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DEPARTMENT OF DEFENSE
DEFENSE ATOMIC SUPPORT AGENCY
WASHINGTON 25, D.C.

ADDRESS REPLY TO:
THE CHIEF, DEFENSE ATOMIC
SUPPORT AGENCY

4 AUG 1961

DASARA-3 928.4

MEMORANDUM FOR: ASSISTANT TO THE SECRETARY OF DEFENSE (Atomic Energy)

SUBJECT: Estimate of Helsinki Expected Dose Resulting from Clean Weapons in SIOP-62

1. During the meeting in your office of DASA, Air Force Plans, and AFIC personnel on 12 July 1961, you requested that the DASA staff prepare an estimate of the "expected dose" at Helsinki resulting from the use of two classes of clean nuclear weapons in the FY 1962 SIOP. The weapon classes specified were (a) clean weapons which have been tested, but not stockpiled, and (b) very clean weapons which could become available in the future.

2. The results of the ensuing study were presented orally in your office at the 24 July meeting of the above group. Inclosure 1 to this memorandum provides the written results of this study which you requested at that time.

Robert H. Booth

ROBERT H. BOOTH
Major General, USA
Chief

2 Incl
1. Study, Cys 1A,2A (TSRD)
2. Map, Cy 1A (TS)

Copies Furnished (w/o Incl 2)
LtCol Algermissen,
AF Plans, Cy 3A of Incl 1
(TSRD)
Mr. Shure, AFIC, Cy 4A of
Incl 1 (TSRD)

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ATOMIC ENERGY ACT 1954

TS CONTROL SYMBOL
DASA/ 61-515- File

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AUG 7 1961

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24 July 1961

PROBLEM: To estimate the "expected dose" at Helsinki resulting from the use of two classes of clean nuclear weapons in the FY 61 SIOP.

ASSUMPTIONS:

1. The expected dose to Helsinki from weapons presently scheduled in the SIOP to be surface burst is a measure of the effect fallout will have upon non-Soviet areas.

2. The expected dose is that predicted from the annual wind templates of WSEG-46, Supplement 3.

3. The expected dose from any one weapon is the product of arrival probability, dose per megaton, reduction factor (if the weapon is not 20 megatons, cf. Supp 3 WSEG-46), effective fission yield, and base survival probability. The base survival probability is 0.95 for "alert" weapons and 0.15 for other weapons.

FOIA(b)(3) - 42 USC 2162(a) - RD DOE EO13526 6.2(a)

6. No Soviet weapons contribute to the expected dose.

DISCUSSION:

1. The JCS has directed that JSTPS take steps in selecting weapons for use at burst points near non-Soviet area to minimize local fallout in the non-Soviet areas. Specifically certain control points were selected and maximum dose levels assigned to each to provide a constraining boundary beyond which "expected" fallout levels should not pass. The "expected" dose was calculated assuming that only the largest of all the surface bursts scheduled for any one aiming point actually arrives and that the fallout from this weapon follows the average annual wind pattern for that area. When first applied, Helsinki became the control point which had the greatest effect upon the targeting process. It became necessary to reassign weapons in the vicinity of Helsinki. Some large weapons designed to encompass several targets were replaced with smaller weapons and some surface bursts were replaced with air bursts.

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2. Mr. Shure at the Air Force Intelligence Center re-evaluated the "expected" Helsinki dose from the FY 1961 SIOP by using the approach of Supplement 3 to WSEG-46. Approximately 600 surface burst weapons were considered to be within range of the WSEG-46 templates and a complete listing of these weapons was used in the calculation.

FOIA(b)(3) - 42 USC 2162(a) - RD DOE EO13526 6.2(a)

design. Data provided by Roger Batzel and independently confirmed by Lt Moreland of DASA were used to calculate new effective fission yields. They are expressed as a constant times the total yield (See Appendix A). Using these expressions the "expected" dose at Helsinki was calculated for each weapon used by AFIC by multiplying arrival probability X dose per megaton X reduction factor (for non 20 MT weapons) X new effective fission yield X base survival probability. The only factor that was different was the effective fission yield. No air burst weapons were considered in the study of the problem.

3. As an additional exercise, all of the above calculations were repeated with the arrival probability and base survival probability factors assumed to be unity. While unrealistic, this might serve as a measure of the upper bound of radiation dose which could be delivered to Helsinki. No attempt was made to bring any presently scheduled air bursts to the surface in this part of the study as it was impossible to distinguish between those weapons lifted from the ground to stay within the constraint and those originally scheduled for air burst. It should be pointed out that the actual winds on the day that the SIOP is executed will have a much more profound effect on the maximum possible dose at each control point than is implied in this maximizing exercise. The dose calculated from the average annual wind can easily be an order of magnitude or more too high or too low depending upon the meteorological situation.

4. A measure of the effect of meteorological variability is provided by Figure 4 WSEG-46 and Figure 3, Supp 3, WSEG-46 where the probability of exceeding a certain dose or death rate is plotted as a function of the expected dose.

RESULTS:

1. The basic results are broken down into fractional "expected" doses at Helsinki: for alert and non-alert weapons and for weapons less than and greater than 1 megaton (See Appendix B).

The total expected doses at Helsinki are:

Present	-	91r
Clean	-	23r
Immaculate	-	6.5r

2. One important feature of the study is that it shows that 26 alert weapons on 16 aiming points within 300 miles of Helsinki produce 50r (See map). The "expected" dose from these 26 weapons could be reduced to 12r and 3.5r respectively if clean or immaculate weapons of the same yield were substituted for them. In addition it is noted that 5% of the total "expected" dose comes from a single 60 KT weapon burst 45 miles south of Helsinki.

CONCLUSIONS:

FOIA(b)(3) - 42 USC 2162(a) - RD DOE EO13526 6.2(a)

2. An additional reduction by a factor of about 4 might be made with the production of immaculate (super clean) weapons. This appears to be the irreducible minimum.

3. Extreme caution should be exercised in applying the results of this study to other control points because the spectrum of weapons and burst points may be different.

APPENDIX A

Analysis of the Effective Biological Dose (EBD) expected from clean and very clean weapons, for application in targeting studies.

The following analysis was performed to determine the "effective fission yield" equation appropriate to clean and very clean nuclear weapons for use with the templates and method of WSEG Staff Study #46, with 3 supplements.

[redacted]

This data and that contained in DASA Staff Study 617 allow the calculation of the EBD expected from clean weapons, as described below.

ASSUMPTIONS:

1. The average EBD per kiloton fission yield per square statute miles is numerically equal to twice the H+1 hour dose rate, i.e. equivalent to the dose from fission products in fallout received from H+6 hours (average arrival time) to one month after burst. In WSEG #46 with supplements, this value is 0.8 X 5,000 = 4,000 r.

2. That the following parameters apply to present and future clean weapons:

[redacted]

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3 Excised Pages

APPENDIX B

"Expected" Dose on Helsinki for Various Types of Weapons

(A) Complete SIOP

T	Cat.*	Base Survival Probability = 1 Arrival Prob. = 1 Normal	Clean	Immaculate	Base Survival Probability ≠ 1 Arrival Prob. ≠ 1 Normal	Clean	Immaculate
>1MT	1	137r	31r	10r	60r	13r	4.4r
>1MT	≠1	67	15	5	5.4	1.4	0.45
<1MT	1	33	10	1.9	24	8.4	1.5
<1MT	≠1	12	4	.7	1.2	.40	0.072
Total		249	60	18	91	23	6.5

*1 = Alert weapon
≠1 = Non-Alert weapon

(B) 26 Selected Alert Weapons
(Arrival Probability ≠ 1)

Normal	Clean	Immaculate
50r	12r	3.5r

ONC 153

This chart represents combined requirements for a graphic to satisfy special military operations as well as general navigation uses.

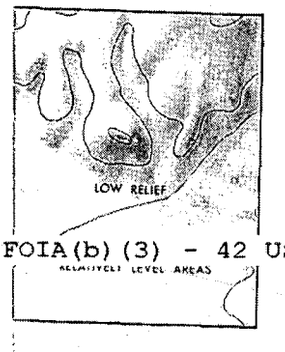
STUDY THE LEGEND
KNOW YOUR TOOLS

LEGEND

RELIEF PORTRAYAL

Elevations are in feet. Highest TERRAIN elevation is 1077 feet located at 56°53'N 29°31'E

TERRAIN CHARACTERISTIC TINTS
(areas of unreliable relief are devoid of tint)



REEN depicts relatively level areas all elevation levels to delineate and parate the relatively flat from the ping or more rugged areas. In addi-n, the GREEN extends along the ijor drainage system to retain a alley accent feature."

CONTOUR INTERVAL

00 feet with intermediates at 0 feet

1000
Contour

250
Intermediate

SPOT ELEVATIONS

vation and position accu-a, maximum vertical error feet ..... • 2385

ition accurate, maximum pos-e vertical error shown ..... x 9700

proximate or doubtful locations indicated by omission of the at locator (dot or "x")

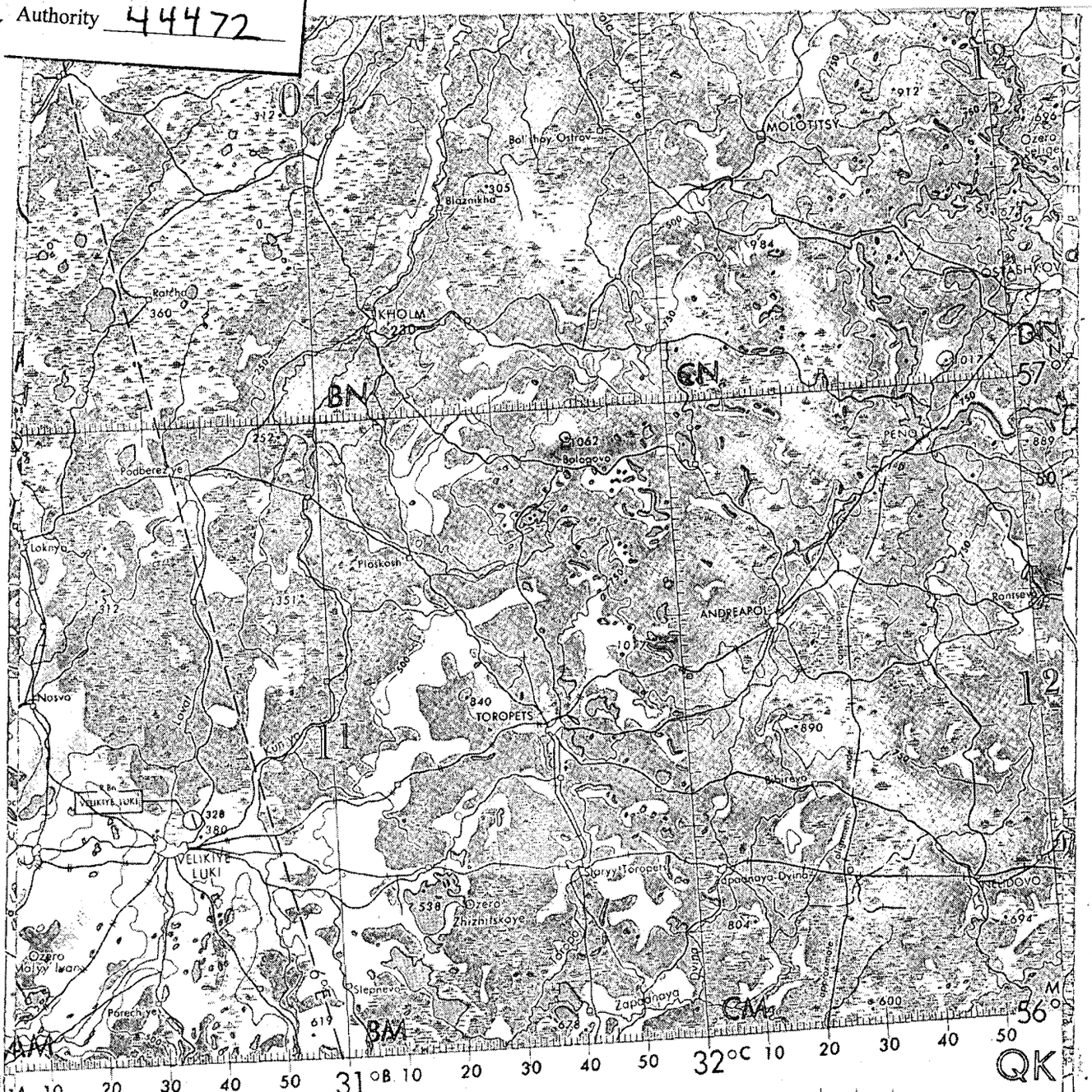
e elevation 1050

am elevation 740

XIMUM ELEVATION DATA

ures indicate highest TER-N elevation within a quad-gle bounded by ticked lines, do not include elevation of ical obstructions. Relief infor-ion is inadequate in quad-gles without maximum eleva-data).

6 Excised Pages



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NAUTICAL MILES
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CAUTION

AIR INFORMATION CURRENT THROUGH
17 FEBRUARY 1959
Aeronautical Information shown in this color is subject to frequent changes. The rate of change of air information precludes revision of this chart to insure currency. Consult NOTAMS, Radio Facility Charts and ACIC Bulletins for the latest information.

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GULF OF RIGA

FINLAND U.S.S.R.

ONC 153

SCALE 1:1,000,000

This chart replaces WAC 153 for military users.

BASE 100
BASE INFORMATION MAY 1958
SPEC. NO. ONC-A-1

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