

**CIVIL DEFENCE  
PLANNING ASSUMPTIONS  
IN  
CENTRAL SCOTLAND**



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EAST CENTRAL SCOTLAND PLANNING ASSUMPTIONS STUDY  
STRATHCLYDE REGION PLANNING ASSUMPTIONS STUDY

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## **Foreword**

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This publication reports the results of work carried out by the Strathclyde Region and East Central Scotland Planning Assumptions Studies. These two studies were commissioned by the associated local authorities as a result of legislation which required them to undertake civil defence planning to deal with the effects of all types of hostile attack, including nuclear war. Although the Government had issued them with guidance (Emergency Planning Guidance to Local Authorities), the local authorities involved felt that this was too vague and too general. It did not include, for example, the particular local detail required by emergency planners charged with the task of drawing up appropriate civil defence plans. The outcome of the work of the Studies, undertaken over the past two years in order to extend the guidance to emergency planners, is jointly reported in this booklet. We hope that this will serve as an overview and guide to the various areas of concern investigated, not only to the general public but also to those who might in the future become involved in civil defence in central Scotland.

The results of the East Central Scotland Planning Assumptions Study will be reported more fully in their final report.

October 1989

**Councillor Charles Gray**

**Chair of the Special Committee  
on Emergencies,  
Strathclyde Regional  
Council**

**Councillor William B. Herald**

**Chair of the  
Management Committee,  
East Central Scotland  
Planning Assumptions Study.**



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EAST CENTRAL SCOTLAND PLANNING ASSUMPTIONS STUDY

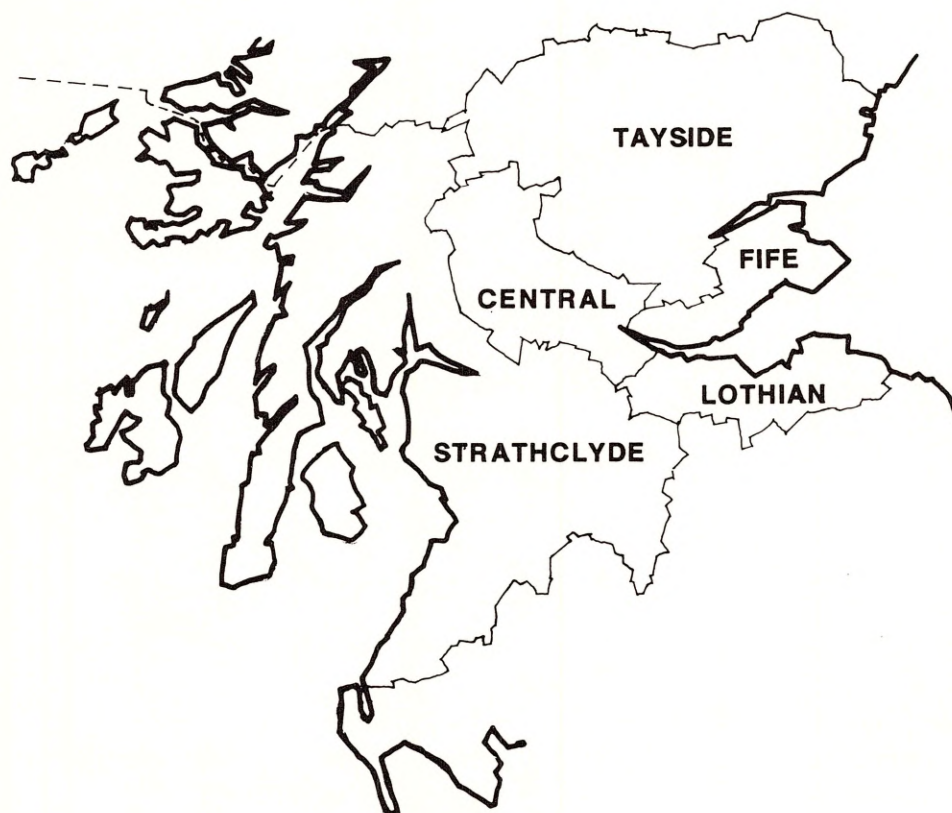
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The East Central Scotland Planning Assumptions Study research project was undertaken on behalf of the University of Edinburgh by Alan Walker (Study Co-ordinator) of the Department of Physics and Rod McKenzie (Research Associate). The university-based consultancy was undertaken during the two-year period from September 1st, 1987 to August 31st 1989.

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The Strathclyde Region Planning Assumption Study was undertaken by William Guthrie (Study Co-ordinator), John Donlin and Derek Kelly of Strathclyde Regional Council during the period from January 1988 to June 1989.

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STRATHCLYDE REGION PLANNING ASSUMPTIONS STUDY

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# CIVIL DEFENCE PLANNING ASSUMPTIONS IN CENTRAL SCOTLAND

## Contents

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Foreword.....	iii
Map of Central Scotland showing Study areas.....	iv
1) Introduction to Planning Assumptions Studies.....	1
• The Civil Defence Regulations of 1983	
• Responsibilities of Local Authorities	
• Background to Planning Assumptions Studies	
• The Nuclear Free Zones initiative	
• East Central Scotland Planning Assumptions Study	
• The Local Authorities involved	
• Strathclyde Planning Assumptions Study	
2) Target Scotland.....	3
• Scotland's importance in NATO military planning	
• Map of potential targets in Scotland	
• Conventional attack	
• Chemical and biological attack	
• Escalation to nuclear war	
3) The Effects of Nuclear Attack.....	8
• The assessment of nuclear attack	
• The nuclear attack scenarios	
• The Soviet weapons available pre- and post- the INF Treaty	
• Targets in Central Scotland in the two nuclear attack scenarios used	
• The effects of nuclear weapons	
• The Nukecalc2 program	
• The Nukecalc2 effects maps	
• Maps of the effects of nuclear attack on Central Scotland	
• The Nukecalc2 casualty estimates	
• The overall assessment of casualties in Central Scotland	
• Casualty estimates for East Central Scotland and Strathclyde Region	
• The assessments by Earth Resources Research Ltd	



<b>4) Government Policy on Civil Defence Planning.....</b>	<b>18</b>
<ul style="list-style-type: none"> <li>• Emergency Planning Guidance to Local Authorities (EPGLA)</li> <li>• The Planned Programme for Implementation (PPI)</li> <li>• Criticism of Scottish Health and Health Department guidance</li> <li>• Government policy on evacuation</li> <li>• Criticism of Home Office scientific advice</li> <li>• General review.</li> </ul>	
<b>5) Local Authorities' Civil Defence Responsibilities.....</b>	<b>22</b>
<ul style="list-style-type: none"> <li>• Local Authority statutory obligations</li> <li>• Regional responsibilities and civil defence planning.</li> <li>• District responsibilities</li> </ul>	
<b>6) Planning Assumptions Conclusions.....</b>	<b>24</b>
<ul style="list-style-type: none"> <li>• Military mobilisation and the use of civilian resources</li> <li>• The impact of Government emergency legislation</li> <li>• Government planning assumptions on conventional war</li> <li>• Conflicting burdens and civil protection</li> <li>• The protection of key points</li> <li>• The identification of possible targets</li> <li>• High-risk areas near potential targets</li> <li>• Protection from the short-term effects of nuclear attack</li> <li>• Self-evacuation</li> <li>• Emergency feeding</li> <li>• Accommodation</li> <li>• Environmental health</li> <li>• Disposal of the dead</li> <li>• Volunteers</li> <li>• Rescue, repair and essential services</li> <li>• Emergency centres</li> </ul>	
<b>7) Summary.....</b>	<b>41</b>
<b>Acknowledgments.....</b>	<b>42</b>



# 1) Introduction to Planning Assumptions Studies

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## The Civil Defence Regulations of 1983

In 1983 the Government passed legislation, the **Civil Defence (General Local Authority Functions) (Scotland) Regulations 1983**, which made it a statutory obligation for Scotland's Regional and Islands Authorities to prepare civil defence plans for all possible wartime emergencies. District Councils are also required to assist their relevant regional authority in this planning process.

## Responsibilities of Local Authorities

These regulations require that every region and islands council make, keep under review and revise plans for civil defence on twelve specified topics. All regional and district authorities are required to: establish, equip and maintain emergency centres; to provide training in civil defence for their own staff as well as for volunteers from the general public; and to take part in training exercises organised by designated Ministers.

## Background to Planning Assumptions Studies

Concern by local authorities over the inadequacy and ambiguity of the guidance issued by central government for the preparation of such civil defence plans has resulted in the setting up of a number of 'planning assumptions studies'. The aim of such studies is to formulate a set of realistic assumptions about the likely targets, scale and consequences of any possible hostile action (which may include either or both conventional and nuclear attack) and to review the Government's own civil defence planning assumptions

## The Nuclear Free Zones initiative

The initiative for planning assumptions studies and the model on which they are based came from the **National Steering Committee (NSC)** of the **Nuclear Free Zones (NFZ)** organisation and was endorsed by the **Nuclear Free Zones Scotland** committee. The National Steering Committee set up a national organisation to promote, assist and coordinate such planning assumptions studies. A series of National Guidance Papers was commissioned from external sources, together with computer-aided assessments of nuclear attack from an independent consultancy and a microcomputer-based nuclear attack assessment program for use in local research. A full-time National Study Co-ordinator, based in the University of Bradford was also appointed. These resources were available to those local authorities or groups of local authorities which undertook to set up planning assumptions studies. Such authorities considered that the



results of this research would allow them to take a practical and realistic approach to civil defence planning for their own area(s).

Several studies have been set up in the United Kingdom under a variety of arrangements, including the **East Central Scotland Planning Assumptions Study** and one established by Strathclyde Regional Council, the **Strathclyde Region Planning Assumptions Study**.

The East Central Scotland Planning Assumptions Study is, so far, the only such study based within a university and entirely outwith local authorities. The national organisation provided valuable information and expert guidance to assist these studies. For example, included in the series commissioned from independent researchers were papers on energy resources, food and water supplies, disease and medical facilities and other areas of major importance for planning. The national computer model of the impact of nuclear attack on the U.K. provided a national overview whilst the complementary microcomputer programme provided further detail on a localised basis.

### **The East Central Scotland Planning Assumptions Study**

Four Regions and ten of the associated Districts in East and Central Scotland jointly set up the East Central Scotland Planning Assumptions Study (ECSPAS) as the most efficient and cost effective way of undertaking research on civil defence planning assumptions. Along with nationally provided resources the study has also undertaken its own independent research.

#### **The Local Authorities involved**

The East Central Scotland Planning Assumptions Study was administered through a joint Management Committee with representation from each of the participating authorities :-

<b>Regions</b>	<b>Districts</b>			
<b>Central</b>	<b>Clackmannan</b>	<b>Falkirk</b>	<b>Stirling</b>	
<b>Fife</b>	<b>Dunfermline</b>	<b>Kirkcaldy</b>		
<b>Lothian</b>	<b>East Lothian</b>	<b>Edinburgh</b>	<b>Midlothian</b>	<b>West Lothian</b>
<b>Tayside</b>	<b>Dundee</b>			

Overall co-ordination was undertaken by Lothian Regional Council.

### **Strathclyde Region Planning Assumptions Study**

This planning assumptions study was established by **Strathclyde Regional Council**, and, in contrast to the East Central Scotland Planning Assumptions Study, the research was undertaken 'in-house' by Regional officials, working closely with the Regional Emergency Planning Unit.



## 2) Target Scotland

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Central to the Government's civil defence planning guidance is the implicit assumption that if Britain were to be subject to large-scale hostile attack, it would most probably be as a consequence of conflict between the military alliances of the North Atlantic Treaty Organisation (NATO) and the Warsaw Treaty Organisation (referred to here as the Soviet/Warsaw Pact). Such hostilities may become even more remote in the future if new disarmament measures are realised. Given this underlying assumption, the Studies have examined the consequences of an attack by the Soviet/Warsaw Pact only. Other nations, of course, have, or may have in the future, the capability to attack the UK by conventional or other means.

### Scotland's importance in NATO military planning

Scotland occupies a unique position close to the most important Atlantic and European sea and air routes involved in the war-fighting strategies of the armed forces of both NATO and the Soviet/Warsaw Pact. The North Atlantic contains the major sea and air routes for the military reinforcement of Europe from the U.S.A., and the 'Greenland/Iceland Gap', the Baltic approaches and the North Sea, contain the only routes for the westward mobilisation of the Soviet/Warsaw Pact naval forces.

Scotland has a large number of vital U.K. and NATO military bases and installations, all of which would play a major role in any future war. Scotland's role as a major base and supply depot for NATO will be maintained in the next few years with, for example, the building of an expanded underground NATO maritime control centre at Pitreavie (just north of Rosyth) costing some £70-80 million, and a £60 million expansion of the Royal Naval armaments and fuel supply depot at Crombie, near Rosyth. The U.K.'s Trident programme expansion of its naval nuclear capability will also be based in Scotland, on the Clyde at Faslane and Coulport, and on the Forth at the re-fit base at Rosyth.

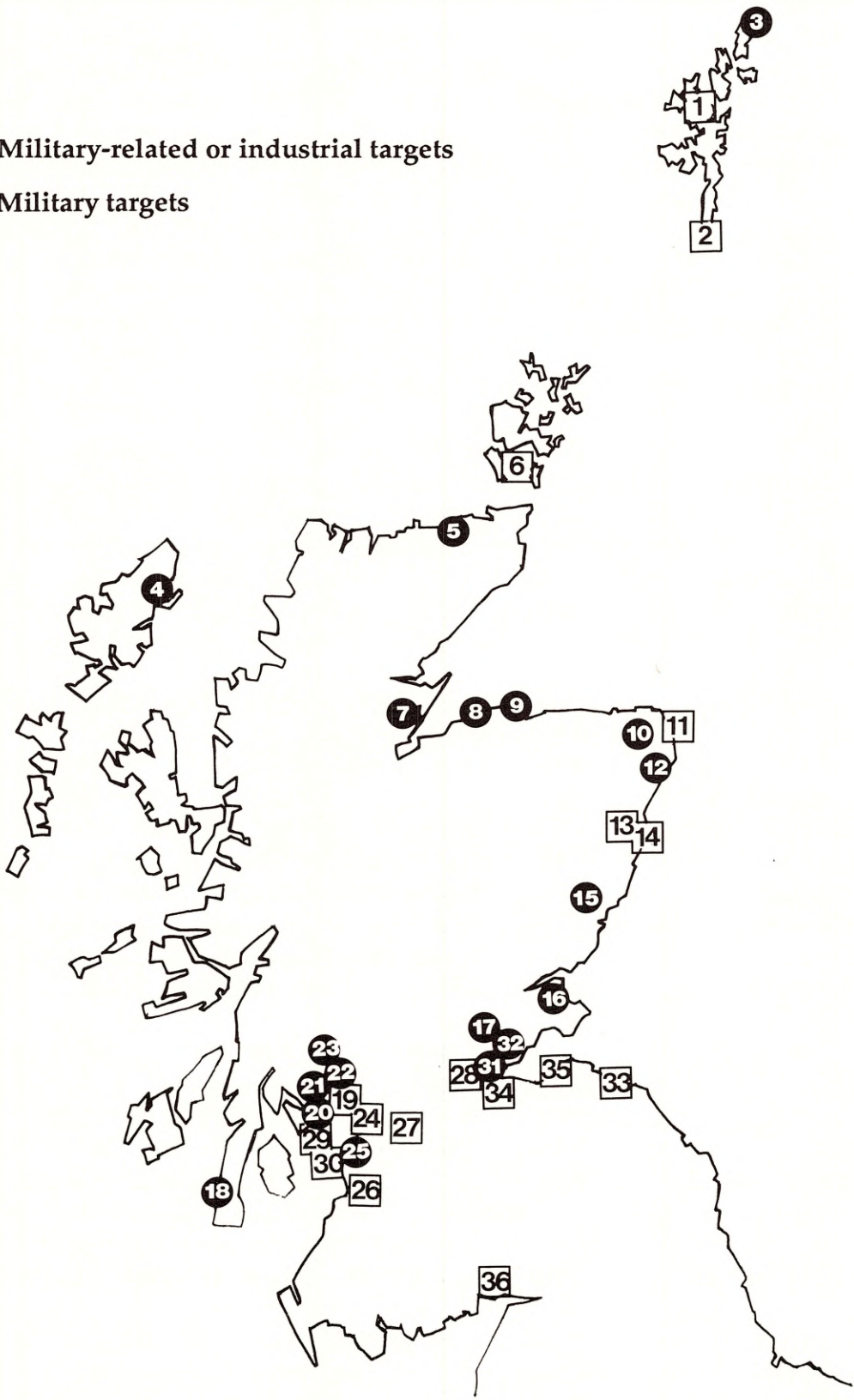
As a result, the sea- and air-space surrounding Scotland will continue to be a major 'front-line' area of operations for both the surface and submarine naval forces and the air forces of both sides in any war in Europe. As a result all of these sites are potential major targets for attack by conventional and nuclear weapons. In addition to these more obvious military targets, most of the main air- and sea-ports would be in heavy use by the military in a war crisis and would also be potential targets, along with the country's main industrial areas and power generating facilities.

Scotland is a small country and most potential targets are close to the main population centres, particularly in the 'central belt' around both Edinburgh and Glasgow (see page 4). This poses major problems in considering any measures which might be of use in an attempt by local authorities to plan for the protection of the civilian population from a hostile attack, **especially a nuclear attack.**



# Map of potential targets in Scotland

- 1 Military-related or industrial targets
- 5 Military targets



This map and the key opposite indicate the more probable major military and military-related or industrial targets in Scotland.



## Key to potential targets in Scotland

TARGET	DESCRIPTION	
1	SULLOM VOE	Major oil terminal; US Coastguard Loran-C LF navigation and communications.
2	SUMBURGH	Civilian airport; radar.
3	SAXA VORD	RAF radar station; UKADGE (UK Air Defence Ground Environment); communications links with NADGE (NATO Air Defence Ground Environment) and NATO 'ACE HIGH' network; microwave, satellite and radio communications.
4	STORNOWAY	RAF/NATO airbase and civilian airport; NATO Forward Operating Base.
5	DOUNREAY	UKAEA Prototype Fast Reactor; Vulcan Naval Nuclear Propulsion Test Establishment + FORSS, US Navy VLF/LF/HF submarine communications transmitter.
6	FLOTTA	Oil terminal.
7	INVERGORDON	Royal Navy oil pipeline and fuel depot.
8	KINLOSS	RAF airbase; UK's principal anti-submarine warfare (ASW) base. Possible wartime nuclear weapons deployment.
9	LOSSIEMOUTH	RAF airbase; "important UK front line base"; RAF Strike Command. Possible wartime nuclear weapons deployment.
10	MORMOND HILL	Important military radars and communications network links; USAF North Atlantic Relay System (NARS) for early warning data; NATO 'ACE HIGH' network relaying UKADGE & NADGE communications and data; US Navy UK Microwave System (UKMS) relaying data on Soviet naval vessels; Part of NATO Integrated Communications System (NICS).
11	ST. FERGUS	North Sea gas terminal.
12	BUCHAN	RAF Sector Control (underground); UKADGE/NADGE radar station. + CRUDEN BAY oil pipeline terminal.
13	DYCE	Aberdeen civilian airport.
14	ABERDEEN	Major port; US Navy microwave communications at Clochandighter.
15	EDZELL	Major US Signals Intelligence facility (SIGINT); US Naval Security Group Agency (NSGA); US Navy & US Air Force microwave and satellite communications.
16	LEUCHARS	RAF airbase; Scotland's prime air-defence airfield for fighter interceptors.
17	BALADO BRIDGE	NATO satellite ground terminal (SGT); microwave links to Pitreavie.
18	MACHRIHANISH	RAF airfield; Forward Operating Base for NATO long-range maritime patrol aircraft. US Navy and NATO nuclear depth charge store.
19	CLYDE	Movement of US Trident 1/Poseidon and UK Polaris missile submarines. Possible wartime US Army/Navy transport terminals.
20	HOLY LOCH	US Poseidon/Trident 1 missile submarine base.
21	FASLANE GARE LOCH	Royal Navy Clyde submarine base; UK Polaris/Chevaline (to be replaced by Trident II) missile submarines base; patrol submarines; Nearby fuel depot.
22	COULPORT	Polaris and Chevaline (to be replaced by Trident II) nuclear warhead and missile store.
23	GLEN DOUGLAS	Major NATO conventional naval ammunition store.
24	RENFREW	Glasgow civilian airport. + BISHOPTON, major Royal Ordnance factory for missile and ammunition propellants.
25	BEITH	RN Conventional armaments depot, for Clyde based ships and submarines.
26	PRESTWICK	Major civilian airport; USAF Military Airlift Command; Royal Navy ASW helicopter squadron; civilian and military radar & air traffic control for Scotland.
27	GLASGOW SE MOTHERWELL EAST KILBRIDE	Major industrial area.
28	GRANGEMOUTH	Petrochemical industrial complex. + KINCARDINE, conventional power station (375MW). + LONGANNET, conventional power station (2400MW).
29	HUNTERSTON	A: Magnox nuclear power station (2 x 150MW); B: AGR nuclear power station (2x600MW).
30	ARDROSSAN	Oil storage; port; nearby Nobel Explosives Ltd. factory.
31	ROSYTH	Major RN naval base for frigates, minehunters and minesweepers; Royal Naval Dockyard; nuclear submarine refit base; + CROMBIE, Main Royal Navy armaments and fuel depot for Rosyth. + FORTH BRIDGES.
32	PITREAVIE	Principal UK and NATO maritime command centre in Scotland; subordinate to the Joint Maritime HQ in Northwood, London; control of NATO air and surface fleets forces from North Sea to North Pole; reserve Polaris control; communications centre.
33	TORNESS	AGR nuclear power station (2 x 700MW).
34	TURNHOUSE	Edinburgh civilian airport; probable wartime use.
35	COCKENZIE	Conventional power station (1152MW).
36	CHAPELCROSS	Nuclear reactor (Magnox) -production of plutonium and tritium for nuclear weapons. + POWFOOT, Nobel Explosives Ltd. ordnance factory.

+ Indicates a nearby facility which is likely to receive "collateral" blast damage.

• Indicates that a nuclear attack on this target would have immediate and short-term effects on Central Scotland.



## **Conventional attack**

For the majority of people, the idea of a war in Europe, or even a conflict in some other part of the world, involving NATO and the Soviet/Warsaw Pact nations, immediately brings the spectre of the use of nuclear weapons. This is a perfectly reasonable fear in view of the large nuclear arsenals which both sides possess.

It is possible, however, that a war in Europe could **start** with a conventional phase. NATO's conventional reinforcement plans and recent changes in the organisation and tactics of conventional Soviet forces certainly suggest that conventional war is considered a real possibility by both sides.

Most available military and other analyses of the Soviet/Warsaw Pact's capability to mount a large scale **conventional** offensive on the U.K. suggest that the attack (by air and sea) would probably be limited to the main military targets. The main aims of these attacks would be to destroy communications, aircraft, ships and land transport and their bases, and to prevent the deployment of nuclear weapons. Although modern conventional weapons are of great destructive power, it is very unlikely that any heavy attacks would be made on towns or cities themselves other than where parts of these are close to important military or industrial sites.

## **Chemical and biological attack**

NATO and Soviet/Warsaw Pact forces regularly exercise troops for the possibility of chemical or biological warfare. Stocks of chemical weapons, mostly of the 'nerve-gas' type, are held at present by both sides. Recent U.S. military assessments suggest that chemical weapons would be used 'selectively' on concentrations of fighting units in the battlefield, or on military bases and support and communications facilities elsewhere. The use of biological weapons is thought unlikely, although there is considerable uncertainty in such analyses. Any use of chemical or biological weapons in an attack on the U.K. would probably be limited to major military sites, especially those involved in the deployment of nuclear weapons.

It is very unlikely that any sophisticated protection or treatment would be available to the local populations around military sites at risk from attack by chemical or biological weapons. However recent political statements by both sides on chemical disarmament suggest that the possibility of chemical or biological attack would be even more remote in future.

## **Escalation to nuclear war**

Even if a war starts with a non-nuclear phase there are a number of reasons why this would probably quickly escalate to nuclear war:



- NATO's 'flexible response' strategy - virtually the threat to use nuclear weapons when thought necessary by political and military leaders - involves the close integration of nuclear weapons in military tactics at a number of levels. The problem here is not to consider how good a 'deterrent' this policy might be but to evaluate it as a real plan for action if 'deterrence' failed and war broke out.
- NATO's conventional war fighting abilities are hampered by a shortage of ammunition, fuel-transport, shipping and other crucial supply deficiencies. This is a well recognised problem - the ability to sustain intensive fighting in Central Europe is reckoned at about 8-10 days maximum, and less in other areas. The Soviet/Warsaw Pact forces are thought to have at least three times this fighting endurance. The option to use nuclear weapons would soon become pressing if NATO forces were facing defeat, even if only in particular areas.
- Modern warfare depends on an extremely complex command and communications system into which both conventional and nuclear forces are integrated. Any attack on these command and communications facilities, or even a pre-emptory conventional attack on the sites of deployment of the nuclear weapons themselves, could severely reduce the ability to control and use nuclear weapons. In fact, conventional attack penetrating well into the opposite sides territory in order to destroy at least some of the other sides 'battlefield' nuclear capability, appears to be part of the conventional fighting plans of both NATO and the Soviet/Warsaw Pact forces. This could lead to an early use of such weapons before they and the control over their use were lost.
- Many modern weapons systems, especially cruise missiles and longer range bombers, are 'dual-capable' - that is, they can carry both conventional and nuclear weapons. The appearance of these on radar screens could prompt a response with nuclear weapons on the principle that it would be too late to decide whether this was a nuclear attack or not, **after** the incoming weapons had exploded. The military and political uncertainty surrounding even a 'false alarm' during a time of crisis or actual war could precipitate a nuclear attack.

Any of these problems might easily bring about the early use of nuclear weapons on the basis of '**use them or lose them**'.

After the implementation of the INF treaty, short-range nuclear weapons will remain, with new longer range weapons being planned or produced for NATO's forces. The overall strategies for war-fighting in Europe have not changed radically since 'flexible response' was introduced. Unless there are any radical changes to NATO's military strategy in Europe, the civil defence planning problems for a country like Scotland, which is so heavily involved in the present structure of conventional and nuclear military planning, will remain essentially the same.



### 3) The Effects of Nuclear Attack

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#### The assessment of nuclear attack

It is probable that a war in Europe between NATO and the Warsaw Pact countries would rapidly escalate into a nuclear exchange which could result in a nuclear attack on the U.K. There can be no certainty about the level of any such attack and the potential targets. The numbers of casualties from two possible exchanges have been calculated using computer programs. These are based on attack patterns that are considered by the two studies to be a reasonably realistic basis for such assessments.

#### The nuclear attack scenarios

In the two nuclear attack patterns studied, it was assumed that only military targets or military-related targets would be hit by nuclear weapons in Scenario 1, and that the additional targets in Scenario 2 would be facilities which could contribute to the U.K.'s ability to continue hostilities. The type of nuclear weapon likely to be used and the height at which it would be detonated depends on the nature of each target. Details of the targets selected in these studies are given below.

#### The Soviet nuclear weapons available pre- and post- the INF Treaty

The attack patterns chosen were arrived at by considering the theatre nuclear weapons available to the Soviet Union for attack on Europe and the proportion that might be available for an attack on the United Kingdom. It was found that there were easily sufficient weapons for the two scenarios used. These studies were undertaken **before** the Intermediate-range Nuclear Force (INF) Treaty came into effect. The removal of the intermediate-range nuclear force weapons specified in this treaty meant that smaller and more accurate warheads, in particular the SS-20, were removed. Older systems remain which are still sufficient in number to maintain the level of attacks chosen. Ironically these older systems generally have larger yield warheads, so that the effect of any given attack pattern is likely to be correspondingly worse than estimated here.

#### Targets in Central Scotland in the two nuclear attack scenarios used

The table opposite lists the potential targets, in or near the regions covered by the studies. Also listed are the delivery systems, warhead yields and type of burst assumed in the two attack patterns studied. These weapons were available before the INF Treaty came into effect. As pointed out above, the net effect of the treaty will be, in the short-term at least, to increase the yields used and therefore to increase the number of casualties from those arrived at using these particular scenarios. There are other targets in Scotland, but nuclear attacks on these do not significantly alter the **short-term** casualty estimates for the Central Scotland area.



Map Ref	Target	Weapon	Yield	Type	Scenario(s)
NO632 691	Edzell	SS20	150kT	Ground	1,2
NO467 205	Leuchars	SS17	500kT	Ground	1,2
NO095 035	Balado Bridge	SS20	150kT	Air	1,2
NR660 233	Machrihanish	SS20	150kT	Ground	1,2
NR660 233	Machrihanish	Backfire AS4	1MT	Ground	1,2
NS280 780	Clyde/Greenock	SS17	500kT	Water	1,2
NS175 715	Clyde/Inverkip	SSN6	1MT	Water	1,2
NS170 810	Holy Loch	SS20	150kT	Water	1,2
NS190 790	Holy Loch Entrance	SS17	500kT	Water	1,2
NS240 890	Faslane	SS17	500kT	Water	1,2
NS240 870	Gareloch/Faslane	SS20	150kT	Water	1,2
NS210 880	Coulport	SS20	150kT	Ground	1,2
NS275 995	Glen Douglas	SS20	150kT	Ground	1,2
NS490 660	Renfrew } & Bishopton }	SSN6	2 x 500kT	Air	2
NS340 540	Beith	SS20	150kT	Ground	2
NS365 260	Prestwick	Backfire AS4	1MT	Ground	1,2
NS720 590	Motherwell } East Kilbride } S. E. Glasgow }	SS4	1MT	Air	2
NS930 820	Grangemouth } + Longannet }	SSN6	1MT	Air	2
NS180 510	Hunterston	Backfire AS4	1MT	Air	2
NS255 420	Ardrossan	Backfire AS4	1MT	Ground	2
NT105 825	Pitreavie	SS17	500kT	Ground	1,2
NT125 845	Rosyth	SS17	500kT	Ground	1,2
NT750 750	Torness	Badger bomb	350kT	Air	2
NT155 735	Turnhouse } + Dalmeny }	SSN6	1MT	Ground	1,2
NT390 750	Cockenzie	Badger bomb	350kT	Air	2
NY140 650	Chaplecross	SS20	150kT	Ground	1,2

Some of the other potential Scottish targets in Scenario 1 are Dyce, Buchan, Mormond Hill, Invergordon, Lossiemouth, Kinloss, Invergordon, Stornoway, Sullom Voe and Saxa Vord. There are other Scottish targets in Scenario 2 also. Only those in the above table were used in the Nukecalc2 computer estimates, as nuclear weapons hitting these other targets would have little further impact on central Scotland *in the short term*.

### The effects of nuclear weapons

The physical effects of nuclear weapons differ from those of conventional explosives not only in scale but also in nature. At the instant of the explosion, prompt ionising radiation is emitted. For the higher explosive yields of modern devices (i.e. much larger than those used in Hiroshima and Nagasaki) the effect of this may be ignored as other effects will dominate. The fireball that results from the explosion emits immense amounts of thermal radiation (heat-flash) which can cause severe burns injuries and initiate fires, some possibly on a large scale. The shock wave which results from the rapid expansion of the fireball travels out to large distances, with the associated blast overpressure causing physical damage



which decreases as it travels further from the point of detonation. If the weapon is exploded on the ground, or at a height such that the fireball touches the ground, an enormous crater is excavated and dust and vapourised rock and soil will be swept high up into the atmosphere in the characteristic mushroom-shaped cloud. The highly radioactive bomb materials will condense on to the particles carried in this cloud and descend downwind as fallout. This will emit ionising radiation from which people will be at high risk, unless adequately protected. Although the intensity of this will fall off fairly rapidly with time, it will initially be of such high intensity that in many areas it will be essential to take shelter. There may be areas that will remain uninhabitable for many months or even years afterwards.

### **The Nukecalc2 program**

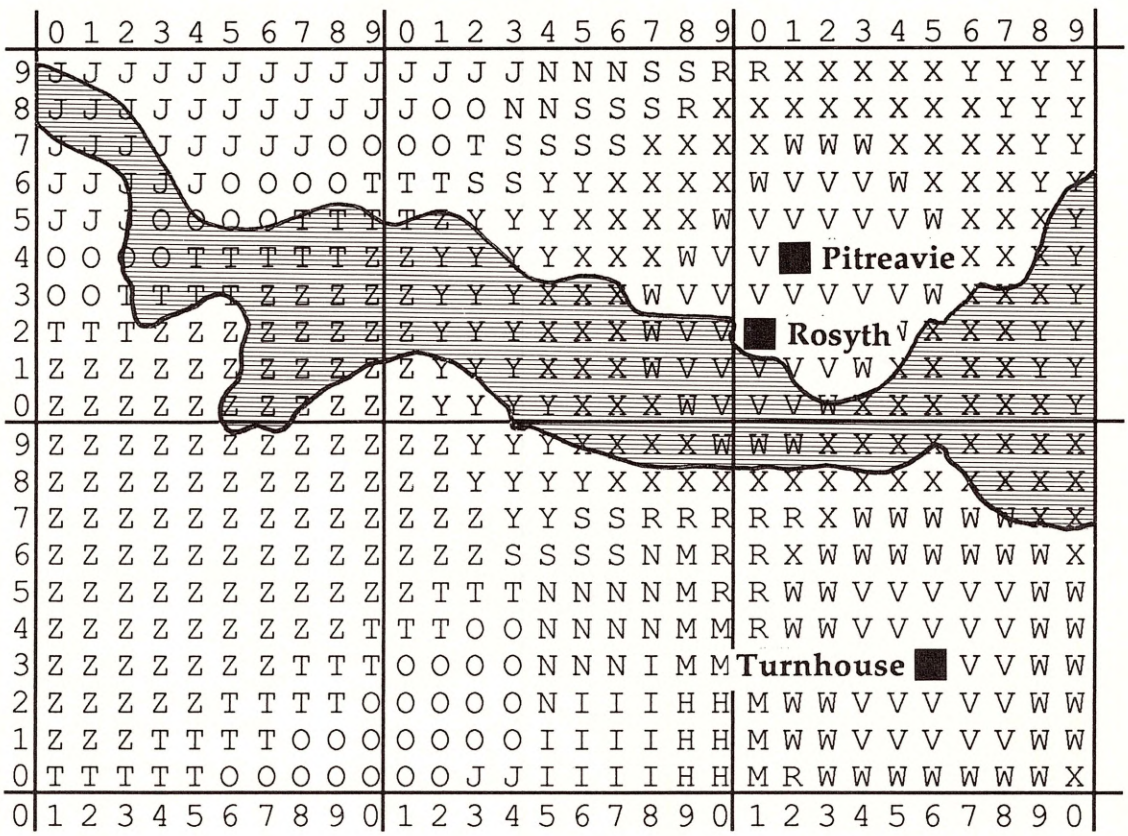
During the period when atmospheric testing was carried out by the United States, data was collected by the Departments of Energy and Defense on the effects of nuclear weapons of varying yields exploded at various heights. This included data on the distances to which blast overpressures reached and the damage caused, the distances to which heat-flash effects reached and their likely medical effect, and the propagation downwind and deposition of radioactive fallout. Using this, together with the data collected at Hiroshima and Nagasaki, estimates were made of the proportions of people who would be killed or injured by each of the effects. A microcomputer program was commissioned by the Nuclear Free Zones National Steering Committee to model these effects and to allow local estimates of the number of casualties that would result from any particular attack. The population data taken from the 1981 census was built in to the program which then predicted for each one-kilometer National Grid square the effects of the chosen nuclear attack and then calculated the likely number of casualties. The total number of casualties was then given for the area under consideration. These results clearly depend on many assumptions, including not only the pattern of attack considered and the weather conditions, but also the behaviour of the population. The estimates given below assume that the population are in their normal residences and take shelter there for two weeks after the explosion(s).

### **The Nukecalc2 effects maps**

The program also generates maps which show the blast and fallout effects of the attack pattern considered. The protection offered by a dwelling against radiation depends on its construction, and on the amount of blast damage that it may have suffered. The ratio of the radiation dose received outside in the open, to the dose that would be received inside the house is known as the **protective factor**. In the examples given below, the maps generated by Nukecalc2 show the level of blast damage and radiation dose that would be accumulated in two weeks in the **open**. Hence the protective factors in all blast zones have been set equal to one.



**Results Effects Map: Part of Fife and Lothian Regions**  
**Scenario 1, Wind WSW 40 mph All protection factors set to 1**



**Key for nuclear weapons effects indicated on Nukecalc2 maps**  
 This map shows the effects on part of Fife and Lothian Regions of the nuclear attack pattern of Scenario 1 with a wind in the WSW direction with an upper atmosphere speed of 40 mph. The NUKECALC2 map indicates the predicted blast overpressure and two-week accumulated radiation dose (received from fallout) for each one kilometre square, coded according to the following key:

Two-week radiation exposure in centi-Grays	Blast overpressure zones				
	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

Blast zone	A	B	C	D	E
Blast overpressure range (psi)	>12	12-5	5-2	2-1	<1

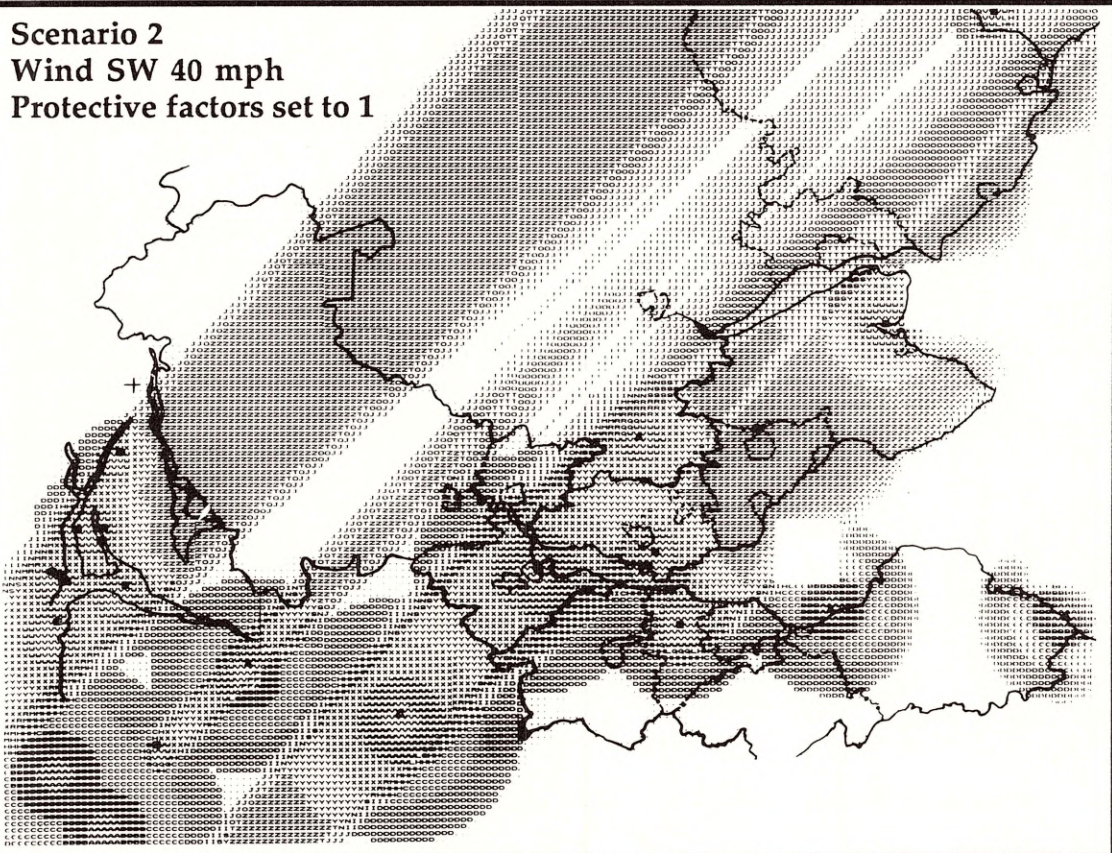
**Maps of the effects of nuclear attack on Central Scotland**

The map above shows a small area of east central Scotland only. Maps for the central belt of Scotland on page 12 are for Scenario 2 with the two wind directions of WSW and SW. Parts of Central, Strathclyde and Tayside Regions are omitted from these maps due to lack of space. These illustrate clearly the distances to which fallout and blast effects extend.

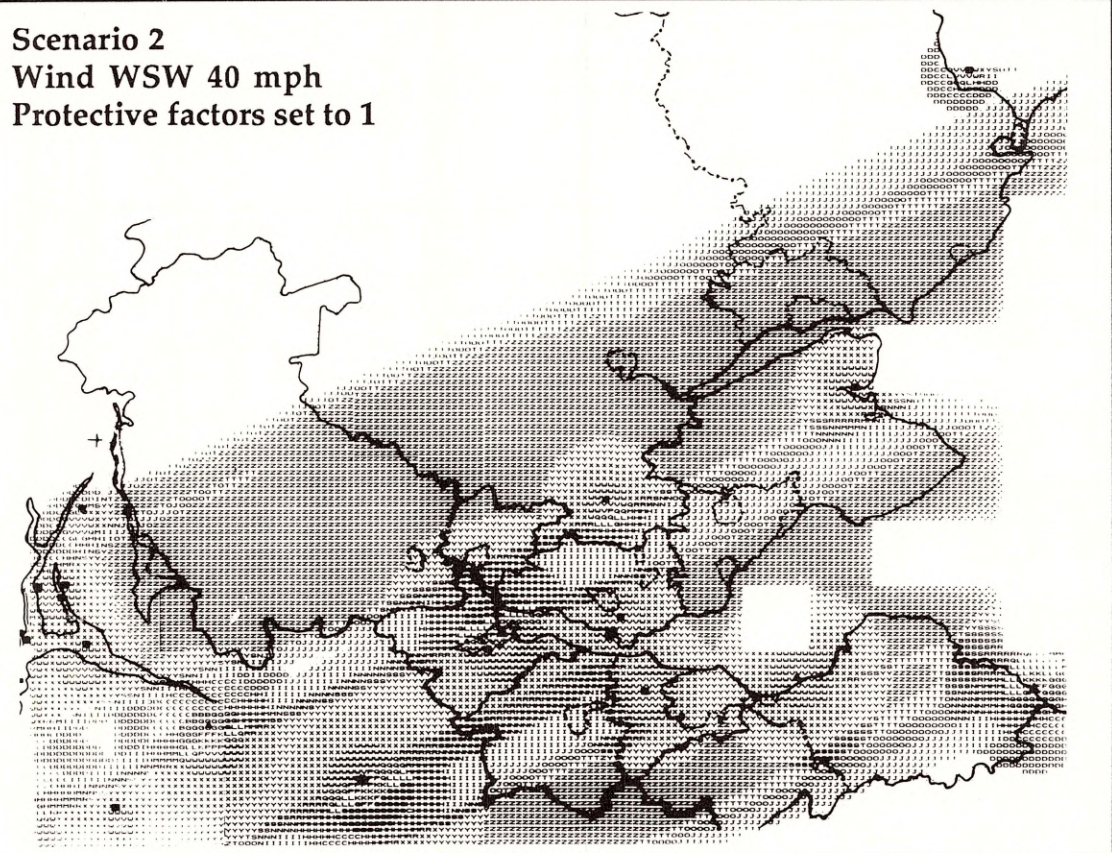


**Central Scotland: Blast overpressure and radioactive fallout effects**

**Scenario 2**  
**Wind SW 40 mph**  
**Protective factors set to 1**



**Scenario 2**  
**Wind WSW 40 mph**  
**Protective factors set to 1**

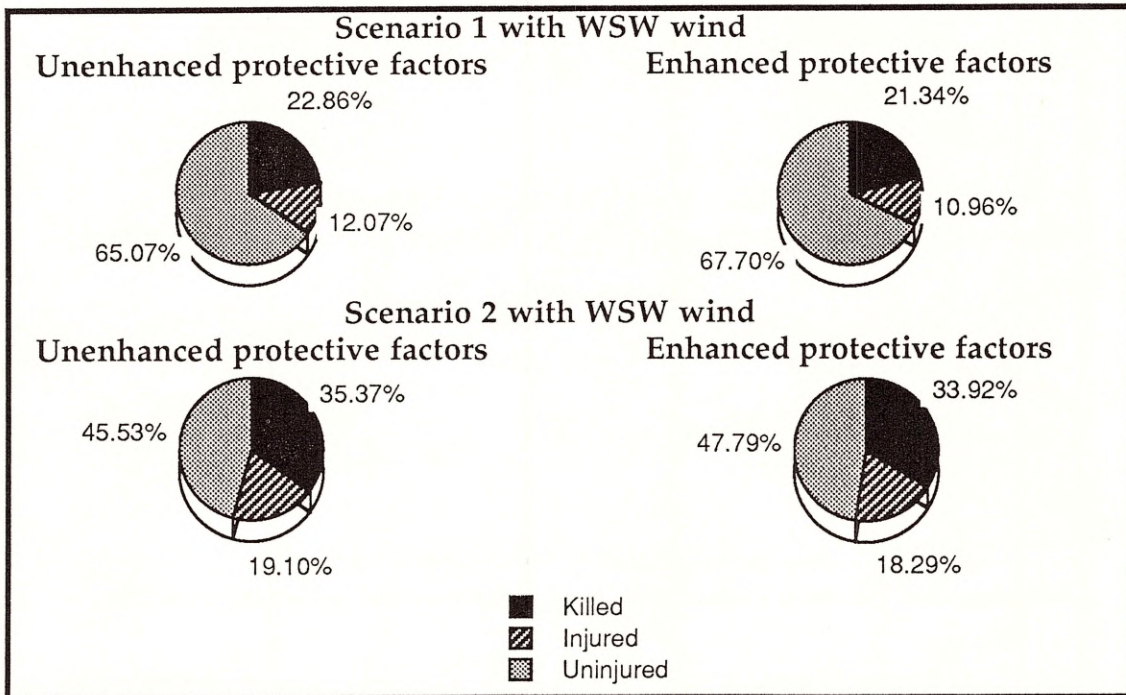




## The assessment of overall casualties in Central Scotland

Although there are some minor variations between the attack patterns and the weather conditions assumed by the two studies, we can combine the results in order to obtain estimates of the **scale** of casualties expected in Central Scotland for the two Scenarios, and for a wind direction of WSW.

### Nuclear Attack Casualty Estimates for Central Scotland E. C. Scotland and Strathclyde Planning Assumptions Studies

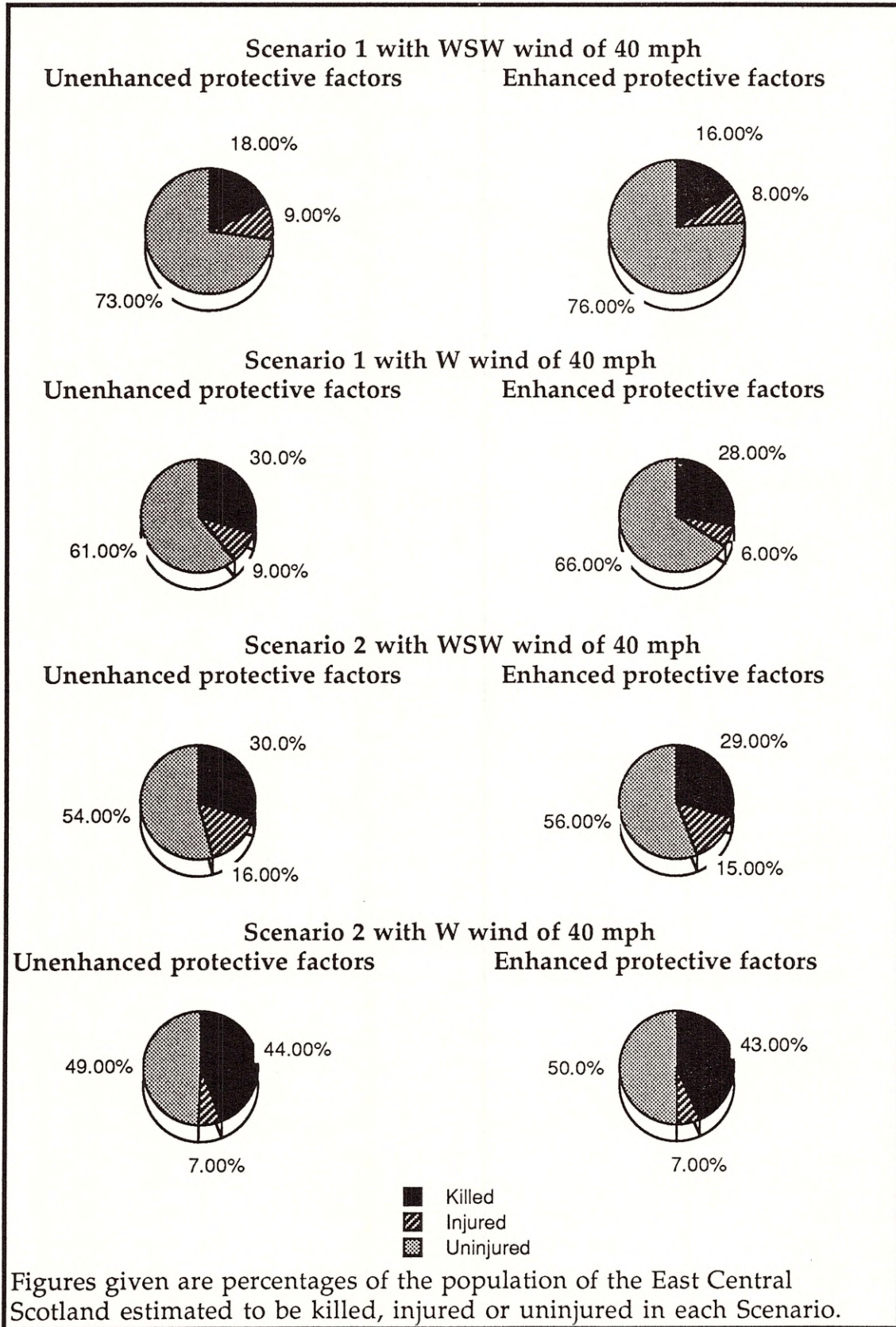


### Casualty estimates for East Central Scotland and Strathclyde Region

The two sets of charts on pages 14-15 indicate the proportions of people predicted to be killed, injured or uninjured, according to the scenarios chosen, in the case of two wind directions for each of the two study areas. In each case the studies considered the effect of some enhancement of the radiation protection offered by each house. The protective factors assumed for **undamaged** housing were therefore increased. There are differences in the approach of each of the two studies to this, but nevertheless the effect of such enhancement can be seen from the charts to amount in most circumstances to 3-5% in the case of Scenario 1 and 1-2% in Scenario 2. The latter figure is **lower** because the overall casualties are **higher** in any case. This shows that even if everyone makes some attempt to enhance their own protection against radiation from fallout whilst within their dwelling, it will have at best only a marginal effect. There are certain circumstances where the effect can be larger, as can be seen from the Strathclyde results for Scenario 2 with an ENE wind. The effect of enhancing the radiation protection in these **particular** circumstances is that another 11% are uninjured. Such a large effect is not seen in general.



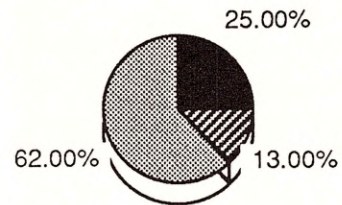
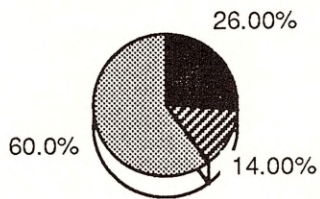
**Nuclear Attack Casualty Estimates for East Central Scotland  
East Central Scotland Planning Assumptions Study**



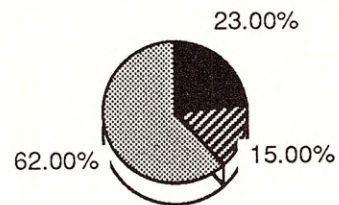
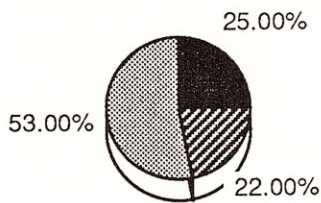


**Nuclear Attack Casualty Estimates for Strathclyde Region  
Strathclyde Region Planning Assumptions Study**

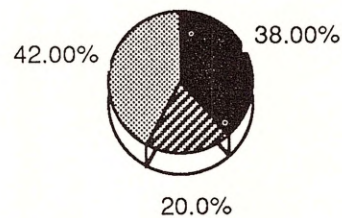
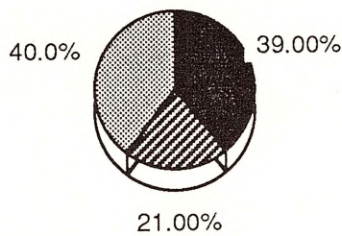
**Scenario 1 with WSW wind of 15 mph**  
Unenhanced protective factors      Enhanced protective factors



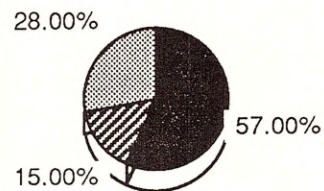
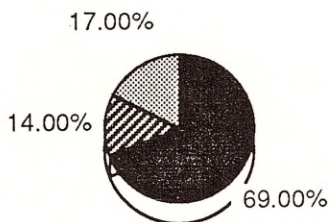
**Scenario 1 with ENE wind of 15 mph**  
Unenhanced protective factors      Enhanced protective factors



**Scenario 2 with WSW wind of 15 mph**  
Unenhanced protective factors      Enhanced protective factors



**Scenario 2 with ENE wind of 15 mph**  
Unenhanced protective factors      Enhanced protective factors



Killed  
 Injured  
 Uninjured

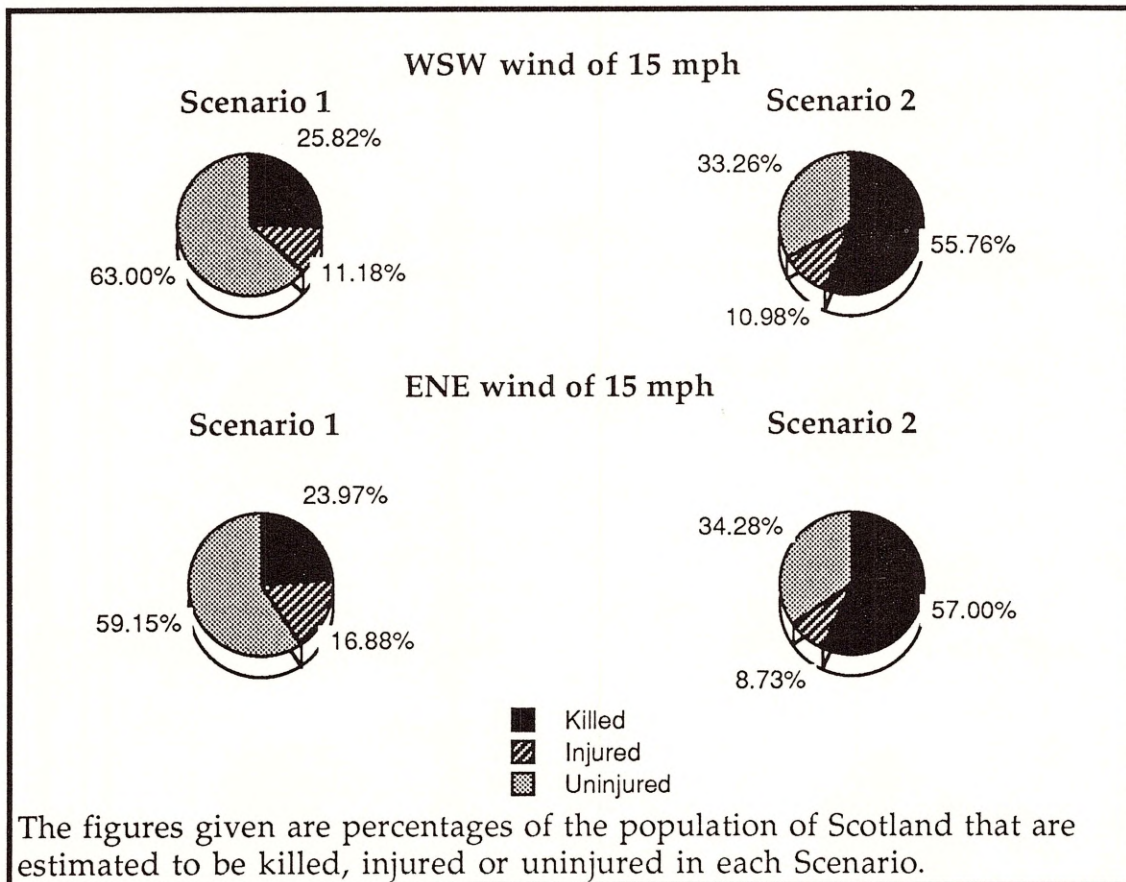
Figures given are percentages of the population of Strathclyde Region estimated to be killed, injured or uninjured in each Scenario.



**The assessments by Earth Resources Research Ltd.**

In addition to the computations of casualties for Central Scotland obtained using Nukecalc2, a computer study of a nuclear attack on the whole of the United Kingdom was carried out by **Earth Resources Research Limited (ERR)**. Their model used the same methodology as Nukecalc2 and the nuclear target lists of Scenarios 1 and 2 adopted by the NFZ National Steering Committee. Contained within these national scenarios are the basic target sets for Central Scotland that were used by these two planning assumptions studies, although these were modified after joint consideration for our own detailed local computations. There are therefore some differences in the local estimates made by ERR, but over the whole of Scotland they nevertheless give a relatively accurate picture of the scale of casualties. Their results are presented below.

**Nuclear Attack Casualty Estimates for Scotland  
Earth Resources Research Limited**

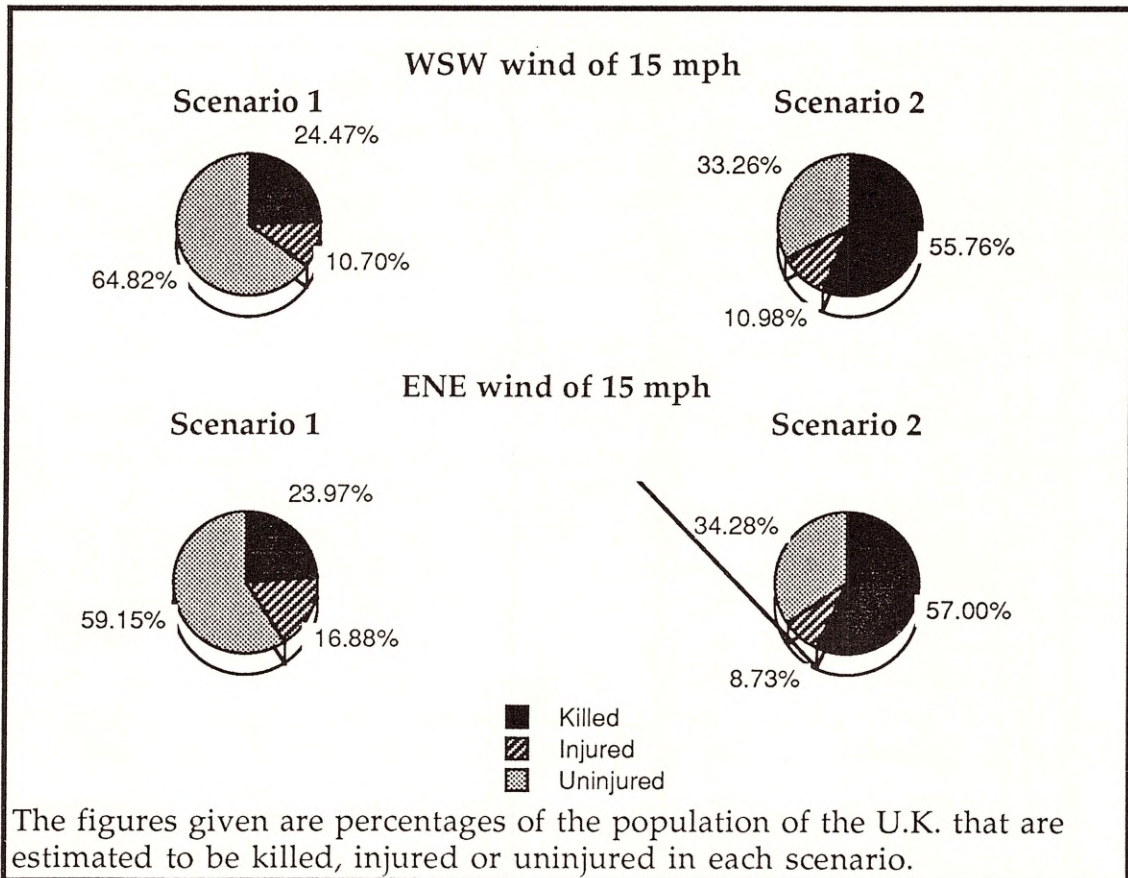


Although the wind direction is an important factor in determining the number of casualties within a local district or regional area, it is clear from these examples that the national casualty figures are not so sensitive. Overall casualties are very much determined in these examples by the level of attack envisaged. In Scotland about 40% in Scenario 1 and 65% in Scenario 2 are estimated to be killed or injured in these attacks.



The results obtained by ERR for the whole of the U.K. are shown in the figures below.

**Nuclear Attack Casualty Estimates for the United Kingdom**  
**Earth Resources Research Limited**



It can be seen therefore that these attack patterns could result in about 40% killed or injured in Scenario 1 and about 65% killed or injured in Scenario 2 in both Scotland and the United Kingdom taken as a whole. There are much wider variations when one considers the results on a more local basis. Casualty figures in Strathclyde Region in these particular attack patterns are roughly similar to the national averages, whereas in the East Central Scotland area they are in general slightly less severe. On local scales, the numbers of casualties are more sensitive to the weather conditions prevailing at the time of the attack, as can be seen from the estimates by the Strathclyde Planning Assumption Study. The numbers of casualties are, of course, extremely high in all cases. Earth Resources Research also considered damage to dwellings, industry and agriculture in their computer study. They made similar estimates with a further scenario, Scenario 3, where they considered a nuclear attack after the removal of those systems specified in the INF Treaty. This work also looked at what would happen if nuclear power stations were to be subject to an attack where the radioactive nuclear fuel in the reactor core was released. Details of this work can be found in their reports.



## **4) Government Policy on Civil Defence Planning**

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### **Emergency Planning Guidance to Local Authorities (EPGLA)**

In 1985 the Scottish Home and Health Department issued its consolidated Emergency Planning Guidance to Local Authorities. This replaced all the emergency services circulars previously issued. Part I of the guidance gave the Government's planning assumptions and advised local authorities on how to discharge their statutory obligations under the 1983 Civil Defence Regulations. It was intended that this guidance was to be under constant development and subject to review. It was also to be supplemented with technical guidance in the form of Emergency Planning Handbooks.

### **The Planned Programme for Implementation (PPI)**

In October 1986 the Scottish Home and Health Department issued its proposals for a planned programme for the implementation of the 1983 Civil Defence Regulations. The first part of this programme was for the period of October 1986 to October 1989 setting out a timetable by which local authorities plans, in various areas of plan-making as required by the 1983 Regulations, had to be submitted to the Department. This timetable meant that the preparation of plans by local authorities had mostly to be undertaken ahead of the research of planning assumptions studies. Plans submitted under the PPI timetable would thus be subject to subsequent review and possible revision on the basis of the findings of the studies.

### **Criticism of Scottish Home and Health Department guidance**

The guidance given in the EPGLA is general and does not give local detail. It is left to local authorities to tailor the advice to their own plans. It does not, for example, give details of potential targets, or of the likelihood of such targets being attacked with nuclear weapons. In other areas detailed guidance is absent or awaited.

There are a large number of topics on which Government advice is either lacking or inadequate. At the initiative of the ECSPAS project, the Study researchers together with the four Regional Emergency Planning Officers involved, sent a number of questions on important civil defence planning assumptions problems to the Scottish Home and Health Department, seeking further and fuller guidance.

The replies received either merely repeat the original guidance given in the EPGLA, or, where changes in guidance resulted, place further responsibilities on the local authorities for the detailed assessment and planning needed. Questions seeking further information on the timing and impact of emergency legislation obtained a repeat of the existing EPGLA material in response. Questions concerning the assumption that



gas supplies could be cut off early in a war emergency resulted in the advice that local authorities would need to assess the impact of this measure in their own areas and plan accordingly for any emergency feeding provision thought necessary.

### **Government policy on evacuation**

In a war emergency, government advice to the public will be to 'stay put', in other words to carry on as normal wherever possible and to use their own homes as shelter against attack. This was originally justified by the Government statement that no area is safer than any other from the effects of hostile attack. Whilst this may be true regarding the effects of radioactive fallout in areas well away from potential targets, it is certainly not true in the immediate vicinity of targets where blast and heat effects are important. People living near obvious targets would be aware of these immediate dangers and are consequently likely to consider moving away to areas which they perceive as being safer.

Government advice to local authority planners now recognises this. Recent guidance from the Scottish Home and Health Department, given in answer to the East Central Scotland Planning Assumptions Study questions initiative, states that,

*"local authorities may decide to plan for evacuation if they consider there were obvious targets in their areas"*

The onus of responsibility for coping with these evacuees, and any 'self-evacuees', has been placed fully on to local authorities. No national policy guidance has been forthcoming on any planning for organised evacuation or co-ordination between local authorities in different areas.

### **Criticism of Home Office scientific advice**

In addition to the guidance issued in the EPGLA and subsequent documents, the Home Office Scientific Research and Development Branch (SRDB) issues scientific advice to emergency planners and their volunteer scientific advisors. In recent years considerable criticism has been made of parts of this advice, in particular on the effects of nuclear weapons.

In comparison to the scientific data taken by U.S. scientists whilst conducting atmospheric nuclear tests in the 1950s, past SRDB advice on blast overpressure has consistently underestimated its effect. Recently however this advice has been reviewed bringing it into somewhat closer agreement with the original U.S. data, but still estimating damage at a lower level.

Home Office computer estimates of casualties due to nuclear attack are only rarely available. In those that are available, there is no estimation of the number of casualties due to the effects of thermal radiation or 'heat-flash'. The number of such casualties will be proportional to the number



of people caught in direct line-of-sight of the fireball. It is clear however that only in extreme circumstances, would no one suffer major flashburns.

There also remains a serious discrepancy in the estimation of the medical effects of radiation from fallout. Most U.S. and independent U.K. sources assume that a radiation dose of 450 centi-Grays at the surface of the skin, accumulated over a short time, will result in the death of 50% of those persons so exposed within 60 days. In contrast, the corresponding Home Office scientific advice puts this figure between 600 and 800 centi-Grays, as a result of the methodology they employ.

There is also considerable concern that the advice given in respect of the protection against radiation from fallout (protective factor) offered by undamaged domestic housing is incorrect. The methods of calculation of protective factors (PFs) outlined by the Home Office are such as to overestimate this protection in certain circumstances. In available Home Office computer studies of nuclear war casualties, there is also no account taken of the reduction of the protective factor of a building due to blast and other damage.

As a result of such criticism of Home Office scientific advice, the Nuclear Free Zones National Steering Committee commissioned several papers on such topics in order that the planning assumptions studies could base their estimates on internationally accepted criteria. In particular the two computer programs used by the planning assumptions studies for nuclear casualty estimation are based on the scientific data contained in material openly published by the U.S. Government.

### **General review**

It is not possible here to cover the many other areas in which Government planning assumptions and guidance for civil defence planning are either inadequate or poorly thought out. Some of these other areas are dealt with in the section on the Planning Assumptions Study conclusions. It would be wrong, however, to think that criticism of the Government's guidance and general approach to civil defence planning comes only from those who are opposed to civil defence planning on principle. Local Authority Emergency Planning Officers have been trying for years to get better and fuller guidance on many areas of concern to them in their civil defence planning duties. General criticism of the Government's approach has also been voiced in a number of military assessments of the problems of organisation for possible war in Europe.

Comments made in recent minutes from the Civil Defence Co-ordinating Committee of the Civil Defence Region for the North West of England exemplify some of these views. In considering the "*main problems and deficiencies*" of the Government's approach, the members of this committee (which include the designated police, military and civil



members of emergency government for the area) listed, amongst other issues:

*"The Government's confidentiality rules, which are a key inhibiting factor that prevent people - in particular local authority emergency planners but extending even to Chief Executives - from having information about Central Government TTW (Transition to War)/Wartime plans without knowledge of which they cannot hope to participate in the comprehensive planning that is necessary..."*

and

*"Shortage of money and manpower (sic) - all round; but particularly perhaps within Central Government, where it helps to stymie all but the most rudimentary planning."*

Recent guidance from the Scottish Home and Health Department (issued in reply to the ECSPAS questions initiative of 1988) reveals the Government's overall approach to local authority civil defence planning.

Their aim is to

*"provide a basic framework of emergency planning which could be developed rapidly into a fuller structure should the risk of war increase at any time in the future".*

This planning is to be

*"flexible but proportional to the risk of war."*

It is very difficult to see how any realistic plans could be written without their being based on detailed knowledge of the Government's intentions in a war crisis, or how these plans could be expanded rapidly without the proper spending on organisation and, importantly, **resources** beforehand. This Government approach is also in conflict with previous advice given in the EPGLA, which requires local authority civil defence plans to be capable of being implemented within 7 days and their 'essential elements' within 48 hours.

Finally, it is difficult to understand how plans could be effective yet 'proportional to the risk' of war. Whatever the **probability** of war occurring, these plans have to address the possible **impact** of a war and consequent effects and have to be scaled according to **realistic** estimates of that impact.



## 5) Local Authorities' Civil Defence Responsibilities

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### Local Authority statutory obligations

The statutory obligations placed on local authorities regarding civil defence emergency planning are specified in the Civil Defence (General Local Authority Functions) (Scotland) Regulations of 1983, which replaced earlier legislation of 1975. The primary responsibility for civil defence emergency planning lies with the Region and Islands Authorities, each of which must maintain and staff an emergency planning unit. These are funded by civil defence grants provided by the Scottish Home and Health Department.

### Regional responsibilities and civil defence planning

The 1983 regulations require every Regional and Islands Authority "to make, keep under review and revise plans for the matters specified in Schedule 2 to these regulations". In summary these specified areas of plan-making are:

1. Collecting and distributing information on the results of hostile attack.
2. Controlling and coordinating action necessary as a result of hostile attack.
3. Advising the public on the effects of hostile attack and protective measures to be taken.
4. Using existing buildings etc. to provide civil defence shelters for the public.
5. Providing a local service for the rescue of persons from damaged buildings.
6. Providing for the billeting or temporary accommodation for those made homeless.
7. Providing measures to prevent disease and its spread, and for emergency sanitation.
8. Providing facilities for the disposal of human remains.
9. Providing a food distribution and emergency feeding service.
10. Providing a repair, replacement or demolition service for buildings and roads.
11. Providing and maintaining any other services essential to life.
12. Securing the participation of voluntary organisations and other volunteers.

In addition each Regional or Islands Authority is required to:

- arrange for the training of regional staff and for the staff of the associated districts,
- arrange for their attendance at civil defence training courses,
- take part in any civil defence training exercise specified by appropriate ministers,
- receive and train volunteers, in the performance of these functions
- draw up plans in each of the areas specified in Schedule 2, and
- if requested by the designated Minister, carry out any of those plans.

The Regional and Islands Authorities are also required to:

*"establish, equip and maintain, in premises at each of two places in the region (not being places in the same district in that region) or islands area, as the case may be, an emergency centre in which to control and co-ordinate action to be taken by them in the event of hostile attack or a threat of hostile attack".*



## District responsibilities

In general the District Councils' role is almost entirely to assist the relevant regions to fulfil their statutory obligations.

The 1983 regulations placed statutory obligations on District Councils:

- to provide information on civil defence matters to the relevant region on request,
- to assist the relevant region in the plan-making process,
- to arrange for the training of appropriate numbers of district council staff,
- to arrange for their attendance at civil defence training courses,
- to take part in any designated civil defence exercises,
- to assist in the arrangements for volunteers,
- to make preparations so that the plans can be carried out,
- to carry out any of those plans.

However, District Councils have a major statutory obligation to:

*"establish, equip and maintain, in premises in their own area, an emergency centre in which to control and co-ordinate action to be taken by them in the event of hostile attack or threat of attack".*



## 6) Planning Assumptions Conclusions

The main conclusions of the Planning Assumptions research are summarised below. The detailed consideration of these points are contained in the fuller reports in the **East Central Scotland Planning Assumptions Study: Final Report**.

### **Military mobilisation and the use of civilian resources**

*"Never before in the history of NATO have so many military planners realised so quickly that they could benefit so much from the use of civil resources." - Michael Elmquist, Director of NATO Civil Emergency Planning.*

Just as great a problem as that of trying to assess the possible targets and scale of hostile attacks is that of trying to find out whether any **resources**, which would be necessary for actually carrying out any local authority civil defence plans, would be available for local authority use during a period of military mobilisation.

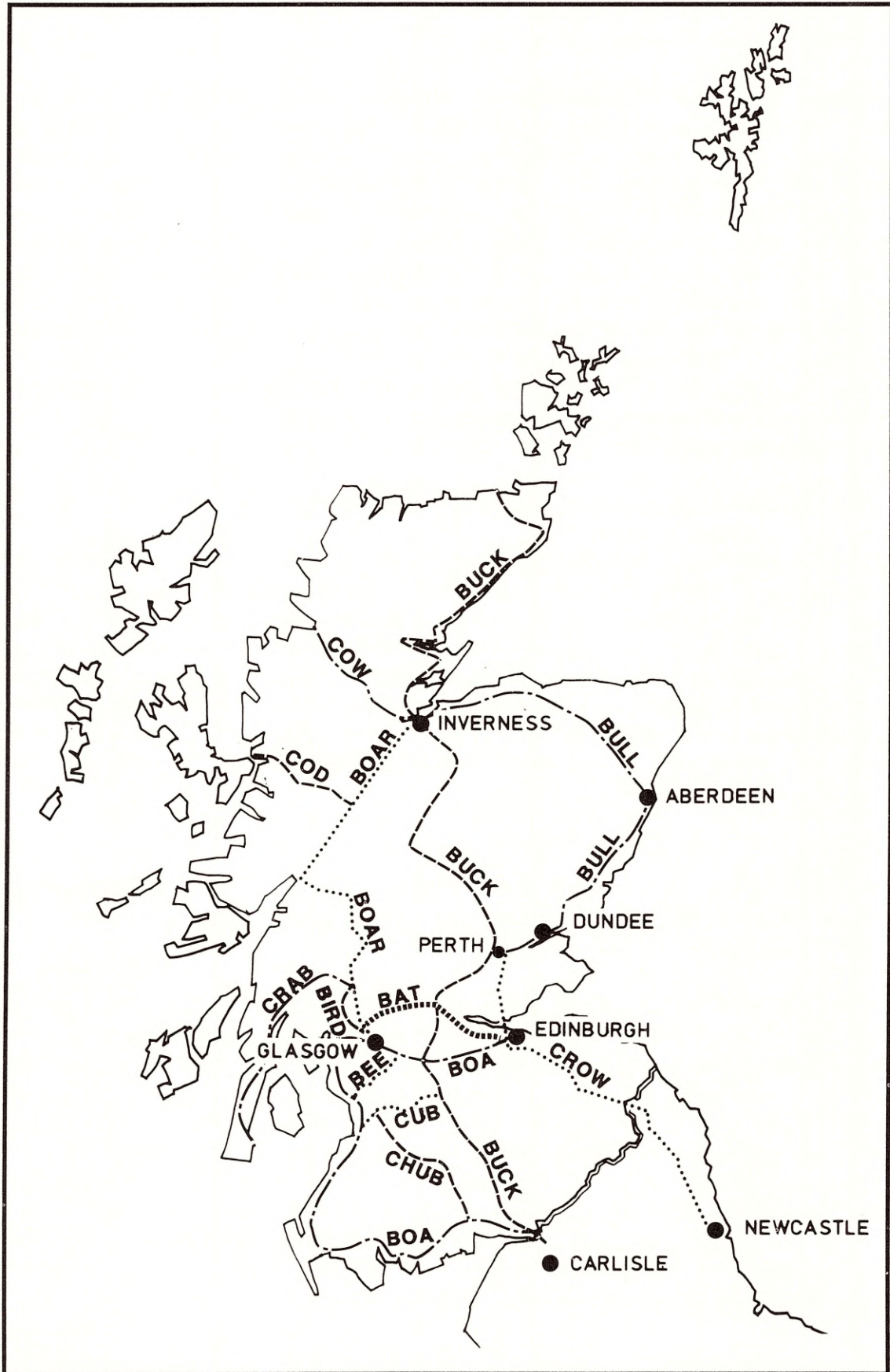
NATO and U.S. arrangements for military mobilisation, and the reinforcement of Europe in a crisis, are contained in the 'Rapid Reinforcement Plan' which will attempt to provide for the movement of 1 million U.S. and Canadian troops and 1.5 million tons of supplies to Europe within ten days. Although this plan was agreed in 1982, for some years previous to this military planners had realised that they needed to use civilian resources to a major extent in order to effect the rapid movement of troops and equipment into and through Europe. The actual plans for the use of civil resources in European NATO countries are made under the '**Wartime Host Nation Support (WHNS)**' and '**Lines of Communication (LOC)**' agreements with the U.S.

The agreements with the U.K. (grouped under one title - **U.S. /U.K. WHNS LOC**) date from 1973 onwards. Their existence was admitted by the present Government in 1986 after being revealed by the investigative journalist Duncan Campbell, but any details contained in these plans remain secret. However, recent unclassified documents (1985-6 Directives from the Headquarters of the U.S. European Command - USEUCOM) released under the U.S. freedom of information legislation, reveal the wide ranging nature of the military requirements for civil resources in;

- **transport** - ports, airports and their workforces; ships, planes and their crews; buses, lorries, trains and their drivers and other staff;
- **medicine** - hospital space; medical staff and supplies;
- **fuel**;
- **food**;
- **civilian labour**;
- **communications**, etc.



Military Main Road Route System





Published military assessments and statements made at various times by senior civil servants indicate that this military demand would be very heavy indeed - about 80% of military requirements would come from civilian sources in some categories.

Because all details of these military requirements remain secret, it is very difficult to assess the impact of this military mobilisation on Scotland during a crisis. What is certain is that it is during this period that local authorities would probably have to try to activate most of their civil defence plans. All the major air and sea-ports, and the main road and rail links between them and to the rest of the U.K., would probably be in heavy use, as would most of the country's transport and other resources. For example, many of Scotland's main roads are designated for military use under the '**Main Road Route System**'. This system, along with some designated civilian sea- and airports, is shown on the map on page 25. There is virtually no government guidance to local authorities to aid their civil defence planning for this obviously very important period, and they do not generally get access to military plans.

### **The impact of Government emergency legislation**

Early in the 1980s the U.K. Government is believed to have re-drafted its emergency legislation to cover the new requirements for the reinforcement of Europe during the crisis period generally known as the 'transition to war'. The existence of drafted emergency legislation in the form of three 'Emergency Powers Bills' and the various statutory regulations to support them, was revealed in 1985. The contents of these draft bills and their regulations are not available to local authority emergency planners even though the fact that

*"over the next two or three years, there is to be a major revision of emergency legislation covering transition to war measures"*

was announced to the Society of County Emergency Planners (including those from Scottish Regions) by the Home Office head of emergency planning as early as 1980.

Most of the other NATO member nations have their emergency legislation on the statute books or written into a constitution and thus available to emergency planners or for public inspection. Unclassified military research and reports from mobilisation exercises make it quite clear that the **main purpose** of the emergency legislation is to enable military mobilisation to proceed as smoothly as possible. Major aspects of this legislation are concerned with the large-scale requisitioning of transport and other resources required by the military as outlined above. There are likely to be provisions for the control and restriction of civilian movement in many areas in order to allow the military as free access as possible to the transport networks and to curb any public dissent.



There will also be provision for the rationing and re-distribution of food and other supplies to the civilian population.

This legislation is bound to have considerable impact on the people of Scotland and on their local authorities' ability to carry out their statutory responsibilities for the welfare of the population in a war crisis. For some years now, local authority Chief Executives and emergency planners have been attempting to get some details of the powers and resources that would be available directly to them, and information indicating the point at which emergency legislation would be enacted during a war crisis. This information is considered to be essential if any meaningful local authority civil defence plans are to be written. The Government response so far has been vague. Local authorities are merely advised that in general their own resources will probably not be required for the war effort. In addition, the increase in 'privatisation' of many local authority services means that even this uncertain pool of resources will continue to be a shrinking one.

### **Government planning assumptions on conventional war**

Recent Government guidance on civil defence planning has stressed the possibility of a war starting with a 'conventional (i.e. non-nuclear) phase'. The development of NATO's plans for the military reinforcement of Europe and recent changes in Soviet tactical thinking and organisation certainly suggest that both sides consider conventional warfare to be a real possibility.

Government advice has proposed that a conventional war might continue for a period of days or even weeks and could even end without nuclear weapons having been used. The East Central Scotland Planning Assumptions Study research has found that NATO's conventional fighting capability in Europe is measured in days rather than weeks, and that NATO's present policy of 'flexible response' (the possible use of nuclear weapons and the integration of these weapons into war-fighting plans) means that the prospect of conventional war rapidly escalating into a nuclear exchange is a very real one. In these circumstances, the prudent approach to civil defence planning for local authorities would require that they should **already have carried out** most of their plans for nuclear attack by the time any actual fighting had broken out. The assumption is that there would be sufficient warning and adequate time in which to do this.

The possibility of the use of chemical or biological weapons adds an extra dimension of horror to the prospect, especially for the civilian population who will not have any of the sophisticated protective equipment or medical treatments which have been developed for the armed forces. If weapons like these were to be used, there is little that can be offered by local authorities to the public other than possibly evacuation or advice to them to attempt to 'seal-up' their homes using any available materials and to stay inside. Persistent chemical or biological agents would require



area decontamination before even evacuation to uncontaminated areas could be attempted post-attack.

Local authority emergency planners have been waiting for some years now for the issue of detailed Government guidance on chemical and biological attack. At present, the Government advises that biological attack is unlikely and that it will not consider this in its guidance. Chemical attack is considered possible but the formulation of guidance is complex and will take time. Meanwhile local authorities again have to plan in the absence of detailed guidance.

### **Conflicting burdens and civil protection**

The civil defence response to conventional, chemical or biological attack would be to have the emergency services standing by and ready to move in to the affected area in order to render as much assistance as quickly as possible. There is a well recognised conflict between planning this kind of concentrated response to these kinds of attack, and planning a response to nuclear attack. The enormously greater immediate destruction and damage and the early effects of radioactive fallout, resulting from a nuclear attack, requires the dispersal and protection of emergency resources in order to try to preserve them for later use. The greater extent of damage and the likely presence of radioactive fallout means that they would not be able to aid most of the areas affected until some time after the attack, if at all.

The dilemma for local authorities in trying to plan for both conventional and nuclear attack is that the often conflicting plans for these very different circumstances would have to be implemented **during the same period** because of the very real risk of **rapid escalation** from conventional to nuclear war.

Part of the conflict in civil defence planning in attempting to be prepared for both conventional and nuclear war, lies in the Government's recent attempt to link civil emergency planning with that for civil defence, under the heading of '**Civil Protection**'. This is an approach to emergency planning which suggests that if sufficiently 'flexible' plans can be made, the essential elements of these plans would be able to tackle a range of 'emergencies' from a train crash to all-out nuclear war. Unfortunately, as far as the civil emergency end of this spectrum is concerned, there is no statutory duty placed on local authorities to do most of their peacetime disaster planning and there are no extra resources available to them other than those from civil defence planning. At the other end of the spectrum, any attempt to mount a civil defence response to modern conventional war is overshadowed by the real threat of imminent nuclear attack in these circumstances.



How are local authorities to try to carry out conflicting plans for conventional and nuclear attack **at the same time**? One Home Office reply to questions on this 'conflicting burden' of responsibilities was that:

*"The Home Office is not able to give general advice on the best way of dealing with these sorts of conflict."*

### **The identification of possible targets**

It would be reasonable to think that both the Government and the military would already have assessed the likely details of the nature and threat of hostile attacks on the U.K. However, as far as local authority civil defence planning is concerned, they do not appear to be willing to provide further guidance on such details. For example, there are Government lists of important military and civilian installations ('key points') which are considered to require special protection and supply in a war crisis, but these lists are secret and are available only to some senior officers in the military, the police and the fire brigades.

It is, however, relatively easy to identify the likely major military and industrial targets in Scotland in the light of both previous, and current, research efforts on this subject. The East Central Scotland and Strathclyde Region Planning Assumptions teams believe that their adopted target lists form a sensible baseline for the relevant local authority civil defence planning considerations.

### **High-risk areas near potential targets**

The main aim in pin-pointing potential targets and the corresponding 'high risk' areas around them, is to identify those areas where the population is potentially at high risk and where, therefore, it would be imprudent to locate vital civil defence resources.

In order to assess the areas around identified targets which would be at greatest risk from the immediate effects of nuclear attack, the published U.S. data on the effects of nuclear weapons were used to estimate the blast and heat effects from weapons of the size and type in the Soviet nuclear arsenal after the INF treaty reductions. Ironically, the removal of the smaller and more accurate intermediate range nuclear weapons means that the remaining weapons are the older and less accurate ones with larger warheads. The use of these in an attack would result in larger areas of destruction.

Different target types would probably be attacked with different weapons and heights of burst, and the Scenario 2 nuclear attack used in the computer simulations formed the target pattern for estimating the 'high risk' areas. Whilst there is no absolute certainty that a particular attack pattern would take place or that the specific weapons assigned to these targets would be the ones actually used, these estimates give a reasonable



and plausible assessment of the scale of the problems that civil defence measures would then have to deal with.

The map on page 31 shows the extent of the blast overpressure contours from the nuclear bursts of 500 kilotons or 1 Megaton assigned to the various targets, overlaid on a population distribution map of the East Central Scotland area. The contours were calculated for **airburst** nuclear weapons over each target because these maximise the blast damage. This outlines a potential 'worst case' for blast damage around each target from one such weapon. The present huge size of the Soviet nuclear arsenal would allow for more than one such weapon to be targeted on the most important military sites, so that even this 'worst case' could be exceeded in some circumstances.

The two blast contours shown on the map were chosen as follows:

**a) 5 pounds per square inch**, at or over which level unreinforced buildings are either severely damaged or completely destroyed. Buildings within this contour will offer little or no protection to the occupants.

**b) 1.5 pounds per square inch**, the level of overpressure which government guidance advises that local authority emergency centres should be able to withstand.

As can be seen from the map, large and densely populated areas are at risk from severe blast damage and emergency centres in many districts and regions would be insufficiently protected from blast at the levels of protection advocated.

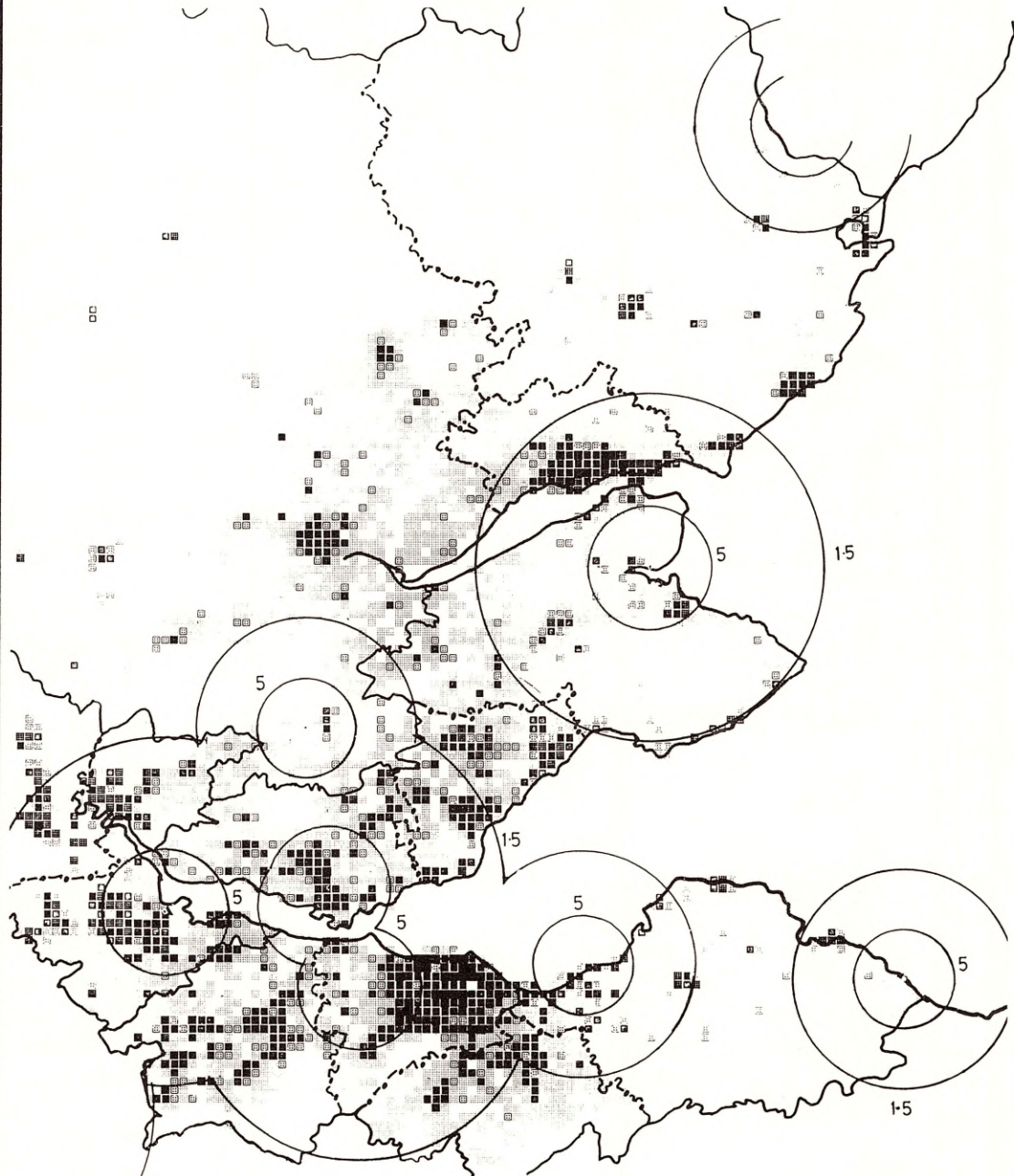
#### **Protection from the short-term effects of nuclear attack**

The Government's advice to a civilian population faced with the prospect of nuclear attack is that they should 'stay-put' and attempt to build some form of internal refuge in their own homes. Despite much criticism of this policy it remains their basic advisory guidance. For those who live near likely military or military-related or industrial targets and who will have to attempt to protect themselves from the immediate and severe blast and heat effects of nuclear weapons, this is a completely inadequate approach. Government guidance has also never taken into account the reduction in protection against radiation from fallout which would occur in buildings damaged by blast. Even in the lighter blast zones, dangerous fallout would be able to enter buildings through broken windows. It is unlikely that most people would be able to obtain and use the building materials needed to protect their windows and doors even from blast levels as low as 0.5 - 1 lb. per square inch. Nor would they be able to repair any damage effectively after the blast wave had passed.

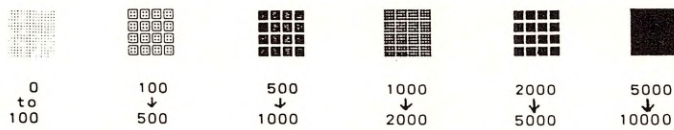


High-risk areas near targets subject to nuclear attack

East Central Scotland



5 and 1.5 psi blast overpressure contours



Population in each 1 kilometre square shown



Even in areas where there is no threat of damage from blast and fire, there will be people whose housing, because of its basic construction, offers inadequate protection from the effects of radiation from the radioactive fallout outside. The Government recognises this as a problem and allows for the provision of communal shelters which will offer greater protection from fallout radiation for such people. However Government guidance has not so far set a minimum criterion for 'inadequate' protection offered against radiation by domestic houses or flats, nor has it laid down a minimum standard for the protection that the communal shelters themselves should offer. In the absence of such detailed guidance local authority planners have to make plans according to their own judgement.

Surveys of the protection from radiation penetration (Protective Factor) offered by the local housing stock have been carried out by all the Regional Authorities taking part in the East Central Scotland Planning Assumptions Study project. All of these surveys show that a considerable proportion of the population live in housing which does not offer reasonable protection from external radiation and which would be difficult to upgrade without major constructional work. The actual numbers vary considerably from one area to another, with those houses at most risk being of more modern and lighter construction than older (pre-1940s) stone- or brick- built houses. In the survey undertaken by the Strathclyde Region Planning Assumptions Study for example, most areas had between 50 and 70% potentially inadequate housing. This large proportion poses an enormous problem for local authorities who have the responsibility of providing alternative shelter for the inhabitants of such housing.

### **Self-evacuation**

No-one has yet knowingly faced the real prospect of an imminent nuclear attack. The Japanese people were caught completely unaware by the nuclear attacks on Hiroshima and Nagasaki at the end of the Second World War. In the Cuban missile crisis, although considerable apprehension was created, the situation was resolved without any overt emergency measures being put in force in the U.K. This was probably a deliberate decision by the government of the time in order to avoid escalating the crisis.

However, research on the experience of other large natural and human-made disasters such as earthquakes, the 'Three Mile Island' nuclear reactor accident etc., indicates that if given sufficient warning and advice, large sections (a third or more) of the population are likely to evacuate areas which they consider to be in immediate danger. Since so many of the major military and large industrial targets in Scotland are close to major population centres and are well known to the local inhabitants, it seems likely then that a large number of people will evacuate themselves from these areas in a war emergency if given some warning.



The Government argues that most people would want to 'stay in familiar surroundings' in this situation, but allows that local authorities can plan for evacuation or self-evacuation if they see a need to do so. There is an unresolved conflict here in that, as far as is known, the government's emergency television and radio broadcasts are aimed at encouraging the 'stay-put' policy. It is not known whether there are any other plans to control population movement other than the control of military mobilisation transport routes and the restrictions likely in the designated military defence areas around important installations ('Ground Defence Areas' or GDAs). In any case, the police and military have often stated that they are unlikely to have the resources to control large population movements.

For Local Authorities, the prospect of large scale population movement has severe consequences for many of their other duties regarding the accommodation, feeding and protection of the public in a wartime emergency. Without proper guidance or planning on a **national** scale, Local Authorities cannot hope to organise and co-ordinate effective plans for large-scale movements of people.

### **Emergency feeding**

This is a major area of concern for local authorities. They are responsible for public emergency feeding arrangements, but the actual **control** of the food-stocks would remain in the hands of central government until the 'post nuclear attack' period. Most local authorities rely on the schools and school meals services as the basis for their emergency feeding arrangements. As these meals services become increasingly 'contracted out', the control over staff and emergency arrangements will diminish.

The Government has a food rationing scheme presently under review. This is based on the local registration of people and the issue of ration books to them by local authorities. There is some conflicting advice from different government sources as to whether this rationing scheme would be introduced as soon as, or as late as possible in an emergency. Government plans also exist for the evacuation of food-stocks stored at ports which are considered vulnerable to attack. It is not known whether other major inland stocks would be moved, and if so, to where these would be moved. Presumably other 'safer' areas have already been designated. Government plans on these matters are classified. Although local authority plans are again having to be written before government guidance and organisational matters are resolved, the greater problem lies with the actual availability and stocks of food.

Modern systems of storage and turnover mean that wholesale and retail food-stocks are becoming increasingly centralised. The stock levels themselves are being kept for commercial reasons at around two weeks supply or less. In a real crisis, where military mobilisation is involved, there will be virtually no NATO merchant shipping available and food



imports will probably cease. The existing food-stocks in the country will then become the only supply. The Ministry of Agriculture Fisheries and Food (MAFF) has commissioned a survey of U.K. food-stocks by the Institute of Grocery Distribution, but it is unlikely that the results of this research will be openly published.

In an emergency, the problem of how to store fresh and frozen foodstuffs will become acute, especially if gas supplies are cut off and the subsequent load on the electricity supply leads to cuts in this supply too, as is suggested in current Government guidance. Storable canned or dried foods will be at a premium. For Scotland the problem is particularly difficult since over 95% of storable canned or dry food comes from outwith Scotland and almost all is transported in by road. East Central Scotland Planning Assumptions Study research on food-stocks in Scotland suggests that there would be only three or four weeks food supply available from existing stocks and then only if this was rationed. This is assuming that stocks 'on the shelves' would disappear very quickly as people would attempt to stock up with emergency supplies if there was sufficient warning of possible hostile attack.

Post nuclear attack, the Ministry of Agriculture, Fisheries and Food (represented by the Department of Agriculture and Fisheries in Scotland) envisages local authority emergency feeding centres providing

*"each day one simple meal for each person" but, "the ultimate objective would be to make people responsible for their own feeding arrangements."*

It is likely that any personal food-stocks would run out quite quickly. In areas affected by heavy fallout, personal supplies would be the only food available for weeks or even months until radiation levels had fallen sufficiently for it to be reasonably safe to spend time out of shelter. Many people would probably be forced by thirst and hunger to move out before that time. Survivors would have to depend on whatever they could find and on whatever emergency feeding was available. The emergency meals suggested in Government guidance could only provide a fraction of the energy requirement for continued longer term survival and it is very difficult to see how people could be responsible for their own feeding in the circumstances likely to be prevailing for a considerable period after a nuclear attack.

### **Accommodation**

The requirement under the 1983 Civil Defence Regulations is for local authorities to make plans for

*"Providing and maintaining a service in their area for the billeting or temporary accommodation therein, and so far as may be necessary, the maintenance of persons who, owing to hostile attack are made homeless."*

Government guidance gives very little detailed advice on how these problems might be resolved. The EPGLA Section on 'Care of the



Homeless' confines most of its advice to the possible situation following a nuclear attack. Before that it is only suggested that

*"..local authorities, especially those in rural areas, could be faced with additional demands on their resources including communal shelters from those who had not followed the Government advice to stay at home".*

The probability of large numbers of people evacuating areas around obvious targets means that this responsibility may well become a problem for local authorities some time before any hostile attacks begin. The uncertainty of their position concerning billeting and the introduction of emergency powers (or indeed any other arrangements for the accommodation of evacuees) in the 'transition to war' period, are only some of the major problems to be faced by local authorities at this stage. The police and armed forces will probably be occupied with a wide range of other duties and it is unlikely that they will be able to offer much assistance with this problem.

The problem of evacuees will be very different for different areas. Regions such as Borders or Tayside, with large rural areas away from most of the major targets in Central Scotland, will probably attract large numbers of evacuees from the more heavily populated areas. The logistics of trying to organise accommodation and to direct or transport people to this, will be a major problem in areas where accommodation is scattered over a wide area. The perception of the Borders and Tayside as areas considered to be relatively safe in a nuclear attack will probably be confirmed in most peoples' minds by the recent discovery that the Scottish Office is building new underground emergency Scottish Central Control Centres for the Government at sites near Comrie in Tayside Region and Galashiels in Borders Region.

Although the care of the homeless and the provision of shelter are considered separate areas of planning in the Government regulations, it is inevitable that the demand for buildings suitable for emergency accommodation will overlap considerably with the requirements to provide civil defence communal shelters in the area as suggested in the Government guidance. The scale of the problem is, however, likely to be greater than that suggested in this guidance. Billeting of people in domestic housing will present a considerable problem of overcrowding, a problem which would be exacerbated by any attempts to improve the protection against radiation through erecting an internal refuge in the centre of the house. The overcrowding will also present acute problems of sanitation and feeding in addition to these difficulties of providing protection from radiation for all those living in the house.

A simulation of the (self-) evacuation of people (about 20% of the Lothian population in the example studied) from areas around targets in Lothian Region, to Borders Region, was carried out using the Nukecalc2 computer programme with appropriate adjustments to the population distribution data files. This influx of people alone would produce on average an



increase of 2.5 - 3 times the number of people per household in Borders Region. This did not include the possibility of evacuees from Strathclyde and Northern England also moving to the Region as a perceived 'safer' area. Although Borders Region was free from the direct blast and heat effects of the nuclear warheads in the computer simulated attack, large numbers of casualties resulted from the radiation levels produced by fallout (carried on the assumed prevailing westerly wind directions and from the chosen nuclear attack pattern), and as a consequence of the lower levels of protection that would be offered by relatively modern houses. This would amplify the problems likely to be faced not only by many of those moving into such areas but also for the local authorities who would then have the responsibility to accommodate and sustain them.

### **Environmental health**

In peacetime, environmental health is the responsibility of district authorities. Consequently, civil defence plans for the prevention of disease (and for measures to prevent its spread) rely heavily on district environmental health officers and their staff, working in liaison with local medical and water authorities. They would also have the responsibility for the provision of emergency forms of sanitation and the removal of refuse during any phase of hostilities.

During a transition to war period, normal procedures should be possible and in a conventional war it may be possible to carry out limited environmental health functions. After a nuclear attack, vital peacetime services on which environmental health depends (including water supply, sewage disposal facilities and sewerage systems, electricity and gas supplies and refuse collection) would be severely disrupted or completely destroyed. Casualties would be on an unprecedented scale, and those suffering from poor diet, bad living conditions, stress and sub-lethal radiation doses would have their resistance to illness and their capability of recovery from trauma substantially lowered. It is very likely that in the first few weeks after attack infectious diseases due to organisms which are already common in the environment, such as tetanus and those associated with food poisoning, but which are kept at bay by environmental health measures and normal health care, would become common. In the circumstances following nuclear attack, it is clear that the available medical resources and their ability to provide anything other than a rudimentary service would be extremely limited.

The British Medical Association considers that communicable diseases such as cholera, typhoid, tuberculosis and even plague could threaten survivors in the longer term. They also acknowledge that:

*"Community physicians and others with expertise in public health will have a duty actively to advise the civil authorities on preventive measures, and other health professionals should give support".*



The priority tasks for district environmental health officers, once movement outdoors is possible, is to make provision for emergency measures aimed at preventing disease or keeping such outbreaks under control. Which of their normal peacetime functions would continue to be feasible would clearly depend on the prevailing local circumstances and would probably be based on ad hoc decisions at the appropriate time.

### **Disposal of the dead**

In terms of the various 'phases of war emergency', a period of tension or conventional attack is not anticipated by the Home Office as posing serious problems for local authorities' responsibilities for disposal of the dead. According to one Home Office model format, local authorities would, before or during a period of tension, lay and review plans and identify sites, resources and staff which would be needed for this task. This thinking is based on the assumption that some sort of coherent framework would operate, even after nuclear attack, if only to take 'ad hoc' decisions and that these decisions could be communicated to designated personnel who would be able to take some kind of effective action. Government advice has not offered much detail on what this action might be.

A County Emergency Planning Officers' workshop on this subject reported a number of serious problems such as shortage of mechanised digging machinery, manual equipment and transport. Also identified were shortages of fuel for cremation and an absolute lack of 'manpower'. All of this was compounded by organisational problems of

*"maintenance of morale, absenteeism, law and order and limitations on mobility."*

The workshop could identify few solutions to most of these problems and none at all to the problem of the source of 'plant' and equipment which would be needed for mass burial. The increasing use of hired commercial equipment by local authorities means that - as with many of their other services - there will be a diminishing pool, or a complete absence, of this equipment under their direct control in such an emergency.

Apart from these problems of organisation and resources, the sheer scale of the problem likely to occur after a nuclear attack in the areas directly affected would probably overwhelm any attempts to organise disposal of those killed immediately or who died a short period afterwards from injuries and/or the effects of radiation. The devastated areas around targets and radioactive areas downwind of nuclear groundbursts would in any case be impossible to enter safely for weeks or even months after the attack and any attempts to rescue those injured or trapped or to deal with the dead would be fatal for any surviving groups to undertake. The only realistic policy would be to abandon these areas along with the dead which they contained. These areas would certainly be rapidly abandoned by most mobile survivors.



The casualty figures for Central Scotland based on the nuclear attack Scenario 2 and Nukecalc2 calculations were around 1.5 million dead, with some 500 to 750 thousand of these in the East Central area. Between 45 and 70% of these predicted deaths were due to lethal exposure to radiation from fallout. This assumed that prevailing winds would bring the fallout over the most heavily populated and damaged areas and was calculated for the exposure to radiation over the first two weeks following the attack.

It takes little imagination to see that the consequences would probably be very different for different Regions and Districts. Falkirk, Edinburgh or East Lothian Districts which contain likely targets, could suffer large scale devastation with some parts having 70 to 90% of their people killed. More remote areas in Tayside or Borders Regions might remain relatively unscathed by the immediate effects. Survivors in the undamaged areas might be faced with the problem of numerous deaths in the shorter term amongst those without adequate protection from fallout including those who had been fatally exposed but had been able to move there from other damaged areas. In many areas the problems of dealing with the dead and dying amongst the living will be acute in the circumstances likely to prevail after a nuclear attack. Radioactivity may delay any action for a considerable time. Burial is a labour intensive and fairly traumatic experience, even without the problems of shock, exposure to radiation and shortages of food likely to affect those involved. Cremation requires a considerable amount of fuel and combustible materials and these would be at a premium for other vital needs. In many areas the problem would be increased by the presence of farm animals also killed by radiation exposure.

Some provision could be made in areas considered likely to be relatively safer from the immediate effects of nuclear attack. If available, equipment and fuel could be pre-positioned at a number of sites to deal with either burial or cremation but little else could be attempted.

## **Volunteers**

When the 1983 Civil Defence Regulations were being proposed the Home Office Minister of State responsible stressed that

*"...it is vital to underline that the whole enterprise, now and in the future, will depend to a large extent on volunteers".*

This major role for volunteers is a traditional approach to civil defence planning in the U.K., having its origins in the volunteer ARP services of the Second World War and continuing in strength until the disbanding of the Civil Defence organisation in 1968, mainly for financial reasons. The present Government is apparently trying to revive this tradition in its approach to civil defence planning.

However, as in many other areas of responsibility for local authorities, they are being asked to produce plans for the organisation and training of



volunteers for civil defence roles before the basic Government guidance has been properly formulated.

Since 1983 a number of guidance documents have been issued, culminating in a 'discussion paper' by the Co-ordinator of Voluntary Effort issued in June 1989. Taken together, the guidance given so far poses a number of basic problems for local authority civil defence planners. As in other areas of planning the government approach is a limited one, proposing just the formation of a 'nucleus' of trained volunteers who

*"...will provide the framework of expertise for a county's (region's in Scotland) community volunteer effort which would be capable of expansion during a period of crisis".*

Considering the wide range of activities, from emergency feeding to disposal of the dead, in which these volunteers are expected to take part this appears to be at odds with the requirement that local authorities produce plans which are capable of being implemented within 7 days, and only 48 hours for their most vital elements. It is also at odds with the requirement for the 'verification' of these plans in the latest Government 'Planned Programme for Implementation (PPI)' of local authority civil defence plans. Since most of these plans are likely to have a fairly large volunteer element it is difficult to see how this verification could be done without the involvement and exercising of an actual volunteer force.

The financial background against which local authorities have to produce plans which include volunteers (and other plans) is revealed in two statements, one from Home Office guidance issued in March 1989 which states that

*"The task for local authorities is therefore to establish realistic and effective schemes which can be maintained within the resources available"*

and the other from the latest discussion paper which says

*"This paper assumes that the current civil defence legislation will remain unchanged for the foreseeable future. It also assumes that although spending on civil defence has increased significantly in recent years, further increases cannot be expected. It follows that additional resources could only be provided for the community volunteer programme if corresponding savings were made elsewhere in the civil defence programme."*

This limited approach cannot, therefore, begin to address the real problems relating to the numbers of volunteers needed to provide 'effective' schemes at a local level for communities faced with the likely scale of death and destruction from a nuclear attack. Problems of replacements of trained volunteers for shift work, or for loss by evacuation, injury or death, cannot be addressed under these restrictions.

The guidance also mentions the problems of recruiting and maintaining volunteers for roles which would only be useful in a wartime situation. Part of the answer to this given in the EPGLA suggests that civil defence volunteers could also be called on to help with peacetime disasters. This is



presumably part of the 'Civil Protection' or 'all hazards' approach which Central Government has adopted towards emergency planning. Unfortunately, local authorities are unlikely to be able to offer an effective role for their civil defence community volunteers in civil emergencies. Of course there are already voluntary organisations which can provide assistance in civil emergencies and which exercise wartime roles. These are either of charitable status like the Red Cross or have Government funding like the Womens' Royal Voluntary Service. However, it is very difficult to see how local authorities could be expected to organise and run an organisation on these lines for civil defence volunteers with the present lack of consolidated guidance and restrictions on funding for civil defence volunteers and without statutory duties and funding for any real involvement in civil emergencies.

### **Rescue, repair and essential services**

Generally rescue of survivors from damaged or demolished buildings is undertaken in peacetime by the fire and rescue services. Most local authority plans allocate this function to their local fire brigade or fire and rescue service. In the particular circumstances following a nuclear attack there may well be the added problem of radioactive fallout from local groundburst explosions or from others upwind. This could mean that it would be hazardous for the personnel involved to attempt rescue in such circumstances. Whole areas would have to be abandoned and the survivors left to their own devices.

After a nuclear attack the human and material resources for repairs to the large amount of damaged property would be extremely limited. Repair could only be undertaken on extremely vital assets. These would necessarily include those facilities essential for the provision of services for the maintenance of health and longer-term survival, such as water supplies and energy sources.

### **Emergency centres**

The statutory obligations for regional authorities is to provide an emergency centre in two of its district areas, and for each district authority to provide one such emergency centre within its boundary. As pointed out above, the recommended minimum protective standard of resistance to blast may well be too low to ensure the centre's survival after nuclear attack in districts near targets. In some of these districts it would be prohibitively expensive to construct a survivable facility. In any such case it is difficult to see what useful role the emergency centre could have beyond conventional war, given that the external damage and the radiation level are likely to render it inoperable post nuclear attack. The resolution of these problems remains difficult in the absence of more detailed guidance, and in any case the Government has recently given the establishment of such centres a lower priority.



## 7) Summary

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This booklet outlines the work undertaken by the two Planning Assumptions Studies since the Autumn of 1987. The main thrust of the research undertaken by the Strathclyde Planning Assumptions Study was the estimation of the casualties likely to occur in a reasonably realistic nuclear attack on Strathclyde Region. The figures obtained were broken down into a district by district basis in order to inform and assist the civil defence plan-making process. The East Central Scotland Planning Assumptions Study had a wider remit and investigated some of the basic planning assumptions upon which Government guidance is based. The results of those deliberations are reported in Section 6 of this booklet. There are many other areas of research that are needed in order to assess realistically the immediate and short-term impact of hostile attack on this area including any possible nuclear strikes. The Studies have reported here on only those topics which could reasonably be researched in the short time available. There remains much further work to be done.

Attempts to quantify the impact of war including nuclear war are only possible for certain areas. In the words of the United States Office of Technology Assessment's report 'The Effects of Nuclear War'

*"The effects of a nuclear war that cannot be calculated are at least as important as those for which calculations are attempted. Moreover, even these limited calculations are subject to very large uncertainties."*

Nevertheless the work reported here is we believe as accurate as is possible at the present time.

Civil defence planning is aimed at providing assistance and sustenance to the survivors in the short-term. The studies have not therefore considered the prospects for longer-term recovery and survival. Modern society depends on a highly organised and efficient infrastructure which would be severely damaged in the event of a nuclear attack. Disruption or destruction of various facilities would cause immense problems which are difficult to assess. Even in the event of minor climatic changes, the ability to restore and maintain food production could be seriously placed at risk. Even more severe climatic changes may be possible. These questions need further investigation, but the long-term recovery after general nuclear war would need national or international measures.

All those involved in these studies will be united in the hope that these considerations will remain a matter for academic research and debate. Whilst nuclear weapons exist on the present scale, the possibility of such a catastrophe will continue.

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## Acknowledgments

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EAST CENTRAL SCOTLAND PLANNING ASSUMPTIONS STUDY

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STRATHCLYDE REGION PLANNING ASSUMPTIONS STUDY

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