3,000
66	18 Oct 58	NZ 7342N, 5454E	6,500	7,600
67	19 Oct 58	NZ 7350N, 5735E	Air	35
68	20 Oct 58	NZ 7335N, 5418E	Air	400
69	21 Oct 58	NZ 7038N, 5445E	Air (?)	<5
70	22 Oct 58	NZ 7348N, 5506E	7,000	6,100
71	24 Oct 58	NZ 7400N, 5800E	7,600	2,200
72	25 Oct 58	NZ 7400N, 5500E	Air	200
73	1 Nov 58	Kapustin Yar 4930N, 4800E	Air (?)	3.5
74	3 Nov 58	Kapustin Yar 4930N, 4800E	Air (?)	3

See footnotes at end of Table 2.

Table 2

PRELIMINARY EVALUATION OF SOVIET NUCLEAR TESTS (1961 AND 2 FEBRUARY 1962)

JOE No.	Date	Location [1]	Burst Height (ft) [2]	Yield (KT) [3]
75	1 Sep 61	Semi 5054N, 7748E	<30,000	75 [8] (20)
76	4 Sep 61	Semi 4912N, 7730E	Below Tropopause	25
77	5 Sep 61	Semi 5012N, 7718E	Below Tropopause	35 [8] (17)
78	6 Sep 61	Semi 5000N, 7800E	..	7
79	6 Sep 61	KY 4824N, 4548E	30,000–80,000	25
80	10 Sep 61	NZ 7345N, 5418E	7,500	4,700
81	10 Sep 61	Semi 4800N, 7800E	..	<10
82	10 Sep 61	NZ 7124N, 5430E	Below Tropopause	20
83	12 Sep 61	NZ 7345N, 5418E	4,500	2,000
84	13 Sep 61	Semi 5000N, 7818E	Below Tropopause	75 [8] (40)
85	13 Sep 61	NZ 7000N, 5200E	Below Tropopause	15 [8] (30)
86	14 Sep 61	NZ 7345N, 5418E	6,500	2,000
87	16 Sep 61	NZ 7345N, 5418E	4,000	1,600
88	17 Sep 61	Semi 5030N, 7706E	Below Tropopause	35
89	18 Sep 61	NZ 7345N, 5418E	6,000	2,300
90	19 Sep 61	Semi 4936N, 7854E	Below Tropopause	15 [8] (7.5)
91	20 Sep 61	NZ 7345N, 5418E	6,000	1,500
92	21 Sep 61	Semi 5018N, 7936E	..	<10
93	22 Sep 61	NZ 7345N, 5418E	4,500	750
94	2 Oct 61	NZ 7348N, 5336E	Below Tropopause	580
95	4 Oct 61	Semi 5000N, 7800E	Below Tropopause	4 [8] (8)
96	4 Oct 61	NZ 7345N, 5418E	7,500	2,900
97	6 Oct 61	NZ 7345N, 5418E	9,000	4,600
98	6 Oct 61	KY 4806N, 4612E	100,000 150,000	200
99	8 Oct 61	NZ 7400N, 5500E	Below Tropopause	25
100	11 Oct 61	Semi 4948N, 7806E	Sub-surface	~5

See footnotes at end of table.

Table 2 (*Continued*)

JOE No.	Date	Location [1]	Burst Height (ft) [2]	Yield (KT) [3]
101	12 Oct 61	Semi 5000N, 7800E	Below Tropopause	35
102	17 Oct 61	Semi 5000N, 7800E	Below Tropopause	2 [8] (5)
103	19 Oct 61	Semi 5036N, 7924E	Below Tropopause	4 [8] (8)
104	20 Oct 61	NZ 7352N, 5421E	4,500	2,700
105	21 Oct 61	SS 4642N, 6936E	>200,000	<5
106	23 Oct 61	NZ 7345N, 5418E	13,000	25,000
107	23 Oct 61	NZ 7039N, 5406E	Underwater	20
108	25 Oct 61	NZ 7345N, 5418E	2,000/10,000	850
109	27 Oct 61	SS 4606N, 7036E	>200,000	<5
110	27 Oct 61	NZ 7041N, 5421E	<1,000	15
111	30 Oct 61	NZ 7345N, 5418E	13,500	58,000
112	31 Oct 61	NZ 7332N, 5655E	8,700	5,100
113	31 Oct 61	NZ 7436N, 5924E	6,000	~1,500
114	1 Nov 61	Semi 5000N, 7800E	Below Tropopause	<20
115	2 Nov 61	NZ 7436N, 5524E	..	~200
116	2 Nov 61	NZ 7512N, 5730E	Prob 1,000/5,000	300
117	3 Nov 61	Semi 5000N, 7800E	..	prob <10
118	4 Nov 61	NZ 7318N, 5636E	Below Tropopause	Low KT
119	4 Nov 61	NZ 7336N, 5648E	7,500	3,200
120	2 Feb 62	Semi 4948N, 7806E	Sub-surface	50

[1] Semi=Semipalatinsk; KY=Kapustin Yar; NZ=Novaya Zemlya; SS=Sary Shagan.

[2, 3] Values of burst height and yield are best values.

[5] Where a range of values have been reported they are written as minimum/maximum.

[6] Greater than: >; Less than: <; Approximately: ~.

[8] Alternate value. Analysis based on this assumed yield.

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