Strathclyde Regional Council

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An equal opportunities authority
A nuclear-free zone authority

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Date: 14 June 1988

See Distribution

Dear Sir,

CIVIL DEFENCE - PLANNING ASSUMPTIONS.

I refer to the Civil Defence Seminar organised by the Regional Council on 19 April 1988 at which your Council were represented. As part of the process of fulfilling its statutory duty to prepare plans under the 1983 Civil Defence Regulations, the Regional Council has initiated a Local Planning Assumptions Study, tasked to examine the possible consequences of military attack on Strathclyde, whether conventional, chemical, biological or nuclear. Clearly the most serious effects would be from a nuclear attack and in order to understand the scale of casualties, two plausible nuclear scenarios have been selected as part of the background against which the Civil Defence plans should be drawn up.

The enclosed document explains the details of the nuclear scenarios and outlines the scale of casualties which might be expected. The figures as presented assume a situation where no protective or preventative measures have been taken by or on behalf of the Region's residents e.g. evacuation, public shelters, construction of domestic refuge, etc.

Please study the effects presented in the document with particular reference to the District resources and personnel which might survive such levels of attack. Your designated Civil Defence Liaison Officer(CDLO) will be contacted soon so that your views can be obtained on the effects and remaining resources which might be used for survival and recovery.

Yours faithfully,

Ian Sim Forlane

Senior Depute Chief Executive.

Enc.

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LOCAL PLANNING ASSUMPTIONS STUDY

N U C L E A R A T T A C K

SCENARIOS AND EFFECTS

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THE EFFECTS OF A NUCLEAR BOMB

FLASH

When a nuclear weapon explodes it emits an intense flash of light that will extend (in the case of a one megaton explosion) for typically ten seconds. This can affect people in several ways. Firstly, those exposed to the fireball can suffer serious flash burns, to a degree that obviously depends on their distance from the fireball and such factors as the amount of skin exposed. People may receive " Partial Thickness Burns ", in which case the skin becomes blistered and may become infected (in clear weather, at 8 miles from ground zero for a one megaton airburst). In the case of " Full Thickness Burns " there is complete destruction of all the skin layers, (in clear weather,at 7 miles from ground zero for a one megaton airburst). Secondly, within the firezone (also extending to 7 miles) started by this flash of heat, people will die from the effects of fires principally by asphyxiation.

BLAST

Most of the immediate damage caused by a nuclear explosion comes from the enormous resulting shock wave, in the case of a one megaton air burst 50% of the energy released is in the form of blast . The pressure resulting from this blast wave is measured, usually in pounds per square inch (PSI) as an amount by which it exceeds normal atmospheric pressure. This is referred to as " OVERPRESSURE ", which can destroy buildings and structures through a combination of the initial blast overpressure, subsequent depressurisation and violent after-winds. People may be killed by the effect of blast directly on the body, which ruptures internal organs and, in much larger numbers, through collisions between the body and flying debris, falling buildings and so forth (see Table 1, Page 2).

INJURY AND DEATH RELATED TO RADIATION

Radiation destroys the internal structure of the cells of the body. The production rate of cells (especially white cells) drops; this in turn lowers the body's resistance to infection.
The LD50 is that level of radiation dose which results in half the exposed population dying. The effects of radiation on the body also vary according to the period over which the dose is received. A given dose spread over weeks or months will not have consequences as serious as the same dose received in days or hours. For those who receive fatal doses, death will not be instantaneous. A dose which is greater than 2,000 rads causes death within a few days at the longest. With lower dose levels death may not ensue for several weeks. The human LD50 lies between 400-450 rads. This value refers to doses to the whole body and to measurements made at the surface of the body. If the dose is measured from the middle of the body or to the bone marrow , the LD50 would be lower.

TABLE 1

BLAST EFFECTS

DISTANCES GIVEN ARE TYPICAL FOR A ONE MEGATON AIR-BURST WEAPON

BLAST RING E (UP TO 1 PSI, APPROX 11 MILES)

0.75 psi - Glass in windows smashed, some slates removed from roofs.

BLAST RING D (1 - 2 PSI, APPROX 7½ MILES)

1.5 psi - Window frames and doors blown in. Roofs bared of slates.

2.0 psi - 30% of coniferous trees and 90% of decidous trees blown down in wind speeds of about 100 mph.

BLAST RING C (2 - 5 PSI, APPROX 4 MILES)

3.0 psi - Ceiling plaster brought down, roof timbers stripped, front and rear (to blast wave direction) brick walls cracked or demolished. Timber frame walls demolished. 90% of coniferous trees blown down, wind speed 130-140 mph. Aircraft fuselages cracked.

4.0 psi - Telephone lines running across blast direction may be brought down

5.0 psi - High voltage power lines brought down, towers remain standing, cars and lorries (side on) blown over.

BLAST RING B (5 - 12 PSI, APPROX 2½ MILES)

6.0 psi - Brick houses reduced to side walls only, front and rear walls demolished completely along with roof and upper storeys. Timber house reduced to low pile of timbers. Multi-storey buildings exterior walls badly cracked. Some floors may collapse.

11.0 psi - Low heap of rubble and timber

BLAST RING A (12 AND ABOVE PSI, 0 - 2½ MILES)

12.0 psi - Some bridges damaged, locomotives (side on) blown over, earthquake resistant buildings damaged.

20.0 psi - Most bridges destroyed.

40.0 - 100.0 psi - Damage to underground structures, although ground shock in the case of a ground blast extends to about 2.5 times the blast crater (rupture and plasic deformation). The crater radius for a one megaton bomb ground burst is 0.075-0.13 miles, depending upon rock type

TABLE 2

MEDICAL EFFECTS OF RADIATION

BLAST RING E

0 - 100 rads - Men become temporarily sterile in 20 - 50 rads range
CONSEQUENTIAL DEATHS (average) : NIL

BLAST RINGS C & D

100 - 200 rads - Nausea and vomiting within 3-6 hours of receiving dose and lasting less than one day, followed by no symptoms for two weeks. Recurrence of symptoms for another four weeks. Number of white blood cells reduced.
CONSEQUENTIAL DEATHS (average) : NIL

BLAST RINGS B & C

200 - 600 rads - Nausea and vomiting lasting 1-2 days. No symptoms for one to four weeks followed by recurrence of symptoms for up to eight weeks. Diarrhoea, severe reduction of white blood cells , blood blisters on skin, bleeding infection. Loss of hair above 300 rads.
CONSEQUENTIAL DEATHS (average) : 0-98% in 2-12 weeks from internal bleeding or infection.

BLAST RINGS'S A & B

600 - 1,000 rads - Nausea and vomiting starting within ½ hour of receiving dose of radiation and lasting 2 days. No symptoms for five to ten days, then same symptoms as for 200-600 rads, for 1-4 weeks.
CONSEQUENTIAL DEATHS (average) : 98-100% from internal bleeding.

1,000 - 5,000 rads - Nausea and vomiting starting within ½ hour of receiving dose of radiation and lasting less than a day. NO symptoms for about seven days, then diarrhoea, fever, disturbed salt balance in blood for 2-14 days.
CONSEQUENTIAL DEATHS (average) : 100% within 14 days from collapse of circulation.

MORE THAN 5,000 rads - Nausea and vomiting immediately followed by convulsions, loss of control of movement and lethargy.
CONSEQUENTIAL DEATHS (average) : 100% within 48 hours from failure of breathing or brain damage.

IT SHOULD BE NOTED THAT THE ABOVE MENTIONED DATA RELATES TO A DOSE OF RADIATION WHICH HAS BEEN ACCUMULATED OVER A SHORT PERIOD OF TIME.

CASUALTY CALCULATION METHODS

The casualty figures presented are generated by the NUKECALC computer program which allows us to change a number of factors which might obtain at the time of an attack, and then observe the resultant changes in casualty figures. The following are some of the variable factors :-

POPULATION FIGURES

The 1981 Census figures for the ' usually resident ' population per square kilometre have been used. Evacuation can be simulated by entering a zero population into specific kilometre squares.

PERIOD OF EXPOSURE TO FALLOUT RADIATION

We have the option of selecting 7 or 14 days as the period over which the population accumulates a radiation dose. The 14 days option has been used in the attached results, since this period accords with government advice to the population to stock up with food and water and take refuge for 14 days post nuclear strike. However, due to the natural decay in radiation levels, the major proportion of the dosage is absorbed in the first two or three days in any case, so the choice of exposure period is not critical.

WIND DIRECTION

The options WSW and ENE have been chosen, because they are statistically the most frequent in Central Scotland.

LD50 (Lethal Dose for 50% of recipients)

450 rads has been chosen because it is the generally- agreed accumulated dose of radiation which will kill 50% of any population group subjected to it. There is also a 225 rads option in the program but the 450 rads level has been generally confirmed by events at Chernobyl. Of course, radiation injuries will still occur at lower levels.

PROTECTIVE FACTORS OF BUILDINGS (PFs)

The structure of buildings gives a degree of protection from external fall-out radiation, depending on the weight and thickness of construction materials in walls, roofs and floors and the degree to which the building has been damaged by blast.

Assuming that a person standing in the open outside a building would accumulate a dose of 100 rads over a given period, by sheltering inside the building, if it had a PF of 2, his accumulated dose would be reduced to 100 ÷ 2 = 50 rads; if the building had a PF of 10, the dose would be 100 ÷ 10 = 10 rads over the same time period. The program uses the PFs 1,1,2,5,8 which are related to the blast damage rings A,B,C,D,E radiating from the ground zero of the nuclear blast(see detailed explanation of blast effects in Table 1).

It should be noted that the attached casualty figures assume that the population has made no attempt to improve the PFs of their dwellings by self-help measures during the pre-strike period of tension. By (say) doubling the program's input PFs to 2,2,4,10,16 it is possible to simulate a situation where the population has acted on advice and doubled the protection available within their houses. The resultant changes in casualty figures could then be observed.

The PLANNING ASSUMPTIONS STUDY team is available to discuss the methods used and explain the local effects produced by altering these and other variables in the circumstances which might prevail at the time of a nuclear attack.

INTERPRETATION OF MAPS

By viewing the maps supplied with this information pack, you can gain an impression of the extent of the effects originating from the various weapons (including overlapping effects). Each 1km-square is given an " effects code ".In relation to each scenario this code presents the post-strike radiological effects, by using a letter. Each letter represents the level of accumulated dose of radiation an individual would incur within that 1km square area.(see CODE USE TABLE).

Tables 1 & 2, (Blast Effects & Medical Effects of Radiation) are intended to give the reader an insight into how the above mentioned effects could be translated in terms of physical damage in respect of buildings, structures etc and physiological damage in respect of the exposed population.

1KM-SQUARE CODE USE TABLE

DOSE (RADS)	BLAST ZONE A	B	C	D	E
< 100	A	B	C	D	.
100 - 300	F	G	H	I	J
300 - 450	K	L	M	N	O
450 - 600	P	Q	R	S	T
> 600	V	W	X	Y	Z

SCENARIO ONE TARGETS

GROUNDBURST : △ AIRBURST : ◇

TARGET SCENARIOS

The target and weapon scenarios are based on those supplied by consultants, Earth Resources Research Ltd, and refined by the Planning Assumptions Study in the light of local knowledge. Scenario One concentrates on targets associated with nuclear strike capability.

Scenario One

TARGET	TYPE OF BURST	YIELD (kt)
Glen Douglas	Ground	150
Faslane	Ground	500
Faslane-Gare Loch	Ground	150
Coulport	Ground	150
Holy Loch	Ground	150
Holy Loch Entrance	Ground	500
Clyde 1	Ground	500
Clyde 2	Ground	1,000
Renfrew	Air	500
Beith	Ground	150
Prestwick	Ground	1,000
Machrihanish 1	Ground	150
Machrihanish 2	Ground	1,000
Leuchars	Ground	500
Balado Bridge	Air	150
Rosyth & Forth Road Bridge	Ground	500
Pitreavie	Ground	500
Turnhouse Airport	Ground	1,000

NOTE : Certain targets outside Strathclyde have been included in both scenarios because their resultant fallout may affect the region.

SCENARIO TWO ADDITIONAL TARGETS

GROUNDBURST : △ AIRBURST : ◇

TARGET SCENARIOS

Scenario Two includes all Scenario One targets plus additional infrastructure and industrial targets shown below.

Scenario Two

TARGET	TYPE OF BURST	YIELD (kt)
Torness	Air	350
Grangemouth	Ground	1,000
Glasgow (South-East)	Ground	1,000
Hunterston A & B	Air	1,000
Ardrossan & Stevenston	Air	1,000
Cockenzie	Air	350

NOTE : Certain targets outside Strathclyde have been included in both scenarios because their resultant fallout may affect the region.

STRATHCLYDE REGION

(TOTAL POPULATION : 2,371,313)

SUMMARY OF CASUALTIES (THOUSANDS)

	Scenario : 1 Wind : WSW			Scenario : 1 Wind : ENE		
SUB-REGION	KILLED	INJURED	UNINJURED	KILLED	INJURED	UNINJURED
ARGYLL & BUTE	14.1	3.6	45.1	17.0	5.4	40.4
AYR	57.8	28.3	288.0	64.7	25.6	283.8
DUNBARTON	69.6	53.2	190.8	27.1	63.7	222.8
GLASGOW	252.3	192.4	310.3	256.0	261.3	237.7
LANARK	0.1	3.1	500.9	4.7	95.2	404.2
RENFREW	224.4	60.8	76.5	226.6	66.9	68.2
TOTALS	618.3	341.4	1411.6	596.1	518.1	1257.1

	Scenario : 2 Wind : WSW			Scenario : 2 Wind : ENE		
SUB-REGION	KILLED	INJURED	UNINJURED	KILLED	INJURED	UNINJURED
ARGYLL & BUTE	14.4	5.1	43.3	19.6	6.5	36.7
AYR	140.6	67.0	166.5	190.8	46.7	136.6
DUNBARTON	70.0	54.7	188.9	164.3	69.4	79.9
GLASGOW	277.0	227.6	250.4	610.6	128.2	16.2
LANARK	200.1	90.1	213.9	348.3	47.1	108.7
RENFREW	225.0	60.7	76.0	294.9	40.9	25.9
TOTALS	927.1	505.2	939.0	1628.5	338.8	404.0

GLASGOW SUB-REGION

(TOTAL POPULATION : 755,029)

SUMMARY OF CASUALTIES (THOUSANDS)

	Scenario : 1 Wind : WSW			Scenario : 1 Wind : ENE		
DISTRICT	KILLED	INJURED	UNINJURED	KILLED	INJURED	UNINJURED
GLASGOW	252.3	192.4	310.3	256.0	261.3	237.7
TOTALS	252.3	192.4	310.3	256.0	261.3	237.7

	Scenario : 2 Wind : WSW			Scenario : 2 Wind : ENE		
DISTRICT	KILLED	INJURED	UNINJURED	KILLED	INJURED	UNINJURED
GLASGOW	277.0	227.6	250.4	610.6	128.2	16.2
TOTALS	277.0	227.6	250.4	610.6	128.2	16.2

GLASGOW

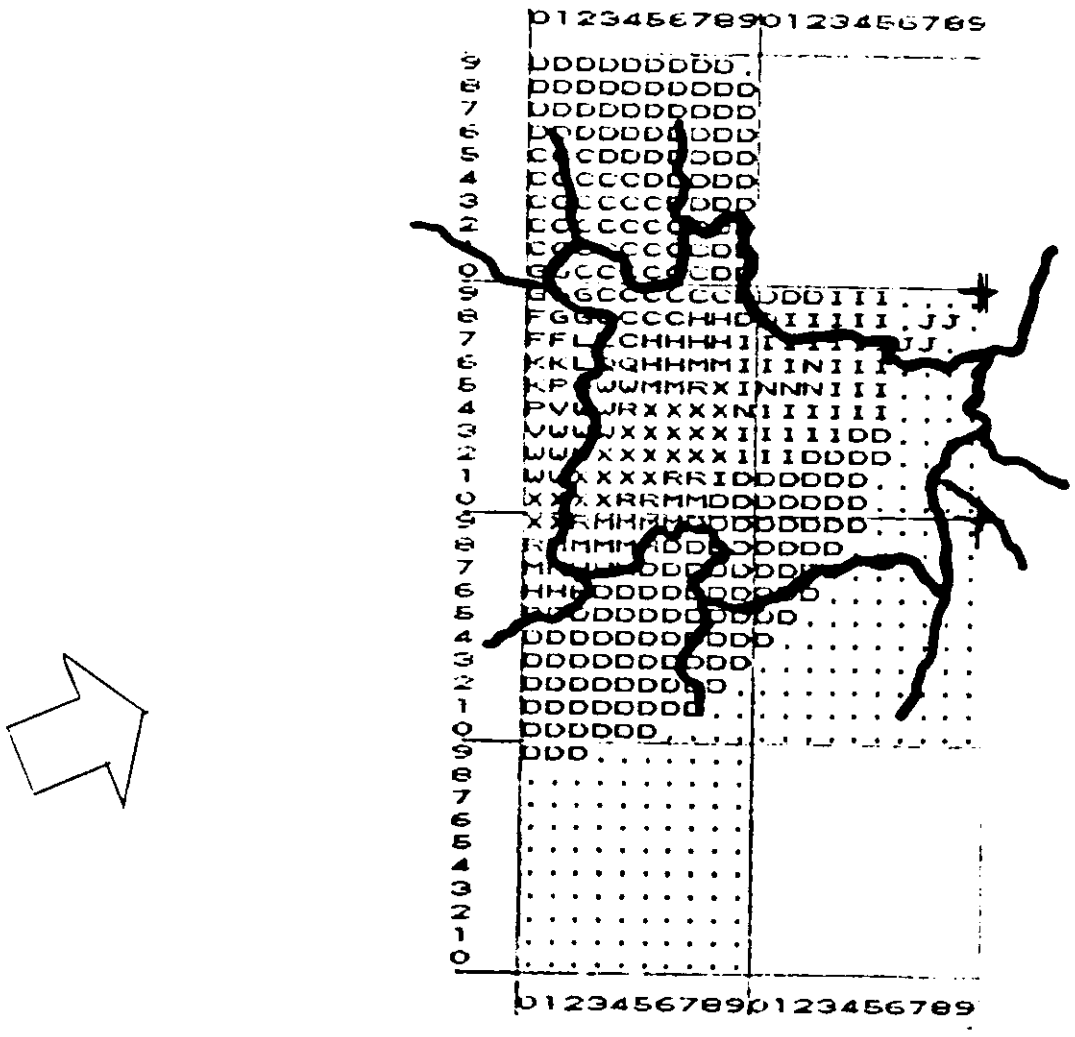
SCENARIO : ONE

NUMBER OF BOMBS : 16 WIND DIRECTION : S.E.S

KILLED	:	252,276
INJURED	:	192,452
UNINJURED	:	310,302
TOTAL POPULATION	:	755,029

Printed 1km-square codes use table:

Dose/rad	East zone A	B	C	D	E
< 100	A	B	C	D	.
100 - 300	F	G	H	I	J
300 - 450	K	L	M	N	O
450 - 600	P	Q	R	S	T
> 600	V	W	X	Y	Z



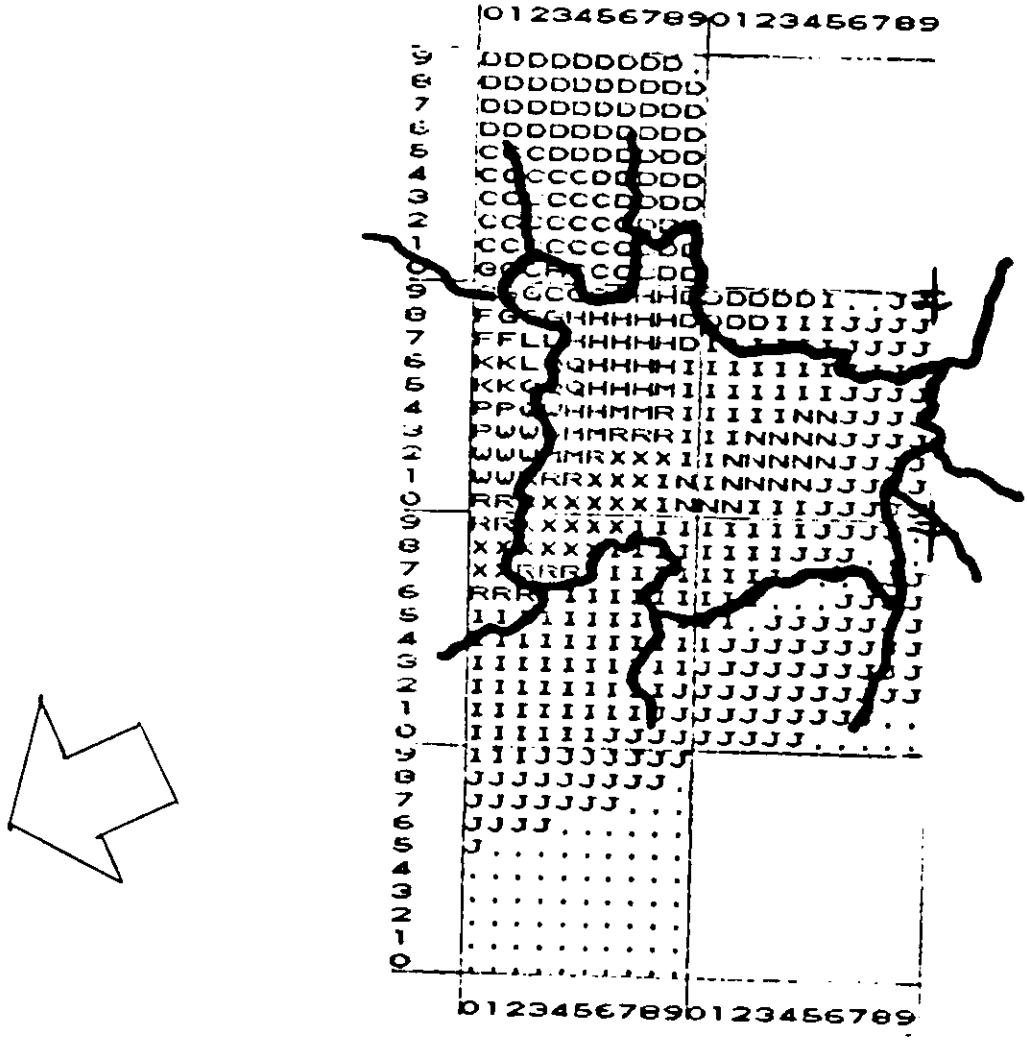
SCENARIO : ONE

NUMBER OF BOMBS : 10 WIND DIRECTION : E.N.E

KILLED	:	266,046
INJURED	:	261,281
UNINJURED	:	237,700
TOTAL POPULATION	:	765,029

Printed ten-square codes use table:

Dose/rad	Blast zone A	B	C	D	E
< 100	A	B	C	D	.
100 - 300	F	G	H	I	J
300 - 450	K	L	Q	N	O
450 - 600	P	Q	R	Y	N
> 600	V	U	X		



SCENARIO : TWO

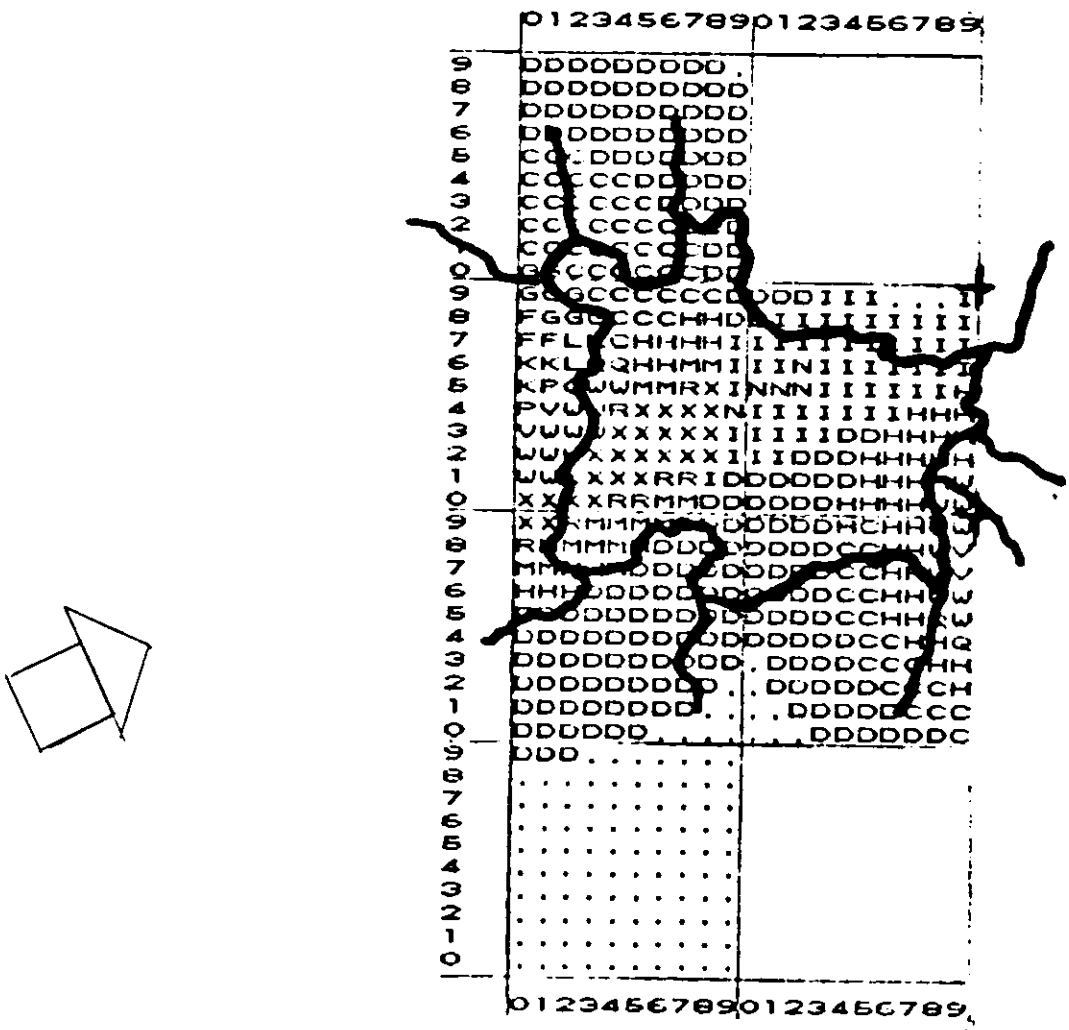
NUMBER OF BOMBS : 24

WIND DIRECTION : W.S.W

KILLED	:	276,956
INJURED	:	227,629
UNINJURED	:	250,444
TOTAL POPULATION	:	755,029

Printed 1km-square codes use table:

Dose/rad	Blast zone A	B	C	D	E
< 100	A	B	C	D	.
100 - 300	F	G	H	I	J
300 - 450	K	L	M	N	O
450 - 600	P	Q	R	S	T
> 600	V	W	X	Y	Z



SCENARIO : TWO

NUMBER OF BOMBS : 24

WIND DIRECTION : E.N.E

KILLED	:	610,629
INJURED	:	126,198
UNINJURED	:	16,202
TOTAL POPULATION	:	755,029

Printed 1km-square codes use table:

Dose/rad	Blast zone A	B	C	D	E
< 100	A	B	C	D	.
100 - 300	F	G	H	I	J
300 - 450	K	L	M	N	O
450 - 600	P	Q	R	S	T
> 600	V	W	X	Y	Z