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TACTICAL NUCLEAR WEAPONS IN SOUTHEAST ASIA (U)

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GLOSSARY OF ABBREVIATIONS

ADM	atomic demolition munition
ASM	air-to-surface missile
CEP	circular error probable
CPR	Chinese People's Republic (Communist China)
DMZ	demilitarized zone
HE	high explosive
IRBM	intermediate-range ballistic missile
KT	kiloton(s)
km	kilometer(s)
MRBM	medium-range ballistic missile
NVN	North Vietnam(ese)
NW	nuclear weapon
POL	petroleum, oils and lubricants
RAC	Research Analysis Corporation
REB	research earth borer
rem	roentgen equivalent man
ROK	Republic of Korea (South Korea)
ST	short tons
SVN	South Vietnam(ese)
TNW	tactical nuclear weapon
VC	Viet Cong
VN	Vietnam

CONTENTS

TACTICAL NUCLEAR WEAPONS IN SOUTHEAST ASIA (U)

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I. PURPOSE AND SCOPE

The purpose of this study is to evaluate the military consequences of a U.S. decision to use tactical nuclear weapons (TNW) in Southeast Asia, under the assumption that the war remains theater-limited and that no strategic exchange occurs. The study divides into two main parts. (1) possible targets for U.S. TNW, and effects of nuclear bombardment on the ground war if the use of TNW remains unilateral; and (2) possibility and effectiveness of enemy retaliation with nuclear weapons supplied by the USSR or China.

Among both military experts and the general public, there is wide agreement that the use of nuclear weapons in Southeast Asia would offer the U.S. no military advantage commensurate with its political cost. This opinion is usually based on an intuitive judgment, however, rather than on detailed analysis.

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[2] University of Chicago.
[3] Harvard University.
[4] University of Chicago.

There is some disagreement as to whether the use of nuclear weapons would still remain unprofitable if China openly intervened with large ground forces in the Vietnam war. It therefore seemed worthwhile to make a study of the consequences that would follow from a U.S. decision to use nuclear weapons in tactical operations in Southeast Asia.

We have arbitrarily excluded strategic nuclear operations from the study. This means that we assume the annihilation of the civilian economy of North Vietnam (NVN) or China to be outside our terms of reference. Nuclear weapons are to be used tactically in the strict sense, that is to say, only on military targets, only within the theater of ground combat, and while avoiding civilian casualties so far as practicable. The reason for limiting the study to tactical use is that we wish to stay as much as possible in the realm of technical military analysis and to avoid involvement with political and moral judgments.

The study has involved four men working for a total of three man-months. Such a small effort cannot deal adequately with so large a subject. Almost all our conclusions are tentative, and they should be investigated further by professional experts. We regard our study as only a beginning.

This report is divided into seven sections; Sections III and IV contain the major part of the work. Section III discusses the military consequences of the U.S. use of tactical nuclear weapons in Southeast Asia, under the assumption that this use remains unilateral and that the enemy response is purely defensive. The questions that arise are: What kind of targets exist, how many weapons of what yields could be profitably expended, and how great would be the effects on enemy ground operations? Section IV discusses the feasibility and effectiveness of enemy use of nuclear weapons against U.S. forces. Here, the emphasis is on the logistic difficulties of supplying nuclear weapons and the means of delivery from the USSR or China to guerrillas in Vietnam, as well as on the vulnerability of U.S. military bases. Section V briefly discusses the long-term effects that may arise if guerrillas in other parts of the world acquire nuclear weapons. Section VI deals with the political consequences of U.S. use of nuclear weapons, but without any attempt at a complete political analysis.

II. CONCLUSIONS

A. UNILATERAL USE OF TNW (See Section III)

The use of TNW on troop targets would be effective only in stopping the enemy from moving large masses of men in concentrated formations. So long as the enemy moves men in small groups and uses forest cover, he would offer few suitable troop targets for TNW.

Viet Cong (VC) base areas in South Vietnam (SVN) could be effectively destroyed with TNW, but this would require large numbers of weapons and an accurate location of targets by ground patrols.

Bridges, airfields, and missile sites make good TNW targets.

TNW can be used very effectively to block roads and trails in forested areas by blowdown of trees, but a vigorous effort to cut through the fallen trees could reopen most of the roads in approximately one month. After the trails are reopened, further nuclear strikes are much less effective in interdicting movement, since a tree can only be blown down once.

From the point of view of cost-effectiveness, the use of TNW against troops in the open compares unfavorably with the use of bomblet-canister ordnance.

Fallout from groundburst weapons cannot by itself provide a long-lasting barrier to the movement of men and supplies, without endangering civilian populations at up to a distance of 200 miles. It can provide, at most, a complicating factor in the reconstruction of damaged facilities.

War games played at RAC and RAND exaggerate the effectiveness of TNW in Southeast Asia, mainly because of the short duration of the campaigns. The games are set up so that large forces are committed and engaged in intense battles within a few days, thus offering excellent targets for TNW. The machinery of game playing makes it impossible to stage a long and indecisive campaign.

We estimate that any of the RAC and RAND games, if played on a long time scale, would end in a stalemate, with the enemy forces retiring into the forests and the U.S. nuclear bombardment running into the law of diminishing returns. So long as the U.S. force is numerically inferior, with or without TNW, the stalemate will not be broken.

The use of TNW for an interdiction of lines of communication in NVN, similar to the ROLLING THUNDER operation, could be highly effective, but it would require a huge number of weapons. A RAND targeting study indicates that, in such a mixed interdiction campaign, one TNW is, on the average, equivalent to about 12 nonnuclear attack sorties. This means that a completely nuclear ROLLING THUNDER campaign would require about 3000 TNW per year.

B. <u>VULNERABILITY OF U.S. FORCES TO ENEMY TNW</u> (See Section IV)

U.S. forces now in Vietnam are concentrated in 14 highly vulnerable bases.

The bases contain a total of about 70 target areas, each having a diameter of about two miles and each packed with men, stores, equipment, or vehicles.

Enemy units can approach on foot close to the perimeter of almost any of the bases, although undetected approach by motor vehicles is unlikely. The six coastal bases are easily approached by small boats (sampans), but any large boat is likely to be challenged and searched.

To smuggle TNW inside a U.S. base would be a high-risk operation, requiring some luck for its success.

The known Soviet TNW are all heavy and high-yield weapons designed for large-scale mechanized warfare. The smallest of them have warheads in the 1000-pound class, which would be extremely difficult for guerrilla forces to handle. However, [redacted] A mortar or recoilless rifle weighing a few hundred pounds would be a possible delivery system with a range of a few miles.

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If we assume that the USSR has manufactured a supply of TNW [redacted] these weapons could be shipped from the USSR to South Vietnam and distributed to launch points even in the face of U.S. nuclear interdiction attacks. The transportation through Vietnam would necessarily be by foot, and it might take several months to complete the trip. Larger TNW could probably not be brought further than North Vietnam.

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TNW of megaton yield could be brought into harbors from a boat or submarine lying a few miles off shore, the weapon being enclosed in a buoyant container and pulled by a frogman riding a sea sled.

If about 100 weapons of 10-KT yield each could be delivered from the base perimeters onto all 70 target areas in a coordinated strike, the U.S. fighting capability in Vietnam would be essentially annihilated. In the more likely contingency that only a few weapons could be delivered intermittently, U.S. casualties would still be extremely high and the degradation of U.S. capabilities would be considerable.

It is not feasible to disperse U.S. forces in Vietnam sufficiently to make TNW attacks on them ineffective. Given sufficient time, it would be possible to protect a high percentage of U.S. forces against attacks of the magnitude described in Section III-C by hardening the bases (building blast shelters for troops, planes, and supplies) at a cost which is not unreasonably high.

A megaton weapon delivered by sea sled could cause essentially total destruction of a harbor and its associated facilities. A kiloton weapon delivered in this way could, at most, sink a fraction of the shipping in the harbor and interrupt operations for a few weeks.

If TNW are provided by the USSR, a sustained campaign against U.S. forces will not impose any strain on the Soviet stockpile. If China is the provider, only enough weapons for sporadic attacks can be available during the next few years.

In addition to the main parts (Sections III and IV) of the study, brief attention was given to two other items (Sections V and VI).

C. USE OF TNW BY INSURGENTS ELSEWHERE (See Section V)

The use of TNW in Southeast Asia is likely to result in greatly increased long-term risk of nuclear guerrilla operations in other parts of the world. U.S. security would be gravely endangered if the use of TNW by guerrilla forces should become widespread.

D. POLITICAL CONSEQUENCES (See Section VI)

The use of TNW in Southeast Asia would be highly damaging to the U.S. whether or not the use remains unilateral.

The overall result of our study is to confirm the generally held opinion that the use of TNW in Southeast Asia would offer the U.S. no decisive military advantage if the use remained unilateral, and it would have strongly adverse military effects if the enemy were able to use TNW in reply. The military advantages of unilateral use are not overwhelming enough to ensure termination of the war, and they are therefore heavily outweighed by the disadvantages of eventual bilateral use.

III. ADVANTAGES OF TACTICAL NUCLEAR WEAPONS FOR ATTAINMENT OF U.S. MILITARY OBJECTIVES

A. CATALOG OF TARGETS FOR U.S. USE OF TACTICAL NUCLEAR WEAPONS

Troop Concentrations

The majority of nuclear strikes in all the war games that we have studied were made against troop concentrations. In the two OREGON TRAIL games[1], the average number of enemy casualties per strike was about 100. This average was achieved against troops actively engaged in large-scale fighting with conventional armor and artillery. If the North Vietnamese army or a Chinese invading force should fight in this style, there is no reason to doubt that they could be defeated by U.S. employment of tactical nuclear weapons. The number of nuclear strikes required would be large (several hundred at least).

In reality, it is extremely unlikely that a return of 100 casualties per strike could be maintained in Southeast Asia. The OREGON TRAIL studies showed that the outstanding difficulty in the use of TNW lies in locating troop targets accurately and striking before the location becomes obsolete. A dramatic example of this difficulty was provided by exercise FLORIDA ISLAND (OREGON TRAIL, Vol. 10, Annex I) in which a two-seater airplane (OV-1B MOHAWK) was searching for targets while flying at 180 knots and 500-ft altitude. In eight sorties flying

[1]Project OREGON TRAIL, Final Report, USACDC No. USC-6, February 1965.
Volume 1, Main Report, TOP SECRET RD.
Volume 8, Annexes E and F, War Games by RAC, SECRET RD.
Volume 10, Annex I, Troop Evaluations, SECRET RD.
Volume 17, Annex P, Political Considerations, SECRET RD.

over 354 targets (e.g., an infantry company in defensive position, an artillery battery in firing position, a tank company in an assembly area, a missile site, a command post, and a line target consisting of about ten 2-1/2-ton trucks) and using both visual and photographic reconnaissance, not a single target was picked up. A BIRD DOG plane flying at 90 knots was able to pick up only 31 percent of 72 target items in three sorties.

It seems likely that the introduction of TNW in Southeast Asia would not radically change the present vulnerability of North Vietnamese and Viet Cong (VC) ground forces in the field. The limiting factor in the U.S. capability to destroy them is target acquisition, rather than firepower. In many situations where the enemy employs hit-and-run tactics, the necessarily cumbersome command-and-control routine will make the use of TNW impossible.

In summary, the use of TNW on troop targets would be effective only in stopping the enemy from moving large masses of men in concentrated formations or in confined spaces. So long as the enemy continued to operate as he does at present, moving men in small groups and making good use of forest cover, he would offer U.S. forces few opportunities to use TNW effectively.

Headquarters and Communication Centers

The permanent VC base areas in South Vietnam (SVN), for example, Zone C and Zone D, would be suitable targets for TNW. However, their area is so great (about 1000 square miles each) that they could not be attacked blindly. It would be necessary to locate targets within the base areas by ground patrolling or aerial reconnaissance, as is done for the current B-52 ARC LIGHT attacks. When a target is located, it could be destroyed with TNW rather more thoroughly than with conventional bombs, provided that the use of TNW introduced no additional delay. With groundburst TNW, it would be possible to destroy even deep tunnel systems, but this would require that the positions of the tunnels be known to within a few hundred feet. The tunnel systems are so extensive that many groundburst TNW would be needed, and this would give rise to serious fallout problems, either in Saigon or in Cambodia, depending on which way the wind was blowing.

There is a new type of weapon under development,[2] called research earth borer (REB) which is an airdropped bomb that penetrates the ground to a desired depth. The bomb is optimized for a given yield, and the crater diameter is about double that of a surfaceburst of the same yield. Alternatively, the depth can be chosen so that the explosion is almost contained and fallout practically eliminated. [redacted], while in the second case the limit is about [redacted] (U) DTRA

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REB would be a useful weapon for dealing with the deep VC tunnel systems. The destructive range would not be much increased over that of a surfaceburst, so that a large number of weapons and accurate location of targets would still be needed. Elimination of long-range fallout, if REB actually performs up to specifications, would make a nuclear attack on tunnel HQ a relatively inconspicuous operation.

Supply Lines

A large fraction of the current ROLLING THUNDER air attacks on NVN is directed at supply lines, particularly road and rail traffic. Most of the targets are dispersed or mobile, and

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[2] W. N. Caudle, et al, "The Sandia Program for Earth Penetrating Systems," Sandia Corporation, SC-WD-65-201, May 1965, SECRET RD; C. Young and G. Ozanne, "Low Velocity Penetration Study," Sandia Corporation, SC-RR-66-118, July 1966, CONFIDENTIAL.

therefore they are unsuitable for TNW. The best supply-line targets for TNW are bridges, of which 42 had been attacked up to March 1966. Attacks on the bridges with conventional bombs are generally unrewarding, and the damage is either quickly repaired or circumvented. Groundburst TNW could destroy bridges with much greater certainty and thoroughness, but accurate delivery would still be essential (within a few hundred feet for complete destruction by a kiloton-range bomb). It is possible that the introduction of an accurate homing air-to-surface missile (ASM) with high explosive (HE) warhead, viz., WALLEYE, would be almost as effective as TNW in keeping bridges unserviceable.

The combination of REB weapons with controlled dive gliding as in the BAYONET system[3] makes possible accurate delivery from low-flying planes, since the weapon does not skip on the surface as in conventional low-level delivery. Thus, BAYONET, with either conventional or nuclear warheads, could be very effective against bridges, and it is not clear on which side the greater advantage would be.

Airfields and SAM Sites

Airfields are ideal targets for TNW and are expensive targets for conventional bombing. At present there are 14 airfields in NVN, of which four are unserviceable as a result of ROLLING THUNDER attacks. Introduction of TNW would quickly remove the remaining ten airfields from operation.

SAM sites could also be destroyed effectively with TNW, but it is possible that the enemy would learn to operate SAM from dispersed and camouflaged positions which would be relatively invulnerable to TNW. The elimination of SAM would be

[3] SC-WD-65-201, op cit, pp. 32, 56,
The BAYONET System SCWD-66-458, 1966, SECRET RD.

very advantageous to U.S. air operations, since it would enable aircraft to fly at an altitude out of the effective range of light AAA.

Mountain Passes and Trails

TNW of higher yields are extremely effective in blowing down trees. [redacted] (b)(1) DTRA

It would be possible with a few hundred such weapons to block all mountain passes and trails between NVN and China, or between NVN and Laos. Important routes could be blocked by forest blowdown over distances of tens of miles. Large-scale movement of men and supplies could be stopped for a considerable time. The interdiction could be maintained even longer if, after an initial nuclear strike, repair work on the trails were harassed by continued air attack with the use of nonnuclear ordnance.

The main weakness of tree blowdown as a method of interdiction is that a tree can only be blown down once. Once the trees are down and the enemy has cut a new trail through the fallen trunks, further TNW strikes will be relatively ineffective. In fact, the fallen trunks will give excellent cover against the blast and heat effects of subsequent strikes. Therefore, the main question in assessing the usefulness of tree blowdown is how long will it take the enemy to cut a trail through a blown down forest. If the time taken to cut a trail is short compared to the duration of the war, the blowdown will not have a decisive effect on the outcome.

A careful study would be needed to determine the trail-cutting time, which would depend strongly on details of logistics and topography as well as on the size and taxonomy of the trees. Presumably, the job could be done with a liberal use of HE much more rapidly than with hand saws. If caches of food and HE were prepositioned along the trails, the work of trail cutting could proceed simultaneously at many points within the blown down area. Men could climb in over the trees and work independently of outside supplies.[4]

Just for purposes of illustration, without any basis in detailed study, we consider the figure of ten feet per man-day[5] as a possible figure for the length of trail that could be cut through blown down forest. [redacted] This estimate is only a guess, but it gives an idea of the order of magnitude of effort required for trail-cutting. If the U.S. delivered several hundred 100-KT weapons in a major interdiction strike, we could expect at least a substantial fraction of the trails to be reopened by 50,000 men working for a month or two.

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From this very rough estimate, we conclude that the duration of interdiction by forest blowdown would be measured in weeks or months, rather than in years. Unless the U.S. had some assurance of ending the war within a year, the interdiction could not be decisive. Further study is, of course, required to confirm this judgment.

[4] It is possible that a freshly cut trail through fallen forest would be more conspicuous and, hence, more vulnerable to aerial attack than a trail through standing forest. On the other hand, when the forest had originally been dense, the fallen trees would be piled on top of one another, and the new trail might be cut through the undermost trunks, leaving the overlying trunks undisturbed. Thus, the effect of blowdown might be to make trails through sparse forest more vulnerable and trails through dense forest more invulnerable. The vulnerability of major roads and railway lines, which are visible from the air anyhow, would not be much affected by blowdown and subsequent clearing.

[5] This figure is based only on an intuitive feeling that 1 foot per man-day is too little and 100 feet per man-day is too much. We consider it probable that 10 feet per man-day is in fact an underestimate.

TNW can be used for interdiction of passes and trails, independently of tree blowdown. Effects of fallout will be considered separately in Section III-B. Effects of blast, heat, and fire will only be felt by men who happen to be on the trails at the time of the burst; these effects are subject to the limitations already discussed in the section on troop targets. In conclusion, it appears that interdiction of passes and trails by TNW can be effective only against massive enemy movements on a short time scale, but not against dispersed movements extending over many months or years.

B. CHARACTERISTICS AND EFFECTS OF TNW ON THESE TARGETS

Prompt Effects

The main question in judging the utility of TNW against troop targets is the relative effectiveness of TNW, as compared with BLU-3B and other bomblet-canister ordnance now being introduced in B-52 ARC LIGHT attacks. Detailed comparisons of effectiveness are made in the OREGON TRAIL report[6], assuming conditions of large-scale warfare in the European theater. The OREGON TRAIL comparisons do not apply in detail to operations in Southeast Asia. In general, they indicate that TNW are more cost-effective than bomblets against tanks and armored vehicles, but bomblets are more cost-effective against troops in the open. In Southeast Asia, strikes against troop targets will usually be made under conditions that make TNW relatively ineffective.

The effect of TNW upon tunnels in the VC base areas will depend on unknown details of the tunnel system, particularly upon the nature of the rock or soil through which the tunnels are dug. From Glasstone, "The Effects of Nuclear Weapons,"

[6] Project OREGON TRAIL, Final Report, Vol. 1 (USACDC No. TSC-6, February 1965, TOP SECRET RD), page 307.

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1962 Ed., page 300, it appears that, in general, a tunnel will survive a groundburst TNW at a distance of four times the crater radius. [redacted] change this conclusion.

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Delayed Effects, Duration of Fallout Patterns in Maintaining Interdiction of Supply Routes

We consider two types of fallout barriers, those which aim to block movement across a continuous front and those which block movement along individual roads or trails. The two types fail to be useful, for rather different reasons.

Continuous-Front Barriers

Fallout can be an effective barrier to movement of troops and supplies on a short time scale. The actual dose rates and distributions obtainable from groundburst weapons are extremely sensitive to local conditions and meteorology. It is therefore helpful to calculate upper limits to the effectiveness of fallout under the assumption of an optimal distribution.

Suppose that Y megatons of fission products are distributed uniformly over a rectangular area of width L and depth D (i.e., we are considering a barrier along a front of width L and depth D, both expressed in miles). Suppose that, T days after the explosion or explosions, a man crosses the front without any shielding at V miles per hour. According to S. Glasstone, "The Effects of Nuclear Weapons," 1962 Ed., Chapter 9, the dose rate at three feet above ground, when perfectly level ground and uniform distribution are assumed, is

$$d = 6 \times 10^4 (Y/LDT^{1.2}) \text{ rem/hour.}$$

The total dose to the man crossing the barrier is then

$$\Delta = 6 \times 10^4 \ (Y/LDT^{1.2}) \text{ rem,}$$

and this is independent of the depth of front.

Consider, for example, a barrier that is two weeks old ($T = 14$, $T^{1.2} = 24$) and a man walking across with $V = 3$. Then

$$\Delta = 800 \ (Y/L).$$

Suppose we take $\Delta = 40$ rem as a dose that is low enough to be acceptable (a man could then walk across the barrier twice without noticeable effects). Then the barrier requires

$$Y = (L/20),$$

that is, one megaton per 20 miles of front, and this must be repeated every two weeks. For a 100-mile front, the total fission yield required is 130 MT per year[7]. This is a minimum value, because unavoidable irregularities in the distribution and the topography will allow people crossing the barrier to choose routes where the dose would be less than average. If we chose a time interval, T, less than 14 days, the total yield required per year would be reduced by a factor $(T/14)^{0.2}$. The reduction is less than 50 percent even if the barrier is relaid every day ($T = 1$).

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[7] This assumes that accumulation of fallout products beyond two weeks can be neglected because of leaching, countermeasures, etc. If complete accumulation of fallout is assumed, the required one-year yield is reduced by a factor of about three.

It seems unlikely that the U.S. would be willing to expend more than 1000 nuclear weapons per year for a 100-mile barrier. Therefore, the average fission yield per weapon must be 130 kilotons (KT) or greater. The job simply cannot be done with low-yield weapons.

Now let us estimate the effects of the fallout on civilian populations and U.S. forces at a distance from the barrier. These effects are even more sensitive to meteorology than the local effects. Since we are dealing with yields of 130 KT or greater, the fission products will fall from heights of around 40,000 feet and the fallout patterns will be something like the idealized pattern shown in Glasstone, page 449. Let us assume a value of 15 miles per hour for the component of wind speed that is perpendicular to the front, averaged from sea level to the 40,000-foot altitude. Such a velocity component can be expected to occur fairly often under operational conditions. Then, from Glasstone, pages 429 and 449, we find a total fallout dose between one day and 14 days after the explosions which is, on the average,

$$\Delta' = 600\ (Y/L)\ \text{rem}$$

at a distance of 200 miles downwind from the barrier. If we assume, as before, that $Y = (L/20)$, then $\Delta' = 30$ rem. So the population at a distance of 200 miles from the barrier is exposed to 30 rem in two weeks every time the average wind happens to be blowing in its direction. If the barrier is maintained for a year at two-week intervals, and if the wind direction is bad roughly half the time, then the population at a 200-mile distance receives about 400 rem[8]. This figure is

[8] Assuming no cumulative effects from previous doses. If complete accumulation is assumed the figure would be approximately 500 rem.

an extremely gross average, and large variations up and down are certain to occur. We may therefore assert a definite conclusion as follows: <u>Any fallout barrier that is effective in stopping men from walking across it at three miles per hour would constitute a lethal threat to a population living permanently within a distance of 200 miles on either side of it.</u> If the people were "friendly," they would have to be evacuated; if they were "enemy," the barrier would be primarily an anti-population, rather than a tactical, operation.

<u>Point Barriers</u>

Since continuous-front barriers appear to be unfeasible, we consider the opposite situation, where fallout is used to block a single road or trail. If the fallout is to be localized, weapons in the kiloton range must be used.

The condition $Y \geq (L/20)$ still applies, where L now is the spread of the fallout perpendicular to the trail. Since meteorology is always variable, L will also be roughly equal to the length of contamination along the trail. Expressing L in feet, now, and Y in kilotons, we have

$$L \leq 100\ Y$$

for a barrier that is effective for two weeks. Since, for the fallout to be localized [redacted] (b)(1) In fact, the optimum situation for the barrier will occur when most of the fallout is contained in material splattered around the bomb crater.

In the majority of circumstances, the barrier will be easily circumvented by the building of a new road or trail for a few hundred yards around the crater. This could be done in many cases within a few days (or nights). In places where the topography makes an alternative route impossible, it will usually be possible to make a passable road right through the bomb crater. Twenty-four inches of earth over the floor, with a sandbag wall on each side, will reduce the radiation dose on the trail by a factor of 100 (Glasstone, page 651). Since the heavily contaminated section cannot exceed 1000 feet in length, a large number of men working in relays could certainly build a shielded trail within two weeks without exposing themselves to lethal radiation doses.

It would of course be possible to block a road or trail by exploding nuclear weapons on it at intervals more frequent than two weeks. But in this case the barrier would be due mainly to the prompt effects of the weapons (killing people who were on the trail at the time of the explosion, and excavating the ground), and the fallout would only be a complicating factor. The use of fallout to constitute by itself a long-lasting barrier is unfeasible, whether the barrier is intended to cover a continuous front or to block individual passes or trails.

C. EXAMINATION AND CRITICISM OF RELEVANT WAR GAMES

The only way to estimate with any degree of precision the effectiveness of TNW in military operations is to conduct detailed war games. Since we have neither the competence nor the facilities to conduct games ourselves, we have confined ourselves to examining the results of past games carried out at RAC and RAND.

RAC Games, [redacted]

As a part of the OREGON TRAIL study, two games were played by RAC in 1964, one studying [redacted] Full details are to be found in Vol. 8, Annexes E and F of ~~the~~ OREGON TRAIL report. The weapons and organization of the U.S. forces are not those that now exist; the games were played primarily to test the performance of various alternative future force structures. From the point of view of evaluating the effectiveness of TNW, the differences between the game forces and actual U.S. forces are probably not crucial. The differences lie mainly in the direction of simplifying command and control problems and permitting a more rapid and flexible use of TNW. Thus, the results of the games probably represent an upper limit to the effectiveness of TNW under current operational conditions.

Both games were played with the unilateral use of TNW by U.S. forces.

[redacted]

[redacted]

[redacted] (b)(1) 07/28 Phase 1 ends at this point, with the invaders in possession of the cities and airfields and with the remnants of the defenders retreating into the forested interior of the island.

Phase 2 takes place a month later. U.S. forces are deployed in a "search and destroy" operation, the defending forces being dispersed, Viet Cong style, in the hills. The U.S. forces are successful in surrounding some Chinese units and destroying an infantry battalion; and the game ends, after 29 hours, in a very inconclusive fashion. The report states: "The ability of the (U.S.) division to accomplish its mop-up operation with nuclear weapons was not impressive."

From these games, much can be learned concerning the effectiveness of TNW in a short, intense campaign. The fundamental defect of such games is their short duration. In order to play the battles through with adequate attention to detail, many days of real time are required for each day of game time. For example, the play [redacted] which totalled 72 hours of game time, required three months. It is totally impracticable to play through a war of realistic length at this level of detail. One is almost in as bad a situation as Tristram Shandy, who started to write his autobiography but took a year to describe the events of the first day.

RAND Games, Vietnam and Laos[9]

The RAND games that we have studied are of older vintage than the RAC games, and they were played at a higher level of

[9] E.W. Paxson, *et al.*, "Limited War in Indochina," The RAND Corporation, RM-2050, March 1957, SECRET; G.C. Reinhardt, "Escalation of Limited War in Laos," The RAND Corporation, (Footnote continued on next page.)

aggregation, i.e., with forces lumped together in larger units. This makes the results of the games less reliable as to details, but has the compensating advantage that wars of longer duration can be played.

The game, Vietnam-3, was played in 1957 and staged in 1958. Red forces invaded South Vietnam across the DMZ and from Laos. In a campaign of 26 days, the invasion was repelled and 33,000 Red troops were killed with 34 TNW.

The game, Seasia-1, was played in 1961 and staged in 1963. A large Red force (310,000 men) invaded Laos and Thailand. Blue replied with heavy interdiction strikes, using TNW to block the mountain passes in northern Laos. Forests were extensively blown down and large Red forces were trapped. In a 30-day campaign, 140,000 Red troops were killed with 208 TNW. The game ended before the fate of the surviving Red forces could be decided.

Both of these RAND games make TNW appear very much more effective than the RAC games do. There are several reasons for the discrepancy. The main reason seems to be that the RAC players allowed the Red forces to react intelligently to the nuclear environment, while the RAND players did not. In particular, the RAND scenario of 310,000 men marching through the mountain passes within a few days seems highly improbable. If these men had moved in small groups over a period of months, as the NVN army in fact does at present, they would never have laid themselves wide open to TNW attack. We conclude that the RAC estimates of TNW effectiveness are the best available and that the RAND estimates are probably too high by a factor of ten.

(Footnote continued from previous page.)
RM-2854-PR, June 1962, SECRET RD; G.C. Reinhardt, "Nuclear Weapons in Limited Warfare -- A Review," The RAND Corporation, RM-3838-PR, January 1964, SECRET RD.

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There are three fundamental weaknesses in all the games we have studied, if they are supposed to have predictive value. First, they ignore the possibility that the use of TNW may be two-sided; we discuss the two-sided situation in Section IV of this report. Second, they do not credit the enemy with the ability to hide and maneuver in the jungle, an ability that he has already demonstrated in Vietnam. Third, they are played on much too short a time scale; the proper time scale for war in Southeast Asia is almost certainly years, rather than days or months, with or without TNW.

Attempt to Guess What Would Happen if These Games Were Conducted on a Longer Time Scale

Nobody can claim the wisdom to predict what would happen in reality after the use of TNW in Southeast Asia had begun. An effort was made in the course of the OREGON TRAIL study to include worldwide political repercussions in a TNW war game. To quote from the OREGON TRAIL report[10], "Project OREGON TRAIL conducted one politico-military war game and sought to construct another, in an effort to test the potential politico-military utility of a capability for tactical nuclear war. The game that was played fell short of achieving its purpose, and the one under construction was aborted, largely because of gamers' disbelief that there was any objective short of national survival for which the United States and the Soviet Union would be prepared to employ TNW, and their equal disbelief that either would let his national survival be determined by the outcome of an arbitrarily limited battle." This unwillingness of professional experts to include long-range political factors within the scope of their predictions shows that they have a proper awareness of the limitations of their discipline.

[10] Project OREGON TRAIL Final Report, Volume 17, page P-7.

A more modest type of prediction may be more allowable. We may ask, not what would happen in real life after the introduction of TNW, but what would happen if one of the RAC or RAND war games were played according to the same rules for a much longer time. That is to say, we assume that the war remains limited and confined to the local theater, that the use of TNW remains unilateral, and that the military struggle continues without change of political objectives. What, then, will happen after two or five years?

When we ask ourselves this question, we find ourselves always coming back, perhaps because of lack of imagination, to the same answer. We find that, after an initial success, the further use of TNW brings diminishing returns and the situation gradually reverts to the status quo. [redacted] the enemy retires into the [redacted]W, and continues to operate more or less in the way the Viet Cong have been operating for the last few years. In the end, there is a stalemate that can only be broken by introducing larger U.S. forces or other extraneous factors into the game. So long as the game is played with the postulated forces, the stalemate persists, and a numerically inferior U.S. force with or without TNW cannot break it.

D. SCENARIOS FOR USE OF TNW IN ESCALATION OF CURRENT OPERATIONS IN VIETNAM

Use of TNW Against VC Bases in SVN

We discussed this use in Section III-A. TNW can be very effective if the positions of bases are known accurately, especially if attacks can be delivered without warning. Attacks, to be useful, must be preceded by ground patrolling and followed by ground mop-up operations. In these respects, the use of TNW will require the same sort of coordination as the current ARC LIGHT attacks. If accurately delivered, TNW can dig out tunnel systems that are impervious to ARC LIGHT.

In summary, the use of TNW in SVN would be helpful, but in no sense decisive. It would be equivalent to a major increase in the strength of the B-52 bombardments.

Use Against Chinese Troops Moving Through Passes

Provided their movements are dispersed in space and time, there is no reason why Chinese troops in the passes should be particularly vulnerable to TNW. The most important effect of TNW on a Chinese force invading Southeast Asia would probably be in limiting its size. A force that is too large to live off the country would be subject to disaster, through interruption of its supply lines. It is therefore reasonable to think of TNW as having a decisive effect only in the conventional scenario of a Chinese "horde," a million strong, walking into Southeast Asia. A more probable scenario would have a Chinese army of two or three hundred thousand moving south in small groups, in support of NVN or against Thailand, and keeping under cover of the jungle most of the time. Their vulnerability to TNW would then be not much greater than that of the Viet Cong.

Use for Long-Term Interdiction of Supply Routes

We saw in Section III-B that the specific long-lasting effects of nuclear explosions (e.g., fallout) are not capable by themselves of long-term interdiction. What can be done in the way of long-term interdiction is to repeatedly attack roads, railways, bridges and waterways, vehicles, and petroleum, oils and lubricants (POL) in the same style as the current ROLLING THUNDER attacks in NVN, but with TNW to increase the effectiveness. Such attacks will certainly reduce the movement of vehicular supply to a very low level, if TNW can be used in sufficient numbers. Still, the numbers of TNW required will be very large over a period of time. At least one TNW is required for each target, and the targets are mostly small and fleeting. A reasonable guess at the order of magnitude of weapon requirements for a nuclear ROLLING THUNDER operation would be ten per day or 3000 per year.[11] This is an extravagant use of the U.S. stockpiles, especially when other stockpiles in the world are not being correspondingly depleted. And in spite of it all, the basic Viet Cong system of supply by man-hauling and bicycle would not be destroyed. VC units could continue to fight at a reduced level, ready to spring back as soon as the nuclear bombardment should slacken.

[11] During the year from March 1965 to February 1966, 28,640 attack sorties were flown in operation ROLLING THUNDER (Southeast Asia Military Fact Book, DIA-ISIC, DIAIS-105-66, April 1966, SECRET). There were three categories of targets: 134 major (JCS-designated), 6100 small fixed (bridges, ferry facilities, military barracks, and supply facilities), and 3400 mobile (trucks, trains, and boats). A RAND targeting study (T. T. Connors and M. G. Weiner, "Target Study: Weapons, Sorties and Time Requirements for Four Alternative Force Employment Concepts," The RAND Corporation, RM-4537-PR, September 1965, SECRET RD), comparing the effectiveness of nonnuclear air attack with TNW in the destruction of the entire military target system [redacted] reached the conclusion that approximately 12 nonnuclear sorties are equivalent to one TNW. Applying this conversion ratio to the ROLLING THUNDER sorties, we reach the figure of 2400 TNW for a year which included the 37-day bombing pause. Thus, 3000 TNW per year of full-scale interdiction is not a highly inflated estimate.

IV. THE USE OF NUCLEAR WEAPONS AGAINST U.S. FORCES IN SOUTHEAST ASIA

The employment of nuclear weapons by U.S. forces in Vietnam raises the question of a Russian or Chinese nuclear response, either directly or by supplying North Vietnam and/or the Viet Cong with nuclear weapons. In the case of Russia, three considerations may compel action:

- Competition with China for the leadership of the Communist world and revolutionary movements in the "third world." At present, Russia is the only Communist country capable of responding in kind to a nuclear attack on an ally; failure to do so might be considered by Soviet leadership as an intolerable loss of prestige and lack of revolutionary fervor.
- Credibility of the Soviet deterrent. Soviet leaders may feel that any failure to challenge the use of even tactical nuclear weapons by the U.S. would be construed in America as evidence of Russian weakness and lack of determination. Since the Cuban missile crisis constituted a backdown by the USSR, it may be felt that a show of determination in Vietnam is that much more important.
- Denying carte blanche to the U.S. The Soviets may wish to demonstrate that unilateral use of nuclear weapons for crushing revolutions will not be countenanced.

In the case of China, similar motives may exist, modulated by the fact that China possesses no strategic deterrent and only a very small weapons stockpile. It is anybody's guess how China would weigh the advantages and disadvantages of using its nuclear weapons in Vietnam.

Finally, a word about first use of TNW by Communist forces in Vietnam is in order. The conclusions of this section indicate that U.S. forces in SVN offer a number of well-defined, lucrative targets. Despite this, the <u>first</u> use of nuclear weapons by Communist forces appears quite unlikely for the following reasons, even if the time should come when the VC despair of winning:

- Russian unwillingness to risk escalation, either through tactical use or through use on unauthorized targets (e.g., Saigon).
- Russian unwillingness to risk the theft of nuclear weapons (NW) by China.
- Chinese fear of retaliation on Chinese targets (e.g., nuclear facilities).

The remainder of this section is devoted to an estimate of the possibilities and results of a nuclear attack on U.S. forces in SVN. Although troop concentrations *per se* might on occasion offer substantial targets, the existence of a small number of densely packed U.S. bases offers stationary targets of immense value, and we therefore restrict ourselves to considering attacks on bases.

A. THE U.S. ORDER OF BATTLE IN VIETNAM

American ground forces in SVN are concentrated in 13 main bases (pages 26 and 28 of the S.E. Asia Military Fact Book, DIAIS-105-66, April 1966). Of these, six are located in the coastal plain (Hue, Qui Nhon, Da Nang, Nha Trang, Vung Tau, Phan Rang), five in the southern lowlands (Saigon, Bien Hoa, Cu Chi, Ben Cat, Phuoc Vinh), and two in the central highlands (Pleiku, An Khe). Air/naval forces are located in nine bases, of which only one, Cam Ranh Bay, is not included in the above list. Table 1 shows the locations, contents, perimeters of the bases.

Approach distances are based on the following considerations. Foot infiltration by small units up to the actively defended perimeter of all bases is an acknowledged fact. Undetected approach by motor vehicles, on the other hand, is improbable, if only because it has, to the best of our knowledge, not been attempted. This is not to exclude the use of trucks in urban areas -- Saigon or Hue, for instance -- as long as the truck contents are sufficiently small to permit camouflage.

Table 1. SUMMARY OF U.S. BASES IN SVN

Base	Location	Ground HQ	Planes or Specialty	Diameter of Perimeter (miles)	[redacted]
Hue	Coastal Plain	Regiment		5 to 8	[redacted]
Qui Nhon	Coastal Plain	Division	Major logistic support	25	7 to 8
Da Nang	Coastal Plain	Corps	119	25	7 to 8
Nha Trang	Coastal Plain	Division	25	10	4 to 6
Vung Tau	Coastal Plain			10	4 to 6
Phan Rang	Coastal Plain	Brigade	18	5 to 8	2 to 3
Cam Ranh Bay	Coastal Plain		72	25	7 to 8
Saigon	Southern Lowlands	Army MACV		Many small enclaves	[redacted]
Bien Hoa	Southern Lowlands	Division	81	5 to 8	2 to 3
Cu Chi	Southern Lowlands	Division		5 to 8	2 to 3
Ben Cat	Southern Lowlands	Brigade		5 to 8	2 to 3
Phuoc Vinh	Southern Lowlands	Brigade		5 to 8	2 to 3
Pleiku	Central Highlands	Brigade	18	10	4 to 6
An Khe	Central Highlands	Division	Large no. of helicopters	1 1/2	1

(b)(1) DTRA

(b)(1) DTRA

The coast is patrolled in 10-mile sectors by fast motorboats (Swifts), which are capable of intercepting all coastal traffic. At present, all large junks (40 to 50 ft and 5 to 10 tons) are inspected. It is unlikely that such a vessel would have a mean free path greater than five miles, and its approach to within 5 to 10 miles of a base is thus unlikely. On the other hand, there are thousands of small sampans of about 20-ft length and about 1-ton capacity, only a fraction of which are now routinely inspected, and sea or river approach to within a few miles by such vessels is possible at present. It may be possible to enforce a perimeter of several-mile radius around each base, which could be entered by any vessel only after inspection; this would be very difficult where bases are located near rivers or civilian harbors, e.g., Da Nang, Qui Nhon, and Saigon.

B. MEANS OF DELIVERING TNW

Delivery Systems

Table 2 lists some characteristics of known Soviet tactical and medium-range missiles. Table 3 lists characteristics of Soviet fighter and medium bomber aircraft. The missile systems cover a wide spectrum of ranges (from 10 to 2000 miles) and are characterized by fairly heavy warheads, even in the case of the mobile tactical FROG systems, suggesting yields in the multi-kiloton range for all systems. Very little seems to be known about the existence of TNW designed specifically for infantry [redacted] (b)(1) TRA

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To give a feeling for what the Soviets might do along these lines, Table 4 lists characteristics of some relevant U.S. systems. [redacted] RA (b)(1)

Table 2. SOME SOVIET MISSILE SYSTEMS

	Missile							Launch Vehicle			
	Length (ft)	Weight (lb)	Maximum Diameter (in)	Warhead Weight (lb)	Type	CEP	Range (n mi)	Weight (ST)	Range (mi)	Speed (mph)	Type
Scud-A (SS-1b)	--	--	--	2860	Inertial BM	0 5 n mi	80	--	--	--	Stalin tank
Scud-B (SS-1c)	--	--	--	2000	Inertial BM	0 4 n mi	150	--	--	--	Stalin tank
Sibling (SS-2)	(essentially a V-2)			3300	Radio/ Inertial BM	3 4 n mi	300	(Fixed site)			
Shyster (SS-3)	--	--	--	1800 to 3000	Radio/ Inertial BM	1 0 n mi	620	(Fixed site)			
Sandal (SS-4)	(single-stage storable propellant)			2200	Inertial BM	1 5 n.mi	1020	(Fixed site)			
Skean (SS-5)	(storable propellant)			3500	Inertial BM	1 0 n mi	2200	(Fixed site)			
Shaddock (SSC-1)	(cruise-type Mach 1 2 at <3000-ft altitude)			1000 to 1500	Cruise	500 ft	150 and 3000	(Fixed site)			
Short-range cruise	(Mach 0 9 cruises at 2000 to 3000 ft)			1000 to 1500	Beam rider w term homing	150 ft	40	(Transport-launcher)			
FROG-1	--	--	--	--	--	--	13 to 17 5	(Tracked vehicle)			
FROG-2	--	--	--	--	--	--	10	--	--	--	--
FROG-3	35	4700	21	1320	Solid prop rocket	450 yd	17 5	18 6	155	25	PT-76 amphibious tank
FROG-4	34	4200	16	820	Solid prop rocket	750 yd	29	18 6	155	25	PT-76 amphibious tank
FROG-5	30	4200	--	820	Solid prop rocket	750 yd	29	18 6	155	25	PT-76 amphibious tank
FROG-6	18 to 20	--	--	est ≤10 KT	--	--	12 to 117	--	--	--	ZIL 157 truck
SS-N-4	--	--	--	1500	Inertial	1 to 2 n mi	350	(Surfaced submarine)			
SS-N-5	--	--	--	1500	Inertial	1 to 2 n mi	700	(Submerged submarine)			

SOURCE Soviet Threat Relating to SAM-D Weapon System, 1970-80, NIO-CR-17-02-65, June 1965, SECRET NOFORN

the DAVY CROCKETT warhead fro[redacted] by [redacted]

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Table 3. SOME SOVIET AIRCRAFT CHARACTERISTICS

Type	Combat Radius with Bomb Load (n mi.)		Bomb Load (lb)	Ceiling (kft)	Max Speed (knots)	
	High-Low-High	Low-Low-Low			Sea Level	50,000 ft or Ceiling
MIG-15 (Fighter)	230	85	550	51	585	505
MIG-17 (Fighter)	210	90	550	54	605	550
MIG-19 (Fighter)	440	140	550	55	650	635
MIG-21 (Fighter)	425	150	550	61	660	1150
TU-16 Badger (Medium Bomber)	2000	2000	10,000 or 2 AS-1[a] or 1 AS-2[b]	47	380	475
Blinder (Medium Bomber, Supersonic)	~1500 to 2000	~750 to 1000	3,300 or 1 AS-4[c]	47	560	850

SOURCE "Soviet Threat Relating to SAM-D Weapon System, 1970-80," MID-CR-17-02-65, June 1965, SECRET NOFORN

[a]Cruise missile, range 55 n.mi., speed Mach 0 9

[b]Cruise missile, range 100 n mi , speed Mach 2 0

[c]Boost-glide missile, range 280 n.mi , speed Mach 5.3 (max.).

(b)(1) OTRA

[redacted] The weight of such a mortar tube is probably 500 to 1000 lb, which makes it cumbersome for guerrilla use. However, it is certainly within Soviet or Chinese technological capabilities to build sectioned mortar tubes, particularly since each tube need only be fired a few times, at most.

Relatively little seems to be known about the existence of Soviet atomic demolition munitions (ADM). Since such devices are small and light in weight and are emplaced by hand, this

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Table 4. SOME U.S. TACTICAL NUCLEAR WEAPONS

System	Launcher	Range (km)	Warhead (lb)	Yield (KT)
LITTLE JOHN	2-1/2-ton truck takes four	[redacted]		
DAVY CROCKETT	120mm recoilless 155mm recoilless			
ADM 59	--			
ADM 50	--			
SADM	--			

[a]Motor 860.

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may merely indicate a gap in intelligence. There is no doubt that the USSR is capable of either designing ADM or adapting weapons from stockpile to ADM with little difficulty. The characteristics of some U.S. ADM are shown in Table 4.

Modes of Employment

Tables 1 and 3 show that all U.S. bases are within range of Soviet bomber aircraft based on Hainan or the Chinese mainland. MIG fighter-bombers based on Hainan can make the round trip to all but the southern bases and can reach all bases if the crews bail out over Cambodia or Laos. While planes stationed in NVN could reach U.S. bases, it is unlikely that a U.S. first strike would leave operational airfields in NVN.

The data of Tables 1 and 2 indicate that all U.S. bases in SVN are within range of the sea-launched Soviet SS-N-4 and SS-N-5 missiles, within range of the medium-range ballistic missile (MRBM) SS-3 and SS-4 located in NVN, within range of the intermediate-range ballistic missile (IRBM) SS-5 located in China, within range of the short-range missiles SS-1b, SS-1c, and SSC-1 located in Laos, and within range of short-range mobile FROG rockets, mortars, or recoilless rifles suitably located in SVN.

The ease with which these systems can be deployed may vary inversely with political desirability, at least from the Soviet point of view, since a response in Vietnam (as contrasted to an attack on Europe or the U.S.) implies a desire to avoid escalation and keep the conflict localized. There is little doubt that Russian submarines can approach to within range of all U.S. bases in Vietnam. However, their offensive use would constitute an overt Soviet attack on U.S. forces and, therefore, it has great potential for escalation. The installation of Soviet IRBM or aircraft in China with relative ease is technically feasible, but this would require a considerable shift in

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Sino-Soviet relations, and it also involves a serious risk of escalation. The emplacement of MRBM in NVN without detection by U.S. aerial reconnaissance is difficult, but probably not impossible, if missiles are located singly rather than in batteries, and deployed beneath forest canopy (which could be removed before firing). This course involves less risk of escalation than the first two alternatives. Least escalatory is the deployment of TNW in SVN for use by or in conjunction with guerrilla forces.

The deployment of FROG systems offers considerable difficulties, because the transportation problems into and within SVN are formidable. Normally, 80 to 100 pounds are carried on human backs along the Ho Chi Minh Trail. The maximum feasible disassembly of FROG rockets probably leaves pieces in the 2000-pound range.[12] It must be remembered, however, that the Viet Minh managed to emplace twenty 105mm artillery pieces at Dien Bien Phu. (Weight of cannon, 1064 pounds; total weight of weapon, 4475 pounds.) It would not be necessary to use the conventional FROG rocket carriers, which are 18-ton tank chassis or heavy trucks. The actual launch mechanism is probably sufficiently demountable to offer no serious problems of transportation.

While the possibility of a FROG attack cannot be neglected, a more probable mode of attack is one with nuclear weapons fired from mortars or recoilless rifles. If sectioned barrels and lightweight projectiles (250-pound) are used, the approach and emplacement problems would not differ significantly from logistic problems now solved successfully by the VC.

Since a large number of U.S. bases are located on the coast, the possibility of short-range, sea-launched attacks

[12] Very large weights have in the past been moved by primitive means. Robert F. Heinze [Science 153, 821 (August 19, 1966)] states that a group of men using poles can carry a load of 3000 pounds at a walking pace.

must be considered. It is unlikely that vessels large enough to carry FROG missiles could make their way from NVN down the coast without being detected, or that they could be equipped with FROG rockets in SVN at sufficient distances from U.S. bases to make the sea approach worthwhile. The capacity of sampans small enough to avoid routine inspection is insufficient to carry FROG rockets, but such vessels armed with recoilless rifles could probably approach to within firing range at several bases, especially those near harbors or rivers.

Finally, the possibility of clandestine delivery into U.S. bases must be considered. Since the risks of capture of the weapon or death of the agent are high, this method may seem unsatisfactory, but it offers a real possibility for determined guerrillas to emplace heavier, higher yield weapons than can be delivered by mortar or recoilless rifle. Such attacks could be particularly effective against storage facilities and harbors.

Enemy Supply Problems

Potentially, the most difficult problem of all is getting TNW into NVN or SVN in the first place. A U.S. first strike would eliminate at least all known airfields and, probably, railroad connections with China at Lao Cay and Dong Dang. To make the most unfavorable case for supply, let us assume that harbor facilities at Haiphong and the remaining 12 secondary ports are also destroyed, although this would require a massive attack and, in the case of Haiphong, the risk of destroying a considerable quantity of nonbelligerent shipping. Under these stringent conditions, it might still be possible to introduce MRBM into NVN from China by rail shipment to the border at Lao Cay, followed by road transportation into the NVN mountains at night. In view of the considerable difficulties of introducing a large number of MRBM in this manner, sea shipment and off-loading without benefit of dock facilities might also be attempted. In fact, however, the main emphasis might not be on

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MRBM emplacements in NVN, but rather on supplying nuclear mortars, recoilless cannon, and ADM to VC elements in SVN. In view of their small sizes and weights, introduction of these weapons into NVN and subsequent transportation along the Ho Chi Minh Trail into SVN offers only minimum difficulties, although it would probably take several months to deliver 50 to 100 weapons in this way. For this reason, direct shipment to SVN by submarine and landing via sea sled become a possibility if only a few weapons for a rapid initial response are desired. (In many places, the 20-fathom line, which is the approximate limit for submerged submarines lies ≤1 mile offshore.) Thus, there seems to be little question that, even under the most favorable circumstances from the U.S. point of view, heavy nuclear attacks on U.S. bases could be launched from either NVN or from within SVN, within three to six months of U.S. first use, while a lighter attack could be launched within a few weeks.

C. <u>THE EFFECT OF NUCLEAR ATTACKS ON U.S. FORCES</u>

Table 5 lists the effective radii of severe destruction for various target categories from airbursts and surfacebursts of [redacted]

delete

[redacted] .] For groundbursts, roughly the same results would be achieved by weapons of twice the yield.

Most of the targets in U.S. bases consist of subunits of 1- to 2-mile diameter, spaced sufficiently far apart to require separate attack by weapons in the kiloton range. [redacted]

delete

[redacted] depending on the details of each target. In the case of a soft, concentrated target like the helicopter park at An Khe, which measures about 4000 x 3000 feet, one 10-KT groundburst would suffice to destroy all parked helicopters.

Table 5. RADIUS OF SEVERE DAMAGE (FEET) FROM NUCLEAR WEAPONS

Target	Airburst				Surfaceburst			
	1-KT Yield	10-KT Yield	20-KT Yield	100-KT Yield	1-KT Yield	10-KT Yield	20-KT Yield	100-KT Yield
Trucks (7 psi)	1800	4000	4,900	8,400	1200	2600	3000	5,500
Airplanes, Unprotected (3 psi)	3200	7000	8,700	15,000	1900	4200	5300	9,100
Airplanes, Revetted	1400	3100	4,000	6,700	1000	2200	2750	4,600
Ships, Commercial	600	1500	1,800	3,000	600	1500	1800	3,000
Oil Tanks, Half-Full (4 psi)	2600	5800	7,200	12,500	1700	3600	4500	7,600
Unprotected Troops (3 psi)	3200	7000	8,700	15,000	1900	4200	5300	9,100
Dug-in Troops (20 psi)	900	2000	2,500	4,400	700	1500	1900	3,300
2nd Degree Burns on Bare Skin	2600	8000	10,000	21,000	2100	6400	8000	17,000
	Temporary flash blindness will occur at much greater ranges							

SOURCE S Glasstone, "Effects of Nuclear Weapons," U S. EAC, 1962

Unprotected troops would suffer lethal radiation doses (taken as 1000 rem) at 1100 yards from ground zero from a 10-KT airburst, inflammable stores would be destroyed at about 1000 yards.

In the following paragraphs, we examine various attacks.

Coordinated MRBM Strike on All U.S. Bases

Despite the rather large CEP of most Soviet MRBM (see Table 2), the relatively high yields -- about 100 KT to more than 1 MT -- make it certain that all bases could be destroyed within one-half to two hours by 15 to 20 missiles, depending on whether the attack is by land or sea, or a combination of both.

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The average number of troops on base at a given time has been variously estimated at from 30 percent to 80 percent of total complement. The number of planes on base at night is probably closer to 100 percent, while only about 30 percent of all helicopters are generally at the main bases, the rest being deployed in widely scattered forward areas. The effect of a heavy simultaneous attack, timed to within about one-half hour, would thus wipe out a large fraction of the U.S. troops and planes, as well as almost all installations, food supplies, POL, and ammunition. A time scale of two hours would have very similar effects, except for the immediate survival of most personnel if rapid dispersal were carried out. There is no need to carry this scenario further.

Air Strike from Hainan or the Chinese Mainland

An air strike provides the quickest nuclear response, and it might be undertaken for this reason. A massive, simultaneous attack, by BADGER or BLINDER medium bombers runs the risk of radar detection and interception by U.S. aircraft before reaching its targets. Further, such an attack, unlike a missile strike from NVN, would constitute a direct U.S.-China confrontation. Nevertheless, it could be very effective, particularly if standoff air-to-surface missiles (ASM) were used. Perhaps sneak raids on individual bases by one or two low-flying aircraft are more likely. The chances of penetrating air defenses in this mode of attack are fairly high.

Coordinated Attack with Low-Yield (10 to 20 KT) Weapons

If a coordinated nuclear mortar or recoilless rifle attack were launched simultaneously (to within 1 to 2 hours) on all U.S. bases by enough low-yield weapons, much the same result as in a heavy MRBM attack would be achieved. Such an attack would require the approach and simultaneous firing of one or two 10-KT weapons per target, or roughly 10 to 20 weapons per base (see Table 1), i.e., a total of about 70 to 100 weapons. While such an attack cannot be ruled out, it would require great coordination and run some risks of degradation by premature firing or partial discovery.

Drawn-Out Attack by Low-Yield Weapons

A somewhat more piecemeal attack by guerrilla units, spaced out over weeks or months, seems a more probable mode of response to U.S. use of TNW, for instance, an attack on a helicopter park, followed a week later by destruction of a harbor or a POL storage facility, and so on. Attacks of this kind are likely to include as much "mix" as the VC are capable of providing -- mortar attack by infiltrating units and clandestine delivery by truck or boat.

"Revenge" Attacks

It may be that the VC and NVN forces would be unable to mount a full-scale, tactical, nuclear counterattack of the sort discussed above, particularly if they must rely on weapons supplied by the CPR. What sort of revenge attack could they make with a few nuclear weapons of moderate yield?

Perhaps the most attractive single target in South Vietnam is the Saigon airport. Besides the large number of planes and landing facilities that would be destroyed, a single well-placed explosion could also destroy the new intelligence center and kill several thousand Americans. The airport is on the outskirts of Saigon, in an area of sufficiently low population density to qualify as a military target, and the usual wind conditions would not carry fallout directly over Saigon. The present level of security would not keep out suitcase bombs.

After Saigon airport, the most attractive targets seem to be troop concentrations, particularly the barracks areas at Pleiku, Da Nang, and An Khe. Here, a mortar attack would probably be called for (particularly at An Khe, which is closed to Vietnamese), but, although risky, this is far from impossible. A 10- to 20-KT explosion in each one of these three bases would kill perhaps 5000 American troops, equivalent to one year's casualties at the current rate.

Since installations, harbors, storage facilities, and the like are immobile, they are hostage to piecemeal or revenge attacks almost as much as to a massive, coordinated strike. Troops and helicopters and, to a lesser extent, fixed-wing aircraft (which must be on <u>some</u> airfield) can be dispersed on a short-term basis, and thus, they might be much less severely hit in a piecemeal, guerrilla-style attack. However, even a very modest attack would tend to paralyze the fighting efficiency of these bases and to disrupt air support and logistic operations.

The importance of logistic support for troops in the field cannot be exaggerated, so that the net effect of even a light nuclear attack on one or two main bases would be very great. To illustrate that such an attack is possible with relatively modest means and on a short time scale, two illustrative scenarios are described in the appendix to this section.

In addition to the physical effect on U.S. forces, the news of a successful nuclear attack on a U.S. base would have enormous propaganda value for the Communists, not only in Vietnam, but in all of Asia and Africa.

D. <u>COUNTERMEASURES</u>

It is pertinent to inquire how and to what extent the U.S. forces in SVN can be protected against nuclear attacks or counterattacks. Two main possibilities must be considered -- dispersion and hardening.

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Dispersion

A highly dispersed permanent deployment of U.S. forces in SVN in anticipation of nuclear attack would seriously degrade their effectiveness for many reasons. Since U.S. forces operate in a hostile environment, which requires active defense of all positions, large-scale dispersal would mean a vast increase in purely defensive effort. For example, if a major base like Da Nang, with a diameter of 25 miles, were to be dispersed into ten units of the same aggregate area, the defended perimeter would be three times as long. If the split were into 20 units the increase in perimeter would be fivefold. The difficulties of supply would be aggravated at least linearly with dispersion. In addition, the aggressive potential of each smaller unit would be degraded, since a sizable fraction of the troops at any base would be required for defense. Further, present U.S. facilities in SVN represent a large investment in money and effort, so that dispersal by a factor of more than two or three would be very difficult from the point of view of cost and time. While some dispersal, particularly of airplanes and helicopters, is undoubtedly possible, the feasibility of large-scale overall dispersion is highly questionable.

Hardening

While hardening against a massive Soviet missile attack with megaton weapons is infeasible, except for a few key targets like important HQ, many components can be partially protected against attacks with kiloton weapons.

Troops

A high degree of protection for troops can be obtained by hardening sleeping quarters to about 100 psi. [redacted] so that the kill radius is reduced by a factor of eight by hardening

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to this pressure. This provides not only nighttime protection for most of the base population, but it might also permit the personnel of all but the first target to seek shelter, if a base-wide attack is spaced out over a few minutes. If we take a rough figure of 10 sq ft/man for living space at a cost of $50/sq ft at 100-psi hardening (taken from civil defense estimates), the cost of providing living space for 500,000 men is $250 million. If this space figure were quadrupled to include some working space, the cost would not exceed about $1 billion. This estimate is exceedingly rough, but at least the figure for living space seems reasonable.

Aircraft

If we take the figure of $50/sq ft and assign 3000 sq ft to an airplane, the cost of protecting a plane is about $150,000 or about 6 percent of the original airplane cost. There is no present means of protecting runways, but the use of nuclear weapons to attack these seems uneconomical for guerrilla forces.

Storage Facilities

If we assume $6 per cu yd as the cost of excavating in rock, the cost of excavation for providing underground facilities of 10^6 cu yd would be of the order of $6 million. The total cost of providing 1 million cu yd of storage space would probably not exceed this figure by more than a factor of ten.

Extended Perimeters

In sparsely populated regions, bases could be protected against short-range attacks by an extension of the defense perimeter, for instance, by extensive devegetation. If the cost of clearing one acre of forest is taken as being $500, the cost of clearing a 10-mile-radius circle is $80 million.

Thus, the protection of major portions of U.S. bases is possible in principle, at a cost of about 10 percent of the present total investment ($10 billion to $15 billion). However, major efforts at hardening take time and are conspicuous, and they would serve notice to the enemy that we expected nuclear weapons to be used.

E. WEAPONS REQUIREMENTS AGAINST U.S. FORCES IN SVN

The 14 main bases of our forces in SVN can be divided into subunits requiring one or two 10-KT airbursts for more or less complete destruction. There are about 70 of these units. If allowance for capture, malfunction, or redundant use is made by assigning each weapon an *a priori* effectiveness of 0.5, then 150 10-KT weapons would suffice for a crippling blow at U.S. forces.

At present, this seems quite beyond Chinese capabilities, but it represents only a minor demand on the Soviet stockpile, as far as fissionable material is concerned. It is not known to us how many actual weapons in the 10-KT range are available to the Soviets. Since 1962, there have been detonated about a dozen weapons in this range. It is known that MRBM and FROG warheads exist in very large numbers relative to VN requirements.

Thus, there are no stockpile limitations and probably no weapon limitations on repeated attacks on U.S. forces with Soviet-supplied TNW.

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V. EFFECTIVENESS OF TNW IN THE HANDS OF INSURGENTS IN OTHER PARTS OF THE WORLD

A very serious long-range problem would arise if the U.S. use of TNW in Southeast Asia were countered by Soviet supply of TNW to North Vietnam, and if the effectiveness of guerrilla attack with TNW against U.S. forces were as great as we have estimated in Section IV. Insurgent groups everywhere in the world would take note and would try by all available means to acquire TNW for themselves. The USSR might decide, having once taken the plunge in Southeast Asia, that there would be no particular harm in giving TNW to her friends in South America or Africa. Even if the USSR should hold the line against further dissemination of TNW, there would still be an ever-increasing series of opportunities for guerrilla forces to acquire nuclear weapons as the worldwide nuclear power industry expands during the next decade. For example, the presently programmed civilian nuclear power stations in India alone[13] will produce material for about 500 bombs during the next ten years. During the 1980s there will be vast quantities of fissionable material produced in many countries, and leakage into unauthorized channels will be difficult to prevent. It is therefore of tremendous long-range importance to avoid setting a precedent for the use of TNW by guerrilla forces.

It is clear on general grounds that forces of law and order will be at a grave disadvantage in dealing with insurgents

[13] The Indian reactor output is planned to rise approximately linearly to 2980 megawatts (electric) by 1976 (Nucleonics, March 1966, p. 25). The output of plutonium is estimated at 300 grams per megawatt-year (electric) (Nucleonics, April 1966, p. 17), giving a total of 4000 kg in ten years.

willing to make ruthless and irresponsible use of TNW. A small minority of dissidents with a supply of TNW could blackmail and ultimately destroy any but the most resolute government. If this were to happen, the U.S. would probably be faced with a choice between two evils, either to allow nuclear blackmail to succeed or to intervene with military force under very unfavorable circumstances. Just as in Vietnam, the U.S. forces will be very much more vulnerable than the insurgents to nuclear attack.

We conclude this section by mentioning a few places where dissident groups armed with TNW could do particularly grave damage.

- Panama. A few weapons could destroy the locks and put the canal out of operation for a considerable time. In addition, the U.S. base areas in the Canal Zone are highly vulnerable.
- Venezuela. Oil pipelines and storage facilities are very vulnerable. The oil industry is vital to the Venezuelan economy and also important to the U.S.
- The Middle East. It is easy to imagine a group of Arab extremists acquiring some TNW and using them to precipitate an all-out Arab-Israeli war by demolishing, say, Tel Aviv.
- South Africa. The urban economy of white South Africa is a perennially tempting target for any black nationalists who may come into possession of nuclear weapons.

In all of these areas, the danger of nuclear guerrilla activity is likely to arise in some degree during the next 20 years, independently of anything the U.S. may do. But the dangers will certainly become more acute if the U.S. leads the way by initiating tactical nuclear war in Southeast Asia.

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VI. POLITICAL CONSEQUENCES

A. ESCALATION

The use of nuclear weapons represents in itself a major escalation, if only politically, and it is quite impossible to predict with any certainty what the results of such a step might be. It is possible that the danger of general war would deter the USSR and China from making any nuclear response whatever to a U.S. first use of TNW. On the other hand, as pointed out in the introduction to Section IV, there would be strong pressure on the USSR to make a dramatic reply. Despite these large uncertainties, it is worthwhile to examine possible modes of further escalation, if only because this gives some estimate of the relative probabilities of various Communist responses to U.S. first use.

Nuclear Attack by VC Units in SVN

A likely counterresponse by the U.S. would be a very heavy attack, possibly with megaton weapons, on War Zones C and D. If the VC attack were very damaging, our response could well be an attack on NVN strategic targets, including harbors and population centers. Whether this would in turn provoke direct Soviet or Chinese nuclear intervention or would terminate the war is a matter for speculation.

MRBM Attack Launched from North Vietnam

An attack on U.S. forces by MRBM carrying high-yield warheads would undoubtedly be very damaging. The U.S. responses would probably include all the options described above and an attempt to destroy the enemy launch sites.

IRBM Attack from China

The immediate response would undoubtedly be an attempt to eliminate the launch sites. There is the possibility that attacks against Chinese nuclear installations would be launched as well. In addition, blows against War Zones C and D and against NVN also seem likely.

It is not obvious what the results of an attack on Chinese territory would be. It might or might not result in immediate Soviet involvement; in any case, the probability of general U.S.-Chinese war in these circumstances is high. This could lead in turn to a general U.S.-Soviet war, particularly if a strategic attack on China is launched by the U.S.

Air Strikes from China

Essentially, the arguments given for the IRBM attack apply.

Soviet Submarine-Launched Missile Attack

This would constitute a direct U.S.-Soviet confrontation. The minimum counter, in addition to blows at the VC and at NVN, would be an attack on Soviet submarines in Southeast Asian waters and probably anywhere on the high seas. However, an attack on military targets in the Soviet Union, leading to general war, cannot be excluded.

Two additional points must be made. First, the use of NW by either side in VN could elicit from the other side a much stronger response than suggested here, or an ultimatum containing the threat of strong response. The ultimate outcome is impossible to predict; we merely point out that general war could result, even from the least provocative use of NW that either side can devise.

Second, our scenarios presuppose that the source of an attack can be determined with reasonable certainty, so that there is at least the option of a minimum response. In practice, this may not be the case. Sea-launched missiles could probably be picked up by coastal radar during launch phase if the radar were switched on and the crews were alert. IRBM or MRBM might not be detected before impact. Short-range weapons might or might not appear on antimortar radars; but even if they did, this information might not get out of the attacked base. Consequently, the U.S. responses could exceed those sketched here, because of uncertainty about the source and intent of the attack.

B. LONG-RANGE CONSEQUENCES

Even if massive escalation did not result, U.S. first use of TNW in Vietnam would have many serious long-range effects. The most important of these is probably the crossing of the nuclear threshold. As Herman Kahn[14] points out, abstention from the use of any NW is universally recognized as a political and psychological threshold, however rational or irrational the distinction between "nuclear" and "nonnuclear" may be. Crossing it may greatly weaken the barriers to proliferation and general use of nuclear weapons. This would be to the ultimate disadvantage of the U.S., even if it did not increase the probability of strategic war.

Whether or not U.S. first use of TNW is countered by the Communists, the effect of first use on world opinion in general and on our Allies in particular would be extremely unfavorable. With the exception of Thailand and Laos, the action would almost certainly be condemned even in Asia and might result in the abrogation of treaty obligations by Japan.

[14] H. Kahn, "Conditions Under Which the Introduction of TNW by the U.S. Would Clearly Be to Its Ultimate Advantage or Disadvantage," HI-443-D (HI-TS-58), September 1964,,TOP SECRET RD.

The effect on public opinion in the U.S. goes beyond the scope of this paper. It is probably safe to assume that first use of TNW would be extremely divisive, no matter how much preparation preceded it.

In sum, the political effects of U.S. first use of TNW in Vietnam would be uniformly bad and could be catastrophic.

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VII. APPENDIX TO SECTION IV

Harbors, airfields, and staging areas offer attractive targets for TNW. Could the VC smuggle nuclear explosives into these? Suppose we use TNW to interdict the supply lines from NVN and Russia decides to supply nuclear weapons to the VC. While our interdiction would be difficult to maintain, it would certainly slow the overland delivery of bombs for clandestine use. An alternative route, much used in the last world war, is submarine delivery. In numerous places, the SVN 20-fathom line (about the limit for submerged subs) is within one mile of shore. A sea sled for ferrying weapons in neutral buoyancy containers from a submarine to a secret cache on some remote section of the coast would make detection unlikely. The final step in the smuggling from cache to within a U.S. base is a much more dangerous and uncertain project. Each base presents its own problems and possibilities to the guerrilla. We sketch here two possible scenarios:

A. HELICOPTER PARK AT AN KHE

The plan to destroy the helicopter port at An Khe might be the following (no Vietnamese are allowed on this base):

- Prepare a camouflaged garage in the jungle or in a village under VC control.
- Capture two standard trucks of a type commonly used on the base and hide them in the prepared garage. These trucks should have high, closed cabs to mask the nationality of the drivers when they enter the base.
- When and if searches for the trucks by U.S. forces have proved fruitless, a 10-KT weapon will be brought from the bomb cache to the hideout and installed in one of the trucks.

- The two trucks, appearing innocuous, finally enter the base. The weapon carrier is left within a half mile of the helicopter park. Its crew sets the bomb timer for five minutes and boards the other truck. They are two miles away at the time of the explosion and escape in the confusion that follows.

[redacted] This will severely damage helicopters and repair and maintenance shops, and it will destroy partially filled gas storage tanks. A raid like the one described would neutralize An Khe for some months.

B. HARBOR AT DA NANG

For a second example, we give a fictional plan for damaging the harbor at Tourane (Da Nang). The bay approximates a 6-mile-diameter circle with a 4-mile-wide opening to the sea. At the two sides, there are steep hills, but straight inland the ground is low. The 6-fathom line is over a mile from shore in most parts. It is assumed that supply ships are anchored near this line and are unloaded by lighter.

- A 10-KT bomb in its neutral buoyancy container is towed by a sampan to within seven miles of the harbor, arriving at dusk.
- At this point, a skin diver will transfer the bomb to a sea sled, tow it to an active section of the harbor, and anchor it to the bottom near a freighter. Firing will be set for the next morning long after the sea sled and junk have left the scene.

[redacted] Unloading facilities, low-lying warehouses, open stock-piles, etc., could be badly damaged by waves and floods, depending on the bay topography. Radiation hazards could be serious for several days.

A weapon towed by sea sled or carried by sampan could just as well be in the megaton range. In that case, the attack would not only clean out all shipping and shore installations, but it would so contaminate the area that rebuilding would be delayed for months. Attacks of this magnitude in all of the existing coastal harbors would be catastrophic for our forces, which depend on heavy logistic support.

These two examples are meant to emphasize the contention that U.S. bases in general are subject to punishing attacks if TNW are available. The VC have carried out numerous daring attacks when the damage they could or did cause was small. They are unlikely to desist, if they get weapons that can hamstring the U.S. effort.

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Mr. Hans Kristensen
The Nautilus Institute
125 University Avenue
Berkeley, CA 94710-1616

Dear Mr. Kristensen:

This responds to Timothy L. Savage's July 22, 1998, Freedom of Information Act (FOIA) request.

The enclosed document is responsive to the Nautilus Institute's request. Mr. Edmund F. McBride, an Initial Denial Authority for the Joint Staff and Mr. William R. Faircloth, an Initial Denial Authority, Chief of Staff for the Defense Threat Reduction Agency (DTRA), have determined that the release of portions of the document must be denied pursuant to 5 USC § 552(b)(1), which applies to material which is currently and properly classified in accordance with Executive Order 12958. In this instance, some of the denied information is classified according to Section 1.5(a) and (d), concerning military plans, weapons or operations and foreign relations or foreign activities of the United States, including confidential sources. Further, this information is exempt from automatic declassification in accordance with Section 3.4(b)(5) and (6) of Executive Order 12958.

Some information must be denied pursuant to 5 USC § 552(b)(3), which applies to information specifically exempted by a statute establishing particular criteria for withholding. In this instance, the statutes are 42 USC § 2162(a) which provides withholding of Restricted Data under the Atomic Energy Act of 1954 (valid statute by court action); and 2168(a)(1)(C) which provides withholding Formerly Restricted Data under the Atomic Energy Act of 1954. These portions have been withheld by Mr. Finn K. Neilsen, Acting Director, Office of Nuclear and National Security Information, U.S. Department of Energy.

You have the right to appeal the decisions to deny these portions. Any such appeal should offer justification to support reversal of the initial denial and should be forwarded within 60 calendar days of the date of this letter, to this Directorate.

There are no assessable fees for this response.

Sincerely,

H. J. McIntyre
Director

Enclosure:
As stated