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NATIONAL EMERGENCY PLAN FOR NUCLEAR ACCIDENTS

DEPARTMENT OF ENERGY
IRELAND

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NATIONAL EMERGENCY PLAN
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FOREWORD

The Chernobyl accident in 1986 caused widespread radioactive contamination over many countries and showed that countries must be prepared to respond rapidly to such an accident. No mechanisms were available for distributing information between countries about nuclear accidents and as a consequence considerable time elapsed before details about the Chernobyl accident became available. This caused confusion among the public.

Since then many improvements have been made. International conventions have been established to provide a rapid exchange of information about accidents which might affect other countries. As an intrinsic part of the improved arrangements to cope with any radiological emergency, the Radiological Protection Institute of Ireland (RPII) was established in 1991 following passage of the Radiological Protection Act.

The Institute has responsibility under the Act for monitoring radiation levels and advising on measures to be taken for the protection of the public, functions which were not specifically provided for in legislation previously.

A new network of continuously operating radiation monitors has been installed throughout the country and is operated by the Institute in cooperation with the Meteorological Service and the Department of Defence. This monitoring system will detect independently any radioactivity reaching this country and, in case the notification arrangements at international level fail, provide an immediate indication of the potential effects.
After the Chernobyl accident the Government authorised the establishment of a national radiation laboratory which now operates as part of the facilities available to the Radiological Protection Institute of Ireland. The consequences of the Chernobyl accident for Ireland have been assessed with the benefit of these facilities which will contribute to improved preparedness for any possible future accidents.

The Minister for Energy was designated as the Minister with primary responsibility for emergency planning for nuclear accidents and, in conjunction with the Radiological Protection Institute of Ireland, a national plan has been developed to co-ordinate in the most effective way the responses of the different Government Departments and statutory organisations.

This booklet describes the national plan which has been approved by Government and provides information on the arrangements that have been put in place. In addition it discusses radiation protection standards and the measures which might be adopted for the protection of the public. The plan has sufficient flexibility to enable a response to be made to the different types of accidents which might have an impact on Ireland and, as an improved rapid reaction mechanism to any possible radiation event, is a very significant step forward since the Chernobyl accident.

Robert Molloy, T.D.,
Minister for Energy.
1. INTRODUCTION

The National Emergency Plan for Nuclear Accidents is a plan of action designed to provide a response to accidents involving the release or potential release of radioactive substances into the environment, which could give rise to radiation exposure to the public. The plan outlines the measures which are in place to assess and mitigate the effects of nuclear accidents which might pose a radiological hazard in Ireland. It shows how accident management will operate, how technical information and monitoring data will be collected, how public information will be provided and what measures may be taken for the protection of the public in the short and long term. The plan can be integrated with the Department of Defence arrangements for wartime emergencies.

The Minister for Energy has overall responsibility for the emergency plan and for ensuring the co-ordination of the responsibilities and functions of the relevant national authorities. The Radiological Protection Institute of Ireland (RPII) has a special responsibility for radioactivity monitoring and for the provision of advice on the potential consequences of any accident and on measures to be taken. Other Government Departments and statutory organisations have responsibilities to establish appropriate procedures to implement measures within their particular fields of competence including integration, where appropriate, with emergency services already provided for other civil emergencies. An outline of these responsibilities is given in Annex I.

In developing this plan, account was taken of international developments including the International Atomic Energy Agency's (IAEA) Conventions on Early Notification of a Nuclear Accident and on Assistance in the case of a Nuclear Accident or Radiological Emergency. Also taken into account were an EC Decision on the early exchange of information in the event of a radiological emergency, bilateral arrangements with the United Kingdom and
the EC Council Directive on informing the general public about health protection measures to be applied and steps to be taken in the event of a radiological emergency.
2. RADIATION AND RADIOACTIVITY

THE ATOM

The atom is the smallest portion of an element that has the chemical properties of that element. Atoms are the building blocks from which our world is built. Atoms consist of a positively electrically charged nucleus around which negatively charged electrons orbit.

RADIATION

There are very many forms of radiation, some of which occur naturally and some of which are man-made. Light, heat, radio-waves, microwaves used for cooking, X-rays used for medical examinations and cosmic radiation are all forms of radiation. Radiation is defined as the emission of energy as waves or particles. The energy thus emitted is said to be radiated.

The many forms of radiation can all be broadly classified as either ionizing or non-ionizing. Non-ionizing radiations include: heat, light, radio-waves and microwaves while ionizing radiations include: X-ray, cosmic radiation and the radiation emitted from radioactive substances. Ionizing radiation is so called because the interaction of ionizing radiation with matter causes atoms to become electrically charged. An electrically charged atom is an ion. The term radiation is often used to mean ionizing radiation.

RADIOACTIVITY

In 1896 Becquerel found that photographic film wrapped in light proof paper was blackened when stored next to a uranium compound. He called the phenomenon radioactivity. Radioactivity is the spontaneous disintegration of atomic nuclei and usually results in the formation of new elements. Materials which exhibit this property are known as radioactive materials. As the
process of disintegration occurs the material is changed to a different substance and is said to decay. Radioactive materials decay at characteristic rates.

Radioactive decay is accompanied by the emission of ionizing radiation. The principal forms of ionizing radiation associated with this process are known as alpha radiation, beta radiation and gamma radiation.

The unit of radioactivity is the becquerel. This is equivalent to one nuclear disintegration per second.

Radioactive materials occur commonly in nature. They occur naturally, for example, in the earth’s crust, in the atmosphere and in the human body. A particular form of natural radiation occurs in the ground as radon gas. Out of doors, it disperses in the air but indoors it builds up. In addition to naturally occurring radioactivity, certain of man’s activities result in the creation of artificial radioactive materials.

RADIATION DOSE

When ionizing radiation interacts with matter, such as human tissue, energy is imparted and a radiation dose received. The unit used to measure the dose is the millisievert (mSv).

The human body may be exposed to radiation both internally and externally. Radioactive materials may be taken into the body by inhalation or ingestion. The ionizing radiation resulting from the decay of these materials will irradiate the body from within and is referred to as internal exposure. External exposure results from the decay of radioactive material or other sources of ionizing radiation, such as X-rays, external to the body.
RADIATION EFFECTS

The effects of ionizing radiation on the human body can be broadly divided into two categories. These are early and late effects.

Early effects are the result of high doses and high dose rates. These effects result at doses over certain threshold values and usually manifest themselves within a matter of weeks. If the whole body is exposed to an instantaneous dose of about 5,000 mSv or more, death may occur within a matter of weeks resulting from, inter alia, damage to the bone marrow. If only a limited part of the body is exposed to the same dose, the result is likely to be less severe. If, however, this same dose was to be received over a more protracted period of weeks or months, then there may be no early effects as there would be more opportunity for cellular repair.

With regard to a given dose, there is a certain probability of a late effect such as malignant disease and hereditary damage occurring. The higher the dose the higher is the risk. The lower the dose the lower the risk. These effects may not become manifest for tens of years after the exposure. There is believed to be no threshold for late effects, that is, any exposure, however small, will have some associated risk.
3. NATIONAL LEGISLATION

The main domestic legislation in the area of radiological protection is the Radiological Protection Act, 1991 which supersedes the Nuclear Energy (An Bord Fuinnimh Núicléigh) Act, 1971 and replaces the Nuclear Energy Board with the Radiological Protection Institute of Ireland. This Act enables a range of protection measures to be taken in the event of a radiological emergency and gives effect to the provisions of the IAEA Conventions. Under this Act, the Institute:-

- is the Irish Competent Authority for the purposes of the international conventions;
- has responsibility for monitoring radioactivity in the Irish environment and advising the Government on radiation safety matters;
- assists in radiological emergency planning and responses;
- controls the use of radioactive substances.

The protection measures and actions which various Ministers can be empowered to take, should the circumstances warrant it, could include the following:-

- restrictions on the distribution and consumption of foodstuffs and feedingstuffs;
- restrictions on the production, processing, movement and sale of animals, fauna, poultry, crops and water;
- restrictions on the importation of animals and foodstuffs;
- regulation of fishing and the sale of fish;
- slaughter of animals and the destruction of crops.

Other relevant current legislation includes:- the Health Act, 1947 which gives the Minister for Health wide powers in respect of restrictions on the supply of foodstuffs which are declared unfit for human consumption. These powers are set out in detail in the Food Hygiene Regulations 1950-1989. The Public Health Ireland Act, 1878 requires local authorities to provide a pure and wholesome public water supply - water supplies can be discontinued if they are contaminated.
4. RADIATION PROTECTION STANDARDS

Since the Chernobyl accident in 1986, there has been a widespread critical review of the emergency response actions and the criteria adopted by countries during the course of that accident. International organisations such as the International Commission on Radiological Protection (ICRP), the International Atomic Energy Agency (IAEA), the World Health Organisation (WHO), the European Community and others have sought harmonisation of the principles and criteria used to protect members of the public in the event of a nuclear accident and this work is continuing.

The ICRP is an independent international body of scientists and physicians and is recognised as the most authoritative source of recommendations for protection against radiation exposure. Recommendations from the ICRP have over the years provided a consistent basis for European Community and national regulatory standards.

The IAEA has issued guidelines on intervention levels of dose in nuclear accident situations. These are radiation dose levels at which counter measures should be considered.

The WHO in conjunction with the Food and Agriculture Organisation (FAO) has issued joint recommendations to control the international movement of foodstuffs after an accident. These involve proposals for levels of contamination below which there is no need to take any action to restrict trade.

The Council of the European Communities has adopted a regulation establishing maximum permitted levels of radioactive contamination of foodstuffs and of feedingstuffs following a nuclear accident. This regulation would come into force in all Community countries in the event of any future nuclear accident. Foodstuffs and feedingstuffs exceeding the levels specified in the regulation cannot be placed on the market. Different levels were laid
down for dairy products, other major foodstuffs, babyfoods, liquid foodstuffs, minor foodstuffs and feedingstuffs (see Annex II). Another Council Regulation establishes conditions for exporting foodstuffs and feedingstuffs following a nuclear accident.

Countermeasures would be introduced only if their introduction would achieve more good than harm having regard to health, social and economic factors.

Two intervention levels, an upper level and a lower level, are recommended for those countermeasures which might be introduced rapidly after a nuclear accident involving the release or potential release of significant quantities of radioactivity to the environment. These levels are given in terms of the total projected doses to the whole body or to those particular organs or tissues most at risk after a nuclear accident. The lower level is the dose below which the introduction of the countermeasure is unlikely to be justified and the upper is the level above which it should be introduced, except in exceptional circumstances.

In considering the need to introduce restrictions on foodstuffs and feedingstuffs, the maximum permitted levels of radioactive contamination as laid down in the Community Regulation (Annex II) will be observed. These regulations contain limits for different radionuclides in different foodstuffs e.g. the limit for long-lived gamma emitting radionuclides (such as caesium - 137) in dairy products is 1000 becquerels per kilogramme (Bq/kg) and for other major foodstuffs, 1250 Bq/kg.
## Intervention Levels

<table>
<thead>
<tr>
<th>Countermeasure</th>
<th>Body Organs</th>
<th>Intervention levels in millisieverts (mSv)</th>
</tr>
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<tbody>
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<td>Whole Body, Thyroid/lung/skin</td>
<td>Lower 30 300</td>
</tr>
<tr>
<td>Sheltering</td>
<td>Whole Body, Thyroid/lung/skin</td>
<td>Lower 3 30</td>
</tr>
<tr>
<td>Distribution of stable iodine</td>
<td>Thyroid</td>
<td>Lower 30 300</td>
</tr>
</tbody>
</table>
5. POSSIBLE SOURCES OF NUCLEAR ACCIDENTS AND THEIR CONSEQUENCES

There are no nuclear power stations or reprocessing plants located in Ireland and consequently there is no situation where there is a serious threat to the population in the immediate vicinity of such an installation. However, there are installations in the UK and Europe where a serious accident could result in significant contamination in Ireland. Moreover, the Chernobyl accident showed that nuclear accidents can result in contamination in countries many thousands of miles away from the actual scene of the accident.

The types of nuclear installations and activities where accidents might result in releases of radioactive substances to the environment are:-

- Nuclear power and research reactors;
- Nuclear fuel reprocessing plants;
- Installations for producing or storing nuclear fuel;
- Installations for processing or storing radioactive waste;
- Nuclear powered ships and submarines;
- Nuclear powered satellites;
- Nuclear weapons carried by vessels or aircraft;
- Uranium enrichment facilities;
- Civil transportation of uranium ores, nuclear fuel, spent nuclear fuel and radioactive substances;
- Installations for producing radioactive substances and sources;
- Facilities where radioactive substances are used.

The consequences of an accident from these facilities have been examined and a distinction may be made between those accidents where the consequences may affect the whole country and those which are likely to affect only a limited area. The quantity, type and form of the radioactive substances released to the environment would depend upon the nature of the
FIGURE 1
THE INTERNATIONAL NUCLEAR EVENT SCALE
FOR PROMPT COMMUNICATION OF SAFETY SIGNIFICANCE
accident and the installation involved. The release, for example, from a nuclear power station reactor accident would be different from an accident at a spent nuclear fuel reprocessing plant because different radioactive substances and different quantities are present in these installations. For nuclear power plants, the International Atomic Energy Agency (IAEA) has developed an International Nuclear Event Scale (INES) to classify the safety significance of nuclear accidents, as a means of communicating the seriousness of accidents to the public (see Fig. 1).

The crash of a nuclear powered satellite would present particular problems due to the scattering of debris over a large area of the country. This debris may be very small in size and could present a radiation hazard. It would be necessary to investigate reports of the finding of debris, search for unreported fragments and arrange for their recovery.

Radioactive substances released into the air from nuclear accidents would be dispersed in the same way as a plume of smoke spreading into the atmosphere and would deposit material on the ground. The concentration of radioactivity in the plume would decrease with distance from the point of release due to dispersion and deposition but could have effects over large distances. Radiation exposure which would affect members of the public could arise from three main pathways:

- direct exposure to radionuclides in the air and on the ground;
- inhalation of airborne radionuclides;
- consumption of contaminated foodstuffs.

A first concern would be to predict as accurately as possible where and when a radioactive cloud from a nuclear accident abroad would arrive over Ireland and the extent to which the country might be affected. This would depend on the prevailing winds and the amount of rainfall whilst the
radioactive plume was over Ireland. It is imperative therefore that the monitoring arrangements are extremely flexible and able to respond to whatever situation might arise.

If radioactive substances deposited on the ground have the potential to enter the food chain, the time of year when the deposition occurs can have a considerable influence on the potential effects. If the deposition occurs outside the growing or grazing seasons, the consequences will be less.

The occurrence of immediate health effects can be regarded as extremely unlikely in instances of the radioactivity releases taking place outside Ireland. However, the total doses from external exposures and intakes of radioactivity could be of significance in terms of long term health effects and in these circumstances, assessments of the doses must be made.
6. COUNTERMEASURES

6.1 GENERAL

The countermeasures which might be taken for the protection of the public in the event of a nuclear accident involving the release of radioactivity to the environment include evacuation, sheltering, the administration of stable iodine tablets and restrictions on foodstuffs and water supplies. While these are the principal countermeasures, there are others which may reduce radiation exposure after a nuclear accident such as a prohibition on the grazing of animals, the washing of vegetables and closure of greenhouses.

While restrictions on foodstuffs may need to be continued for a period after the accident, prolonged implementation of countermeasures such as evacuation and sheltering would cause great stress and significant disruption of both individuals and society. They should, therefore, be discontinued as soon as practicable following the accident, provided that contamination of the environment does not prevent this.

Responsibility for the implementation of these countermeasures rests with the various Government Departments and State Agencies involved in the National Emergency Plan.

6.2 BASIC PRINCIPLES AND CRITERIA IN RELATION TO INTRODUCTION OF COUNTERMEASURES

The basic principles underlying the introduction of countermeasures are those of avoiding immediate health effects, doing more good than harm and obtaining the greatest benefit in their application. There are, however, several factors of importance in the determination of benefits and detriments. On the one hand the introduction of a countermeasure may provide public reassurance as well as averting doses to people. On the other hand, the introduction of a countermeasure may cause public anxiety and considerable
disruption to people and the country, result in large monetary costs and place individuals at risk of injury and death.

The following criteria should be considered in the decision to introduce a countermeasure:-

- the dose averted;
- the doses to workers received in introducing the countermeasure;
- health effects other than those due to radiation e.g. nutritional consequences of removing certain foodstuffs from the market;
- monetary costs of the countermeasure;
- indirect monetary costs e.g. negative impacts in overseas markets;
- psychological effects;
- observance of concentration limits for foodstuffs and feedingstuffs.

6.3 EVACUATION

The purpose of evacuation is to provide protection against high short-term exposures, i.e. internal exposure due to the inhalation of radioactive materials and external exposure from radioactive substances in the air and on the ground.

Evacuation has the possibility of preventing virtually all exposure provided people can be moved to areas free of contamination. It has, however, many significant disadvantages, particularly if large numbers of people are involved, but can be particularly effective in certain situations to avoid localised exposures.

It is not envisaged that an accident in a nuclear installation abroad would give rise to the need for evacuation of people in Ireland. However, it is possible that an accident close to the Irish coastline, involving, for example, a nuclear submarine, could require the evacuation of people in the
immediate vicinity of the coastline. Equally it is possible that if a nuclear powered satellite crashed in Ireland, people in the immediate vicinity of highly radioactive debris would need to be evacuated until this debris was disposed of. In these cases, responsibility for evacuation would rest with the Gardaí, assisted by the Defence Forces and be carried out in accordance with regional emergency plans.

6.4 SHELTERING

Sheltering is staying indoors, with the doors and windows closed, to reduce the inhalation and external exposure to radioactive materials in the air and on the ground. This countermeasure is particularly effective in situations where high levels of contamination may occur and in situations where evacuation is not practicable or poses considerable risk to people. There are practical difficulties associated with sheltering such as the provision of adequate supplies of foodstuffs and general inconvenience, including economic disruption.

6.5 DISTRIBUTION OF STABLE IODINE

In the special case of releases of radioactive iodine, the administration of tablets containing non-radioactive iodine can block or reduce the up-take by the thyroid gland of this substance. The maximum benefit is obtained by taking the tablets before exposure to radioactive iodine or as soon as possible afterwards.

Whilst stable iodine would normally be used to avoid radiation doses to the thyroid caused by inhalation of radioactive iodine, it could also be used to avert doses due to the consumption of contaminated foodstuffs such as milk. However, it is more satisfactory to introduce restrictions on foodstuffs to avoid such exposures.

While it is not likely that an accident at a nuclear installation abroad will give rise to consequences requiring the distribution of iodine, the Department of Health
has distributed stable iodine tablets to the Health Boards. These Boards will be responsible for their distribution should the situation arise to warrant their use.

6.6 CONTROL OF FOODSTUFFS AND WATER SUPPLIES

Where radioactive fallout has occurred, there is a serious risk of foodstuffs and water being contaminated. Contamination of foodstuffs and subsequent doses to the public can be reduced if certain actions are taken before ground contamination occurs, for example:

- the closure and isolation of glasshouses, although care must be taken to ensure the welfare of crops;
- harvesting mature crops, such as leafy vegetables;
- covering outdoor crops where practicable, particularly low volume, high value crops;
- covering food and feedingstuffs stored out of doors;
- bringing cows indoors to avoid grazing contaminated pastures;
- bringing other animals such as goats, sheep and store cattle indoors.

If contamination of a foodstuff occurs, it will be necessary to consider how doses to humans could arise in the course of its production process and to take action to minimise or avoid these doses. The production of a particular foodstuff could involve many steps and it would be preferable to take action as early as possible during production rather than impose restrictions on the final product.

If the radioactive contamination consists of short-lived radionuclides, then delaying the foodstuffs from reaching the public is very effective in averting doses. If the contamination includes long-lived radionuclides, it may be necessary to remove and destroy contaminated produce. If foodstuffs in mature condition and water are contaminated to unacceptable levels, it will be necessary to impose restrictions on their distribution and consumption.
while at the same time implementing an extensive monitoring programme to determine the extent of the contamination. It may also be necessary to take steps to mitigate, as far as may be practicable, the transfer of contamination from soils to crops.

The Department of Health will be responsible for the rapid seizure and destruction of contaminated milk and other foodstuffs at points of sale to the consumer. If necessary, the appropriate Departments will arrange for the supply of replacement foodstuffs and water. In addition, the Department of the Marine may be required to assist in the seizure and destruction of contaminated marine produce.

Figure 2
Sampling seaweeds for monitoring marine radioactivity along the Irish coastline
7. NATIONAL EMERGENCY PLAN FOR NUCLEAR ACCIDENTS

The main elements of the Plan are as follows:-

(1) Notification of Nuclear Accident and National Alerting Mechanism.
(2) Emergency Response Co-ordination Committee.
(3) Accident Response Phases.
(4) Public Information.

7.1 NUCLEAR ACCIDENT ALERT

First information of the occurrence of an accident at a nuclear installation overseas will be obtained either through the international notification procedures established since the Chernobyl accident or from the RPII national radiation monitoring system.

The International Atomic Energy Agency (IAEA) has established a Convention on Early Notification of a Nuclear Accident and the European Community has adopted a Decision on the Rapid Exchange of Information in the Event of a Nuclear Accident. Both provide for early warning of an accident and for the exchange of information. Both involve the rapid transmission of data to a designated national contact point which in Ireland is the Garda Communications Control Centre.

A further source of early information about an accident in the United Kingdom is the information provided under the bilateral arrangement between Ireland and the United Kingdom.
The information to be provided under the above procedures should include:

- the time, location and nature of the accident;
- the facility or activity involved;
- the cause and possible development of the accident insofar as releases to the environment are concerned;
- the general characteristics of the radioactive release including, as far as possible, the nature, physical and chemical form;
- the quantity, composition and effective height of the release;
- information on current and future meteorological conditions;
- results of environmental monitoring, as appropriate;
- the countermeasures taken or planned;
- the predicted behaviour in time of the radioactive release.

The national radiation monitoring system provides continuous gamma dose rate monitoring at eleven sites in Ireland. These sites are shown in Fig. 3 and are mainly located at Meteorological Service stations. The system initiates alarm procedures in the event of high levels of radiation being detected. Operation of the system means that if the notification arrangements outside Ireland fail, any dangerous increases in radiation levels in this country, as a result of an accident abroad, can be detected.

On receiving notification of a nuclear accident, the Garda Communications Control Centre will immediately contact the RPII Duty Officer. The RPII Duty Officer, who will be a senior official of the RPII, will assess the information received and decide on the initial actions to be taken.

In the event of the accident having the potential to affect Ireland seriously, the RPII Duty Officer will request the Gardai to notify each member of the Emergency Response Co-ordination Committee (ERCC) and to notify the Duty Officers of key Government Departments. The Committee will meet at the Emergency Control Centre located at the offices and laboratories of the RPII.
Lists of RPII Duty Officers, the members of the ERCC and the Government Department Duty Officers have been prepared for circulation to those involved in the emergency arrangements.

7.2 EMERGENCY RESPONSE CO-ORDINATION COMMITTEE
The principal functions of the Committee will be:-

- to consider the technical assessment from the Institute of the consequences of the accident and its advice on what countermeasures should be taken to minimise the radiation exposure of the public;
- to provide advice to the Minister for Energy and to the Government on the implications and practical problems associated with the recommendations of the RPII concerning any countermeasure;
- to co-ordinate the implementation of countermeasures by the relevant Government Departments and other national authorities;
- to co-ordinate the provision of information to the public.

The Minister for Energy has responsibility for nuclear emergency planning and decisions concerning the introduction of countermeasures. The Chairman of the Committee will be a senior officer from the Department of Energy who will be responsible to the Minister for Energy. The members of the Committee will include responsible officers from the key Government Departments, particularly those who would be directly involved in the implementation of countermeasures. The Committee will also include independent technical experts. To assist the Committee in this work, the Institute will provide such technical support as may be required.

Representatives of Government Departments participating in the ERCC will have set up prior arrangements whereby on receipt of data from the ERCC about a nuclear accident each representative will seek from his/her Department an immediate assessment of the implications of the accident for the field of responsibility of that particular Department. That assessment will
be completed and conveyed to the representative within a time-scale set by the Chairman of the ERCC.

7.3 ACCIDENT RESPONSE PHASES

GENERAL

Following the Chernobyl accident, the limited environmental radioactivity monitoring programme undertaken by the Nuclear Energy Board was greatly extended. This included the establishment of a National Radiation Laboratory and the installation of the national gamma dose rate monitoring system. The previously existing air and rainwater sampling systems were extended to a larger number of sites around the country. Continuous air sampling systems are now in operation at the 7 sites shown in Fig. 3 and rainwater is now sampled continuously at the 13 sites also shown in Fig. 3. In the event of a nuclear accident, the frequency and scope of monitoring will be substantially increased depending on the gravity of the situation. The RPII will liaise with the laboratories of Irish universities and other institutions, particularly hospitals, in order to maximise scientific resources. In addition, a whole body monitoring system was installed and commissioned at St. Vincent’s Hospital, Dublin.

Time-scales associated with an accident can generally be classified as follows:-

- The early phase may extend for several days after the accident. The immediate risk from an airborne release is likely to be the inhalation of radioactive substances and irradiation from the plume or deposited radioactivity.
FIGURE 3
NATIONAL CONTINUOUS RADIATION MONITORING SYSTEM,
AIR AND RAINWATER SAMPLING LOCATIONS

▲ GAMMA DOSE RATE MONITORS
■ AIR SAMPLING LOCATIONS
▪ RAINWATER SAMPLING LOCATIONS

▲ MALIN HEAD

▲ BELMULLET

▲ CLAREMORRIS

▲ MULLINGAR

▲ GALWAY

▲ CASEMENT

▲ BIRR

▲ SHANNON

▲ ROSSLARE

▲ CAHERCIVEEN

▲ CORK

▲ ROCHES POINT

▲ CLONES

▲ DUNDALK

▲ GLASNEVIN

▲ CLONSKIEAGH

▲ KILKENNY

▲ SHANNON

▲ ROSSLARE

▲ CAHERCIVEEN

▲ CORK

▲ ROCHES POINT
• The intermediate phase may extend from days to weeks after the early phase. The risks may be due to:
  (i) External exposure from ground deposition;
  (ii) Internal exposure from inhalation of resuspended radioactivity;
  (iii) Internal exposure from consumption of contaminated fresh food (milk, vegetables and fruit) and water.
• The late phase may extend from some weeks to several years after the earlier phases depending upon the nature of the release. The risks may be due to consumption of contaminated food in general and to contamination of the environment.

EARLY PHASE
The immediate task will be to collect and evaluate data on the accident, on meteorological conditions and on environmental radioactivity levels.

The information available shortly after the accident should include:-
• data received in connection with the notification of the accident;
• information from the Meteorological Service on the prevailing weather conditions;
• trajectory analysis from the Meteorological Service of the dispersal of the radioactive plume from the accident, including preliminary estimates of the timing and extent of possible contamination in Ireland;
• measurements from the national gamma dose rate monitoring system.

This information will enable the Institute to make an initial assessment of the potential impact on Ireland including the need to recommend any countermeasures and to advise the Emergency Response Co-ordination Committee accordingly. Later, further information will be provided by the RPII from the analyses of air filters and environmental samples and from radiation measurements made by the Observer Corps and Civil Defence.
INTERMEDIATE PHASE

In the event of radioactive contamination occurring in Ireland, further steps will be taken to identify the nature of the contamination and to provide information on the quantity and extent of this contamination. These steps will include:-

- the analysis of air filter samples from continuous sampling systems installed at 7 locations nationwide (Fig. 3),
- the analysis of rainwater samples from continuous sampling systems installed at 13 locations nationwide (Fig. 3),
- gamma dose rate measurements by the Observer Corps using portable instrumentation at 24 pre-determined locations to augment the measurements obtained from the national gamma dose rate monitoring system. (Fig. 4, P.32 )

Subsequently, the Civil Defence organisation, using 32 trained mobile monitoring teams, will undertake further gamma dose rate measurements with portable meters and collect grass, leafy vegetables and soil samples for analysis at the RPII laboratory. If required, a further 36 teams can undertake dose rate measurements with portable meters.

Arrangements have also been set in place for inspectors from the Department of Agriculture and Food to collect milk samples from the major creameries and dairies for analysis at the RPII laboratory. Similar arrangements have been made by the Department of the Marine in respect of fish and shellfish samples. Local authorities will provide samples from public water supplies to check suitability for consumption.

If it is necessary to check for internal contamination of persons, this can be done by thyroid monitoring at a number of Irish hospitals or by the whole body monitoring system at St. Vincent’s Hospital, Dublin. Arrangements have been put in place at designated hospitals in Dublin and Cork for treating persons who may require medical care or decontamination.
FIGURE 4

OBSERVER CORPS
GAMMA DOSE RATE
MEASURING SITES
In the event of a major release of radioactivity at sea, the Civil Defence Organisation will monitor fishing boats, fishing gear and the foreshore in the vicinity of the accident. In addition samples of seawater, fish and shellfish will be provided by the Department of the Marine for analysis at the RPII Laboratory.

As information on the accident develops, the objectives of the monitoring programme will be to estimate the radiation dose which may be received by members of the public in all parts of the country but particularly in areas which may be more heavily contaminated. Information on the accident will be assembled in a central computer data base at the RPII. It may be necessary to:-

• determine the levels of radioactivity in the air and deposited in the ground;
• determine the levels of contamination in home produced foodstuffs, feedingstuffs and imported foodstuffs;
• monitor vehicles returning from areas of high contamination;
• monitor materials that might be affected by the accident, e.g. coal supplies and air filters.

Other potential exposure pathways which may require monitoring include aircraft, ships or migratory birds returning to Ireland from severely contaminated areas.

Based on the information obtained from all of the sources above, the Institute will provide its assessment of the consequences of the accident and give its advice on appropriate countermeasures to the Emergency Response Coordination Committee. This may include advice to persons travelling to contaminated countries.
LATE PHASE
This phase of the accident response will involve the RPII in a continued assessment of the overall situation and provision of advice with regard to the risk to the general public and the environment. This may include:-

- assessment of the risks associated with the consumption of foodstuffs and with the contamination of the environment;
- reducing unnecessary risk to persons from ground contamination and inhalation of resuspended radioactive materials;
- monitoring of imports and exports;
- ensuring that no unauthorised transfer of contaminated livestock or foodstuffs takes place;
- the determination of what health problems to the public have arisen and to ensure that appropriate medical assistance is provided;
- use of stored animal feedingstuffs;
- decontamination of particular areas.

7.4 PUBLIC INFORMATION
The provision of accurate, specific and detailed information to the public is vital in the response to any form of nuclear accident. The media and the public must be kept informed about the accident and its consequences including information, advice and guidance about any countermeasures which are recommended to minimise exposure of the public to radiation. The information provided will be up-to-date and available on a regular and continuous basis so that the public may understand clearly the potential effects of any accident. Full use will be made of modern information technology.

In addition to the provision of information to the public, the Government, local authorities, Health Boards, and other relevant agencies such as farming organisations, medical services, etc. will be informed about the accident and its consequences.
The information to be provided about the accident will include:–

- the areas of the country liable to be affected;
- the potential consequences;
- the levels of risk involved;
- the nature of the countermeasures recommended;
- the manner in which countermeasures should be implemented;
- advice to members of the public.

Information and advice will be given as follows:–

- press statements for the media to provide up-to-date details of the accident, its effects on the country, and any advice on actions to be taken;
- a special telephone service will be installed for members of the public to obtain information about the accident;
- announcements on radio and television covering the points outlined above;
- bulletins will be provided for AERTEL which will contain typical information on radiation levels, meteorological forecasts, details of any contamination of drinking water and foodstuffs and advice to the public and the farming community;
- countermeasures detailed and technical information will be provided to Government Departments, local authorities, Health Boards, etc. to enable them to deal with enquiries in accordance with their individual responsibilities.
Figure 5
Environmental Radiation Laboratory, RPII
BIBLIOGRAPHY


ANNEX I

RESPONSIBILITIES OF GOVERNMENT DEPARTMENTS AND OTHER NATIONAL AUTHORITIES

DEPARTMENT OF ENERGY

- Co-ordinate the response to the emergency from all Government Departments and Agencies;
- Provide the Chairman of the Emergency Response Co-ordination Committee (ERCC);
- Provide the link between the Emergency Response Co-ordination Committee and the Government;
- Maintain up-to-date lists of the key personnel involved in the Emergency Plan;
- Ensure that the sub-plans of the relevant Government Departments and Agencies are in place.

RADIOLOGICAL PROTECTION INSTITUTE OF IRELAND

- Provide an on-call emergency service for the receipt and rapid assessment of information concerning nuclear accidents received by the designated national contact point;
- Establish an Emergency Control Centre at the Institute's premises including accommodation for the Emergency Response Co-ordination Committee;
- Implement the relevant international conventions;
- Provide advice on the potential consequences of a nuclear accident and on protective measures to be taken by the Government and the Emergency Response Co-ordination Committee (ERCC);
• Install, operate and maintain the national radioactivity monitoring network;
• Organise the collection of environmental, foodstuffs and other samples by appropriate national organisations and provide for their analysis;
• Liaise with Irish universities and hospitals to maximise the use of their resources in the event of a nuclear accident;
• Organise, in conjunction with the Department of Energy, exercises of the National Emergency Plan for Nuclear Accidents;
• Provide for the certification of radioactivity levels in foodstuffs and other products;
• Provide such personnel dosimetry services as may be required in the event of a nuclear accident.

DEPARTMENT OF AGRICULTURE AND FOOD
• Collect samples of milk, meat, dairy produce and other agricultural produce, as appropriate, for monitoring for radioactivity levels by the RPII;
• Arrange for the emergency supply of foodstuffs such as powdered milk and feeding stuffs and for their distribution where necessary;
• Collaborate with the RPII in the certification of the radioactivity levels in agricultural produce, including live animals and foodstuffs, for export or for movement in and out of intervention storage;
• Control, seize and, if necessary, destroy contaminated agricultural produce (up to the point of distribution to consumers);
• Monitor live animals in their habitat and at point of slaughter or export;
• Collect samples of food imports for analysis at points of entry, as appropriate, in liaison with Customs and Excise Officials;
• Provide information to the farming community on actions to be taken;
• Restrict the movement of livestock, as appropriate.
DEPARTMENT OF HEALTH

- Determine what health problems to the public have arisen and ensure that appropriate measures for their alleviation are provided where appropriate;
- Assist Health Boards in the provision of information services at local level;
- Arrange for the stocking and plan for distribution of medicines, particularly stable iodine, in case this should be necessary;
- Provide for the issue of medical advice;
- Arrange for the provision of services at designated hospitals for injured and contaminated persons, including whole body monitoring and screening services where the uptake of radioactivity, particularly iodine to the thyroid, can be measured and quantified;
- Arrange for the provision of ambulance services for the transport of injured or contaminated persons to hospitals;
- Arrange for the collection of samples and the seizure and destruction of contaminated milk and other foodstuffs at points of distribution to the consumer and their transmission to the RPII laboratory for analysis;
- Arrange for the collection of samples of food imports at points of entry by Environmental Health Officers, in liaison with Customs and Excise officials.

DEPARTMENT OF THE ENVIRONMENT

- Arrange with local authorities for the collection of drinking water samples and the forwarding of them to laboratories for monitoring, as directed by the RPII;
- Arrange for the control of water supplies.
LOCAL AUTHORITIES

• Provide in accordance with pre-determined arrangements in their Major Emergency Plans and in co-ordination with those of the Health Boards and Gardai for the accommodation and welfare of evacuees and persons displaced by the emergency and for the provision of food and rest facilities for personnel responding to the emergency;

• Ensure that the Fire Brigade and other local emergency services fulfil their normal functions in accident situations.

DEPARTMENT OF DEFENCE

• Arrange with local authorities to have an effective Civil Defence Organisation available to undertake the various duties assigned to the force under the Emergency Plan;

• Train and equip Civil Defence personnel to undertake the following functions:-
  (i) monitoring of radiation levels, as required, throughout the country;
  (ii) monitoring of radiation levels on ships, aircraft, vehicles, individuals and their personal effects at seaports and airports, as required;
  (iii) the collection of samples of soil, vegetation etc. for analysis;
  (iv) assisting, where required, in implementation of control measures.

• Provide aircraft for such aerial surveys as may be required;

• Arrange for:-
  (i) collection of sea water samples by the Naval Service;
  (ii) the Naval Service to assist in the implementation of such control measures as may be required.

• Arrange for the Observer Corps to monitor radiation levels at predetermined and other locations as may be required.

• Provide such assistance as may be required within their competence to assist in the implementation of countermeasures.
METEOROLOGICAL SERVICE
• Provide the meteorological data required for the assessment of the radiological consequences of the nuclear accident;
• Provide facilities for the gamma dose rate monitoring and the air and rainwater sampling systems;
• Provide the RPII with an analysis, using suitable computer models, predicting the spread of radioactive plumes from the site of the release of radioactive materials and the likely pattern of deposition on the ground in Ireland;
• Collect and dispatch air and rain samples from weather stations and headquarters to the RPII;
• Notify the RPII immediately when a specified dose rate threshold is exceeded at continuously manned dose rate monitoring stations.

DEPARTMENT OF TOURISM, TRANSPORT AND COMMUNICATIONS
• Promulgate any restrictions it may be necessary to impose on aviation services.

MARINE
• Collect freshwater and marine environment samples including fish, shellfish, seawater, lake waters, seaweeds and lake and marine sediments as may be required for monitoring of radioactivity levels by the RPII;
• Collaborate with the RPII in the certification of radioactive levels in fish and shellfish;
• Collaborate with the RPII and the Department of Health in the seizure and destruction of contaminated marine produce;
• Arrange for notification to shipping where necessary and for the provision by Harbour Authorities of advice, guidance or instruction to shipping in their harbours;
• Provide the fishing and aquaculture industries with information on the actions to be taken;
• Arrange for the provision by Harbour Authorities to the RPII of information concerning shipping entering ports including information on their cargoes;
• Use the Marine Rescue Co-ordination Centre (MRCC) to co-ordinate the transmission through the Coastal Radio Stations (CRS) to shipping and fishing vessels in Irish waters of such advice, guidance or instructions as the ERCC may consider necessary.

DEPARTMENT OF FOREIGN AFFAIRS
• Arrange for Embassies to immediately inform the Garda Communications Control Centre of the nuclear accident and to seek information on the accident through diplomatic channels;
• Assist the RPII in the making of arrangements under the terms of the IAEA Mutual Assistance Convention and any other agreements in place;
• Consult and co-ordinate with other States, especially our European Community partners, in determining appropriate action at international level following a nuclear incident.

RTE AND COMMERCIAL STATIONS
• Broadcast information on radio and television which will provide the public with up-to-date information about the nuclear accident, its effects on the country and advice on actions to be taken.
GARDA SÍOCHANÁ
• Ensure that the Garda Communications Control Centre, Harcourt Square, Dublin 2 acts as the key communications point for the receipt of information about nuclear accidents;
• Notify the RPII Duty Officer on receiving notification of a nuclear accident;
• Notify, at the request of the RPII Duty Officer, all members of the ERCC and the duty officers of key Government Departments;
• Provide such assistance as may be required within their competence to assist in the implementation of countermeasures;
• Control access to areas which have been affected by a nuclear accident.

REVENUE COMMISSIONERS (CUSTOMS AND EXCISE)
• Collaborate in the collection of samples for monitoring for radioactivity levels by the RPII at points of import and export;
• Seize and detain such products as are deemed unsuitable for import or export.
## ANNEX II

**EC MAXIMUM PERMITTED LEVELS FOR FOODSTUFFS AND FEEDINGSTUFFS (Bq/kg)**

<table>
<thead>
<tr>
<th>FOODSTUFFS (1)</th>
<th>Baby Foods (2)</th>
<th>Dairy Produce</th>
<th>Other foodstuffs except minor foodstuffs</th>
<th>Liquid foodstuffs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isotopes of strontium, notably Sr-90</td>
<td>75</td>
<td>125</td>
<td>750</td>
<td>125</td>
</tr>
<tr>
<td>Isotopes of iodine, notably 1-131</td>
<td>150</td>
<td>500</td>
<td>2000</td>
<td>500</td>
</tr>
<tr>
<td>Alpha-emitting isotopes of plutonium and transplutonium elements, notably Pu-239, Am-241</td>
<td>1</td>
<td>20</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>All other nuclides of half-life greater than 10 days, notably Cs-134 and Cs-137(3)</td>
<td>400</td>
<td>1000</td>
<td>1250</td>
<td>1000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FEEDINGSTUFFS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>FEEDINGSTUFFS</td>
<td>1250 (pigs)</td>
</tr>
<tr>
<td></td>
<td>2500 (poultry, calves, lambs)</td>
</tr>
<tr>
<td></td>
<td>5000 (other)</td>
</tr>
</tbody>
</table>
NOTES


(1) The level applicable to concentrated or dried products is calculated on the basis of the reconstituted product as ready for consumption. Member States may make recommendations concerning the diluting conditions in order to ensure that the maximum permitted levels laid down in this Regulation are observed.

(2) Baby foods are defined as those foodstuffs intended for the feeding of infants during the first four to six months of life, which meet, in themselves, the nutritional requirements of this category of person and are put up for retail sale in packages which are clearly identified and labelled "food preparation for infants".

(3) Carbon 14, tritium and potassium 40 are not included in this group.