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**THE NUCLEAR THREAT,
ITS IMPLICATIONS
AND PLANNING GUIDANCE**

JUNE 1973

*Canada Emergency
Measures Organization*



*Organisation des
mesures d'urgence
du Canada*

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**CANADA EMERGENCY MEASURES
ORGANIZATION
OTTAWA**

THE NUCLEAR THREAT, ITS IMPLICATIONS, AND PLANNING GUIDANCE

Aim

1. The aim of this paper is to provide civil emergency planners with an understanding of the implications of the threat to Canada of a nuclear weapon attack on the North American Continent to assist them in preparing their programs and contingency plans for such an emergency. This paper updates and replaces the information contained in the Canada Emergency Measures document "The Nuclear Threat to Canada" dated December 30, 1970 and "Implications of the Nuclear Threat and Planning Guidance" dated April 1971. It consists of five parts as follows:

- a. Part I — The threat and General Effects
- b. Part II — General Implications of the Threat
- c. Part III — Planning for Various Types of Risk Areas
- d. Part IV — Planning Guidance for Civil Emergency Activities
- e. Part V — Conclusion

PART I — THE THREAT AND GENERAL EFFECTS

Significance of the Threat

2. While various forms of attack against the North American Continent are possible, nuclear attack remains the most significant threat.

3. The likelihood of the acquisition of nuclear weapons by countries in addition to the five nuclear powers increases the risk of their ultimate use in war. Moreover, the increase in size, effectiveness and numbers of such weapons, together with the diversification of delivery systems, has increased the magnitude of the nuclear threat.

4. In the event of a nuclear attack, certain areas of Canada could be involved directly as nuclear targets while others would be seriously affected by nuclear fallout.

5. It is generally accepted that targeting would include a mix of retaliatory bases, centres of government control, major military control centres, industry, resources and population centres. The delivery systems could include intercontinental ballistic missiles, submarine-launched ballistic missiles and manned bombers.

6. It is impossible to determine exactly the numbers or yields of weapons which would be used against any particular target area. However for planning purposes, it is assumed that the enemy would wish to cause at least major destruction of industrial and other facilities within a target area. This, in effect, represents a situation which tends toward a worst possible case for each area at risk.

7. The geographic, demographic and socio-economic aspects of each area at risk are subject to provincial review and continuing consultation with Canada EMO with regard to matters of mutual concern. Factors to be considered are:

- a. Targeting as derived from the threat
- b. Weapon yields
- c. Weapon effects

related to existing administrative boundaries.

8. It should be borne in mind that enemy capabilities for attack could be increased in the future. This could occur in three ways — new weapon technology, an increase in weapon yield and/or more accurate delivery systems, or the addition of more locations to the target list.

9. There is an inherent danger in attempting to delineate the size of areas at risk in too much detail since there may be a tendency to use them rigidly, whereas, planning must be flexible enough to meet a post-attack situation which cannot be accurately forecast. On the other hand, some definition of the area at risk is needed to provide both comparisons and a basis for contingency planning.

Warning Time

10. It is impossible to determine how much warning time of attack will be available. Advances in technology have reduced though not eliminated the likelihood of sudden attack and the direct precipitation into nuclear war. It is probable that about 15 minutes tactical warning time would be available of an actual attack on North America. There may however be some strategic warning of an impending attack. It is considered likely that any international situation leading to nuclear war will develop over a period of time and will probably include various obvious indications of the increasing seriousness of the situation. The controlled response strategy which is then possible, provides both sides with a wide range of options in which the actions and reactions may impose variable significant loads on the civil structure. Thus, the possible period of an emergency may have to be expanded to include periods of increasing international tension and even limited conventional war. Operational planning must always have a capability for rapid implementation using existing capabilities, for example, temporary overcrowding in available shelters or deployment of essential services and personnel to interim locations.

11. Arrangements must be made to speed up and implement program activities on the receipt of strategic warning in order to provide an increased emergency capability using the greater resources which can then be made available.

Risk Areas and Attack Effects

12. In order to provide a basis for civil emergency planning, potential civilian areas at risk have been grouped as indicated at Annex "A" showing, where appropriate, an illustrative weapon yield to achieve the degree of destruction indicated in para 6.

13. The effects of attacks should be derived from the following weapon attack characteristics:

- a. Weapon burst on the surface
- b. A weapon fission/fusion ratio of 50%
- c. A circular error probable (CEP) of one mile or less
- d. Delivery of weapons on any part of the target within a period of 24 hours
- e. Weapon yields sufficient to destroy a major portion of the target

14. A weapons effect data sheet showing some weapons effects for yields of 1, 5 and 10 megatons is at Annex B. Additional details can be found in EMO Manual No. 3 — Nuclear Weapons Effects.

15. In addition to the attack effects indicated above there is also the effect of the Electro-Magnetic Pulse (EMP) on the electrical and electronic systems within the range of such effects. In addition to EMP effects from surface bursts, nuclear weapons burst at high altitudes may cause temporary disruption in many systems vital to the continuance of operations in a war emergency, e.g., communications systems, radar systems, electronic data processing systems, etc.

16. It is not possible to predict detailed radiation levels in advance of an attack. However, using groupings 1, 2 and 3 listed in Annex "A" and the postulated fallout from a comparable level of attack in the USA, an illustration of radiation risks has been developed and is indicated at Annex "C".

17. The fallout map at Annex "C" has been constructed to show areas in Canada where there is a high probability that the radiation doses in 7 days may reach but not exceed that indicated. It is pointed out that the extent of the fallout pattern in any single day is not likely to encompass the entire area indicated but will be restricted within this area, its delineation being in accordance with the meteorological conditions of the day.

PART II – GENERAL IMPLICATIONS OF THE THREAT

Areas at Risk

18. Planning should consider all the direct and residual effects on Group 1, 2 and 3 areas at risk and on related areas at risk from attack on the USA.

19. Because of the widespread nature of attack effects, planning for a particular location must always take account of probable effects from elsewhere. For example, the disruption of hydro-electric power in one area may well be felt in an otherwise unaffected area; in the same way fallout from a target area will affect many other areas. In addition, because a target area is normally a focus of social and economic systems, disruption there will have an effect over a much wider area than the target itself.

20. The division of areas at risk into groups provides an estimation only of the probability of attack and, therefore, an order of priority in determining short term objectives and in the implementation of program activities. It cannot be inferred, however, that priority action must always take place in the areas at high risk. Sometimes it will be necessary to take priority action elsewhere but in support of the location at risk. For example, the development of reception planning in a rural area where surplus shelter exists or where the probability of a free environment is high, may be a high priority supporting activity for a target area.

21. In the context of post-attack planning, operational civil emergency measures in a community are not necessarily related to the target listing nor to any peacetime importance of the community. The important issue is the potential benefit of that community to post-attack operations. Priority should, therefore, go to implementing measures in those communities which show the greatest potential benefit to post-attack survival. Canada EMO will assist in resolving this type of planning problem.

22. Group 4 locations which are in the low risk category should be excluded as reception areas in any pre-attack dispersal plans or as locations for important emergency facilities except on an interim basis until safer alternative arrangements can be made. These locations can of course be considered in contingency planning for post-attack operations.

Planning Considerations

23. Emergency Planners should be aware of how far their readiness capability can be advanced in various time periods, e.g., 30 days, 7 days, 24 hours and 15 minutes.

24. A study of lead times and methods for completion of activity goals will assist in determining what actions must be taken within each time period. This should result in a minimum of items for stockpiling and then only of those resources which are not readily available in the 30-day time frame.

25. Plans should be developed for the most likely post-attack situations using the Canada EMO publication "Concept of Emergency Operations – Life Saving Period" as a guide.

26. Study of the time periods mentioned in para 23 may introduce new concepts for operational dispersal planning. In the meantime, for each area at risk, plans should be developed both for the people, making best use of existing shelter, and for the essential systems which support them.

Levels of Protection – Structures

27. In determining adequate levels of protection for EGHQs, EOCs and shelters for the public, a number of factors have to be considered:

- a. the magnitude of the hazard
- b. the probability of the hazard
- c. where the hazard may occur

Even then there are plausible figures available for each of these factors as stated above; the sensitivity of these figures to changes in enemy intentions, meteorological conditions, etc., must also be taken into account. Annex "C" indicates those areas within which the fallout hazard has a high probability of occurring. In addition, the attack patterns do not make any allowance for the random detonation of erratic weapons, which may well occur.

28. Similar, but by no means identical variations may occur in areas at risk to direct weapon effects. For example, doubling the weapon yield does not double the aggregation of effects.

29. Because these variations are indeterminate, and in the absence of an attack will remain so, it must be decided:

- a. how they will be taken into account in planning;
- b. what logical use might be made of the risk map at Annex C.

30. How to take the indeterminate variations in hazard into account must be a matter of judgement, and should be based upon such factors as:

- a. the degree and extent of the hazard;
- b. an adequate level of protection to meet this hazard at reasonable cost, bearing in mind that 100% survival can never be guaranteed;
- c. the area over which various hazards may be felt.

31. Consideration of these factors has led Canada EMO to recommend elsewhere specific protection levels as the desirable goals for fallout shelters (Canada EMO publication EMO TM 100-4 Section 2), and for EGHQs (Chapter XX and Annex C to the Municipal Planning Guide).

32. The risk map at Annex C provides quite a different type of information. It provides:

- a. a method of comparing the relative risk in one area against the risk in another;
- b. an indication as to which areas should receive program priority in the development of protective measures;
- c. a method of determining the appropriate levels of protection required to meet contingency plans;
- d. information which can be used in conjunction with the Radiation Penalty Table to estimate potential casualties resulting from the use of shelters at various protection levels;
- e. a basis for studies and exercise planning.

PART III – PLANNING FOR VARIOUS TYPES OF RISK AREAS

Planning Areas

33. Annexes to this paper indicate that for planning purposes the country can be divided into three types of areas, namely:

- a. areas at risk to the direct effects of nuclear explosions;
- b. areas of varying degrees at risk from fallout;
- c. the remainder of the country.

Irrespective of the level of government which is involved or the degree of risk to which communities are exposed, there are many common activities in all civil emergency planning programs. In an ideal state of affairs each and every geographic area could have a comprehensive program covering all contingencies arising out of an attack. Nevertheless, because of limited resources, the possibility of reaching the ideal is unlikely. Therefore, emergency planners must direct their attention toward completing or giving priority to those affairs and events which are considered to be most likely without completely ignoring the less likely. The type of planning which should be carried out is briefly described in the following paragraphs.

Planning for Risk Areas Associated with groups 1, 2, 3 – Annex A

34. Pre-attack voluntary evacuation plans should be prepared for each possible target. Even though, at this time, it is impossible to predict that sufficient time will be available, there might well be many factors which could lead governments, at the time of crisis, to suggest such a movement.

35. Although such plans are usually interpreted as being concerned with only the general public, arrangements should also be made for government, business, industry and institutions to disperse key records, plans and specifications, readily moveable physical assets and resources including those which are critical to an essential function to safe locations away from the above risk areas.

36. Under certain conditions, pre-attack evacuation might involve solely the movement of people from a "core" area to basements or other suitable accommodation in designated fringe areas. Although such a movement would not be as effective in life-saving as evacuation to more distant destinations, it could achieve a more desirable distribution of population, thus reducing its potential vulnerability. It may be necessary to have two types of dispersal plans:

- a. to remove everyone to another community;
- b. to withdraw all the people from the core of an area at risk to provide a reasonable degree of safety, but to allow essential workers to return daily to their employment; in the event of attack, essential workers would either:
 - (1) try to evacuate to the locations of their families; or
 - (2) protect themselves in available shelter close to their work locations.

37. Because it is possible that these areas would receive only minimal warning of attack, an adequate public information and education program should be implemented in peacetime. Such a program would direct the public's attention to finding the safest locations for protection against the primary effects of detonations and how to improve them. The public information program would also provide post-attack survival information.

38. For business, industry and institutions, an information program should include advice on improving the protection of vital records, plans and specifications and on physical protective measures which would reduce the vulnerability of buildings, critical machinery, equipment, etc.

Planning for Risk Areas Associated with Group 4 – Targets – (See Annex A)

39. It is considered at this time that these areas are sufficiently low in the attack order of priority so as to make their likelihood of attack low although it remains possible. Therefore, planning for such areas should be based on a "stay put" policy except where in a post-attack situation remedial evacuation might have to be implemented.

40. Although it would be prudent to "ignore" such areas for reception planning purposes they may have to be used on an interim basis because of serious shortages of fallout protected accommodation in other communities.

Planning for Areas at Risk from Fallout

41. These areas should base their planning on:
- a. a public protection program not including dispersal except for remedial evacuation. Where such areas are within 30 miles of a likely ground zero, a program of informing the population, industry, business institutions on how to meet the primary effects as well as fallout effects is necessary.
 - b. the reception of pre-attack and post-attack evacuees from target areas. Where there is only one target complex to be considered, priority attention should be directed to providing reception arrangements in areas "upwind" of such targets. However, this must be balanced with the capability of road systems to cope adequately with anticipated traffic loads, and the capacity of reception communities to receive evacuees and provide adequate fallout protection for them. Where there are a number of likely targets, all locations away from the areas likely to be affected by primary effects should be considered as possible reception areas. It is true that there is a likelihood of exposing evacuees to a significant radiation hazard but this must be balanced against the risk of these people being subjected to all the primary effects if they are not dispersed.
 - c. post-attack emergency operations.
 - d. post-attack remedial evacuation.

The Electromagnetic Pulse (EMP) Threat

42. The Electromagnetic Pulse (EMP) is a very brief and very intense electromagnetic field produced by the interaction with the atmosphere of the gamma radiation from a weapon burst. The most effective technique for minimizing damage to sensitive electrical components involves isolating them electrically. In most cases, satisfactory isolation can be achieved by temporarily disconnecting the equipment from power sources, antennas or other input/output leads that enter the equipment enclosure.

43. Emergency plans should include various options for either partial or complete isolation of essential communications facilities during the threat period. In developing these plans, consideration must be given to the effect that complete communications isolation (either voluntarily or involuntarily imposed) will have on emergency command and control needs. On a calculated risk basis, resources may be balanced against emergency communications needs by the reservation of some facilities to replace systems in use in the event of their failure.

44. In cases where a facility is to be completely shut down during the trans-attack period, the following actions should be taken for power isolation:

- a. Master power switch to be opened at electrical service entrance
- b. All circuit breakers opened or fuses removed at distribution boxes
- c. All critical equipment to be further isolated by turnoff at control boxes or by disconnecting line cords.

45. Since it is probable that commercial power would be interrupted for protracted periods in some locations, it would be desirable to provide important facilities with independent emergency power sources, each with a suitable supply of fuel. These sources may be needed for operation of communications gear, lighting, and other critical equipment.

46. There are other more sophisticated protective measures, which must be considered on the basis of systems design. It is not proposed to list these here, but authorities wishing to develop such protection should consult Canada EMO.

Summary

47. A simple table summarizing the above planning considerations is as follows:

Recommended plans for	Risk Areas 1, 2, 3	Risk Areas 4	Fallout Areas	All Other Areas
Pre-attack Evacuation	yes	no	no	no
Pre-attack Reception	no	no	yes	yes
		(but under some circumstances) yes		
Protection against Primary Effects	yes	yes	yes	no
		(for areas within 30 miles of TAs 1,2,3) no (for others)		
Protection against EMP Effects	yes	yes	yes	yes
Protection against Fallout Effects	yes	yes	yes	yes
STAYPUT	no	yes	yes	yes
Post-Attack Emergency Ops.	yes	yes	yes	yes
Remedial Evacuation	yes	yes	yes	yes

PART IV – PLANNING GUIDANCE FOR CIVIL EMERGENCY ACTIVITIES

48. This part of the paper presents planning guidance for some of the major civil emergency activities. It does not include any related cost factors.

Public Protection

49. The implication of the Threat for most geographic areas, are that the public could be exposed to one or more hazards. The degree of protection required will vary according to the risk to which people are likely to be exposed. Some of the implications on the activities which would comprise the program of Public Protection are included in subsequent paragraphs.

Fallout Protection

50. The long term goal is to provide a fallout protection factor (PF) of 100 for all persons likely to be exposed to the fallout radiation hazard.

51. Short term minimum fallout protection should be based on the degree of risk from radiation doses, the number of people to be sheltered and the shelters available. It must be recognized, however, that there could be serious consequences should the radiation doses exceed the limits contained in Canada EMO publication "The Operational Consequences of Exposure to the Ionizing Radiation Emitted by the Fallout Resulting from a Nuclear Attack" March 1970.

Blast Protection

52. Although a national policy has not been adopted for the provision of blast protection, the desirable long term planning goal should be to provide a degree of protection in the order of at least 30 psi in areas considered to be likely targets. Such protection would also provide adequate protection against all other effects, except those close to ground zeros. Until a policy is adopted and resources made available, planners should direct their attention to exploiting the inherent blast protection afforded by existing buildings.

Dispersal

53. Casualties caused by direct weapons effects would be considerably reduced by dispersal from potential target areas. Plans should, therefore, be made to provide protection by this method. These studies should consider the following factors which are likely to have a bearing on the degree of success of dispersal planning:

- a. time available for implementation;
- b. federal, provincial and municipal government response to worldwide events;
- c. public response to dispersal planning;
- d. feasibility of dispersal, e.g., traffic congestion, refueling facilities, etc.;
- e. arrangements for reception;
- f. fallout protection available.

54. The opportunity to carry out voluntary evacuation should be available to the population in all potential target areas. This would include advice as to the best routes to follow, what to take, and the necessary arrangements for reception and billeting in safe areas.

Individual Protection

55. Individuals should be encouraged to make their own preparations to reduce their vulnerability in a manner commensurate with the risk area in which they reside as indicated in the Canada EMO publication "The Eleven Steps to Survival".

Radiological Defence

56. Fallout monitoring posts should be given at least the same degree of fallout protection as that provided for the public. As a matter of priority, monitoring posts should be established in likely areas of fallout as indicated on the threat map in descending order of risk, then in target areas and finally in areas which indicate little or no radiation hazard. Monitoring posts may be located in communal fallout shelters where they could carry out the dual functions of advice to shelter managers and radiation monitoring.

Public Information

57. In addition to the normal task of conducting informational programs, peacetime information services must develop pre-arranged informational and educational programs for implementation through the various media. Prepared information should be focussed directly onto the likely problems or hazards to which the public will be exposed. It should be stored and reviewed annually to ensure its continuing appropriateness.

58. In most cases, the prepared programs would be disseminated through existing services at existing locations. In an attack, these services will be exposed to the same hazards as the public. Therefore, plans and preparations will have to be made to operate these services from alternative protected locations such as

MEGHQs. Broadcasting stations or other facilities which are required to continue in operation must be tied by communications to local emergency government headquarters from which guidance to the public is to be prepared and disseminated.

Continuity of Government

59. Emergency government headquarters and other forms of EOCs must be protected against the primary and/or secondary effects of nuclear detonations. When located adjacent to likely target areas these headquarters should have sufficient strength to resist over-pressures of 30 psi. If less protection is to be afforded, then a combination of strength and distance as well as fallout protection will be the governing factors. From the point of view of directing and controlling post-attack emergency operations, the headquarters should be located as close as possible to the target area consistent with the weapon effects and the protection provided by the structure. Canada EMO is prepared to assist in determining what constitutes suitable protection in these areas.

60. Headquarters of municipalities outside target areas should be located in buildings with the maximum PF available. Where construction of MEGHQs is considered, PFs of 500 should be provided.

61. Because headquarters for target areas, zones and regions are located in places other than the place of normal work, plans should be developed to phase the manning of such headquarters during periods of increasing international tension.

62. Key facilities and installations should be treated as a form of EOC referred to above.

63. Communications should be safe-routed around areas at risk from direct attack so as to reduce their vulnerability.

Health

64. The following threat implications should be considered:

- a. Hospital facilities now in Group 1, 2 and 3 areas should not be relied on for any major contribution to the health services requirements.
- b. Hospitals located in Group 4 areas may be included in plans provided there are adequate shelter facilities against their radiation hazard expected in the area. Some relocation of patients within the hospital building may be required.
- c. Emergency hospitals, emergency clinics and blood shadow depot should not be located in Groups 1, 2 and 3 areas. It may become necessary to locate Advanced Treatment Centres adjacent to target areas in which the sites selected should be close to the predicted outer limits of the area. An Emergency Health Unit should always be established in accommodation with the maximum protection available.

Welfare

65. Emergency Welfare Services facilities should be located in an area relatively free of radiation using the same criteria as has been decided on for reception areas or for dispersal areas on the periphery of cities at risk from direct attack.

Fire

66. The major part of all firefighting equipment and personnel should be dispersed from Groups 1, 2 and 3 areas prior to the attack. Firefighting resources within 50 to 75 miles of risk areas (i.e., those that might be brought to bear to deal with the 24 hour firefighting problem) should be included in the contingency operational planning for such areas. Fire defence planning should also include, during a crisis period, some escalation in training of the population in activities which reduce vulnerability to fire. Plans must take into account possible interruption of normal means of obtaining water.

Rescue

67. Rescue organizations, some of which should be associated with Casualty Clearing Units, should be provided by all Group 1, 2 and 3 areas, (and arrangements made for their pre-attack dispersal or protection) and in the municipalities adjacent to such areas, e.g., within 50 miles. Owing to the radiation hazard, both firefighting and rescue operations are likely to be curtailed until the radiation levels have decayed to acceptable limits.

Utilities

68. These include water, hydro, and gas installations and plants. Plans should include alternative arrangements for continuation of essential services to the surviving population.

Economic Planning and Resource Control

69. The nuclear threat places a requirement on planners to examine resources located in Group 1, 2 and 3 areas to determine those resources which may be denied by loss of facility and those resources which may be denied for given periods of time because of fallout. Plans should be prepared taking into account relocating, protecting, re-routing or the re-building of resources for the different manufacturing processes or services. Wartime control units for all resource systems should be located in areas where the hazard is negligible or where the hazard can be minimized by the protection available.

Reduction of Vulnerability of Systems

70. The vulnerability of many essential systems such as communications systems, transportation systems, food production systems, etc., is related to their component facilities. The vulnerability is determined by analysing the resistance of facilities to direct weapon effects and the potential exposure of essential personnel to radiation. Such an analysis must be carried out at each link of each system to obtain accurate knowledge of potential weaknesses of the system. Plans should then be prepared to raise the overall level of resistance or to provide replacement items, as far as is practicable in peacetime and during periods of increasing international tension.

PART IV – CONCLUSIONS

71. The guidance provided in this paper should be considered in the light of analysis of all pertinent factors related to civil emergency planning. It is not suggested that the guidance will meet the requirement for all departments, agencies and levels of government for all situations. There may be situations where the threat may require emphasis in planning to be related to a single option rather than a mix-option of the measures suggested.

72. There is need to ensure that full use is made of whatever warning time is available. Plans should place emphasis on the quick and effective response to the threat which can be achieved by the prior assignment of emergency responsibilities to organizations in being.

73. It follows that the development of training cadres and the education of senior officials at all levels of government and industry should be included in the development of contingency plans.

74. Canada EMO is prepared at all times to discuss any course, or courses of action with civil emergency planners in order that a consensus may be achieved and to provide advice regarding all technical, organizational, operational or training matters related thereto.

**ANNEX "A" to:
The Nuclear Threat, Its Implications
and Planning Guidance
dated: April 1973**

POTENTIAL CIVILIAN AREAS OF CANADA AT RISK FROM DIRECT ATTACK

<u>Group</u>	<u>Location</u>	<u>Illustrative Weight of Attack</u>
1	Montreal	30 MT
	Toronto	30 MT
	Windsor	10 MT
	Niagara	10 MT
	Ottawa	10 MT
2	Hamilton	10 MT
	Vancouver	20 MT
	Winnipeg	10 MT
	Quebec	10 MT
	Edmonton	10 MT
3	Calgary	10 MT
	London	10 MT
	Sarnia	10 MT
	Kitchener	10 MT
	Halifax	10 MT
	St. Catherines	10 MT
4	Sudbury	
	Oshawa	
	Victoria	
	Thunder Bay	
	Trois-Rivieres	
	Regina	
	Saint-John, N.B.	
	Chicoutimi	
	Brantford	
Sault Ste. Marie		

ANNEX "B" to:
The Nuclear Threat, Its Implications
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WEAPONS EFFECTS
STRUCTURAL DAMAGE FROM SURFACE BURSTS

STRUCTURE TYPE	DAMAGE	YIELD		
		1Mt	5 Mt	10 Mt
(Distance in miles from ground zero)				
Wood Frame buildings residential type	Moderate	4.8	9	10.5
	Severe	4.2	7.2	9
Wall bearing masonry building apartment house type	Moderate	3.6	6	7.5
	Severe	2.7	4.8	6.6
Multi-storey wall bearing monumental type	Moderate	2.7	4.5	5.7
	Severe	2.1	3.6	4.5
Reinforced concrete (NOT earthquake resistant)	Moderate	2.4	4.5	5.4
	Severe	1.8	3.3	4.5
THERMAL EFFECTS FROM SURFACE BURSTS 50 Mile Visibility				
EFFECT	YIELD			
	1 Mt	5 Mt	10 Mt	
1st Degree Burns to Bare Skin Miles from ground zero	13.0	21.6	24.0	
2nd Degree Burns to Bare Skin Miles from ground zero	9.4	16.0	19.0	
House Fires				
Direct Ignition — Miles	3.2	7.0	9.5	
Tinder — Rubbish — Miles	5.0	11.0	15.0	

**ANNEX 'C' TO THE NUCLEAR THREAT,
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