

Dounreay

Emergency Arrangements for **Local Residents**

FEBRUARY **2014**



Introduction

Legislation requires that a brief note describing the emergency arrangements which would apply in the event of a local emergency occurring at Dounreay or at Vulcan Naval Reactor Test Establishment (NRTE), *hereinafter collectively referred to as Dounreay*, is issued to people living in close proximity to the sites.

In making these arrangements, Dounreay and Vulcan have consulted the following organisations, all of whom are represented on the Dounreay Vulcan Offsite Emergency Planning Group:

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- **Highland Council**
 - **Police Scotland**
 - **NHS Highland**
 - **Scottish Fire & Rescue Service**
 - **Scottish Government**
 - **Scottish Ambulance Service**
 - **Scottish Environment Protection Agency (SEPA)**
 - **Scottish Government Rural Payments and Inspections Directorate (SGRPID)**
 - **Food Standards Agency (FSA)**
 - **Office for Nuclear Regulation**
 - **Civil Nuclear Constabulary**
 - **Defence Nuclear Safety Regulator**
 - **Ministry of Defence Police**

The purpose of this booklet

This booklet describes those aspects of the Dounreay emergency arrangements which apply to you as a local resident in the area. Further details and amplification of the emergency arrangements are provided in a document issued by DSRL entitled 'Dounreay Emergency Plan'. Copies of this document are accessible from: www.dounreay.com

This booklet is issued under the requirements of the Radiation Emergency Preparedness and Public Information Regulations *REPPiR* 2001 and is revised and re-issued to local residents at three-year intervals.



Dounreay

The civil nuclear site at Dounreay was Britain's centre of fast reactor research and development from 1954 until 1994. A wide range of facilities were developed during this time, including three nuclear reactors, reprocessing and other chemical plants, fuel fabrication and a variety of waste disposal and storage facilities. Today, the site is being decommissioned. This work is being performed by DSRL on behalf of the Nuclear Decommissioning Authority, which from 2005 has owned the site and all its facilities.

The programme gives top priority to the removal of the major hazards. This includes alkali metal removal / destruction, liquid ILW (raffinate) immobilisation, historic waste retrieval/ treatment and facility decommissioning. To achieve this there will be a limited amount of new construction required. After the removal of the major hazards, the plan is to complete site decommissioning up to the agreed Interim End State of 2023/25.

The aim is to discharge the nuclear and chemical liability through a well planned integrated programme, where delivery is to the highest standards of safety, security and environmental care.

For more information about what is happening at Dounreay, please contact the Site Communications Department on 01847 802121.



Vulcan NRTE

The Vulcan NRTE is a Ministry of Defence Site operated by Rolls Royce. The Site carries out evaluation of the safety, reliability and performance of a Naval Reactor Plant and the components of that plant. The site comprises of a number of facilities, the majority of which do not hold radioactive material.

The main facilities on the Vulcan Site are:

- **Shore Test Facility (STF)**
- **Dounreay Submarine Prototype 1 (DSMP1)**
- **Decontamination Waste Treatment Facility (DWTF)**



Dounreay emergency arrangements

Measures to minimise the effects to the public from any accidental release of radioactivity or any potential chemical hazard are in place to ensure that the necessary organisation and response is available should this be required.

These emergency arrangements are, and will continue to be the subject of regular exercises as required by the DSRL Nuclear Site Licence for DSRL and the MoD Authorisation conditions for Vulcan. Major annual exercises are demonstrated to the Office for Nuclear Regulation for both sites and, in addition, for Vulcan, Defence Nuclear Safety Regulator (DNSR) for assessment to ensure that the emergency arrangements are adequate. In addition to this, site wide training exercises are held as well as day and silent hours plant exercises.



The scope of the Dounreay emergency arrangements

The Dounreay Emergency Arrangements are similar to arrangements made at all the other civil nuclear installations in the United Kingdom. Vulcan are compliant with REPPiR but follow the MoD Emergency Arrangements.

Of the two Sites Vulcan NRTE is responsible for distribution to the local population out to a range of approximately 2km of stable iodine tablets, due to the different risk posed by the Shore Test Facility. In the event of an emergency it may also be necessary to introduce temporary controls on the consumption of foodstuffs.



Local authority and health service involvement

Within the Highland area, the emergency services including Police, Fire, Ambulance, NHS Highland and the Local Authority have established joint procedures for dealing with an emergency.

Their actions may include: -

- **Evacuation of those at risk**
- **Advice about taking stable iodine tablets**
- **Opening radiation screening units and reception centres**
- **Provision of temporary accommodation**
- **Emergency feeding**
- **Provision of an information service to deal with queries from the local population or concerned relatives**
- **Reunification of family and friends**
- **Return to normality as early as possible**

Special consideration has been given to schoolchildren evacuated during school hours and elderly, disabled or handicapped persons.

In the first few hours dependant on which Site the incident has occurred either the DSRL Representative or Vulcan NRTE Incident Commander / Military Co-ordinating Authority, supported by a team of specialists, give advice to the Local Authority and Police Scotland on measures needed to protect the public. A Government Technical Advisor or Ministry of Defence Military Co-ordinating Authority would, on arrival at Inverness, offer further support to Police Scotland who would be in overall charge of the incident outside the establishment.

Co-ordination during the emergency phase rests with the Police and during the recovery phase with the Local Authority.



The Dounreay emergency siren

Emergency sirens will be sounded at Dounreay in the event of any conditions occurring which could affect the safety of people within the Dounreay boundary. The sirens are also sounded for routine tests and emergency exercises.

Routine tests are carried out on the first working Tuesday of every month at 1100 hours.

Routine tests of the Vulcan emergency sirens are also carried out on the first and third working Tuesday's of the month.

The sounding of the Dounreay and Vulcan emergency sirens is not intended to warn the general public of an emergency. Should an emergency affecting the general public arise, announcements will be issued from the Strategic Co-ordinating Centre via the media as to what actions you should take.

These actions may include the need to shelter indoors, take stable iodine tablets or leave your home.



Stable iodine tablets

Stable iodine tablets are issued to householders within approximately 2km of the Vulcan NRTE site. Further stocks of tablets are held within various locations locally and could be accessed if required.

Stable iodine tablets act by 'swamping' the thyroid gland with stable iodine, in order to prevent it from taking in any radioactive iodine that might have been released into the environment.

One dose in 24 hours (Adults 2 tablets, Children 1 tablet) of stable iodine tablets is necessary and the tablets can be taken by all ages. Instructions will be issued on the authority of the Director of Public Health (*NHS Highland*).

Instruction on the current dosage for each age group and how to take them are supplied when the tablets are given out.



Sheltering

Advice will be issued via the media on the need for sheltering should you be in the area where this is considered necessary. If you are advised to shelter you should take the following action without delay.

a) Go indoors and:

- **close all external doors, ventilators and windows**
- **switch off any fans**
- **if possible extinguish any open fires, and turn off gas, oil or solid fuel central heating systems.**

If possible, pets should be kept indoors and undercover.

b) Switch on your television or radio. Any special information regarding the situation at the site will be passed by local television and radio networks:

- **Scottish TV; BBC TV (Scotland);**
- **Moray Firth Radio (97.4FM and 102.5 VHF, 1107 KHz)**
- **BBC Radio Scotland (92.4 94.7 VHF, 810 MW)**

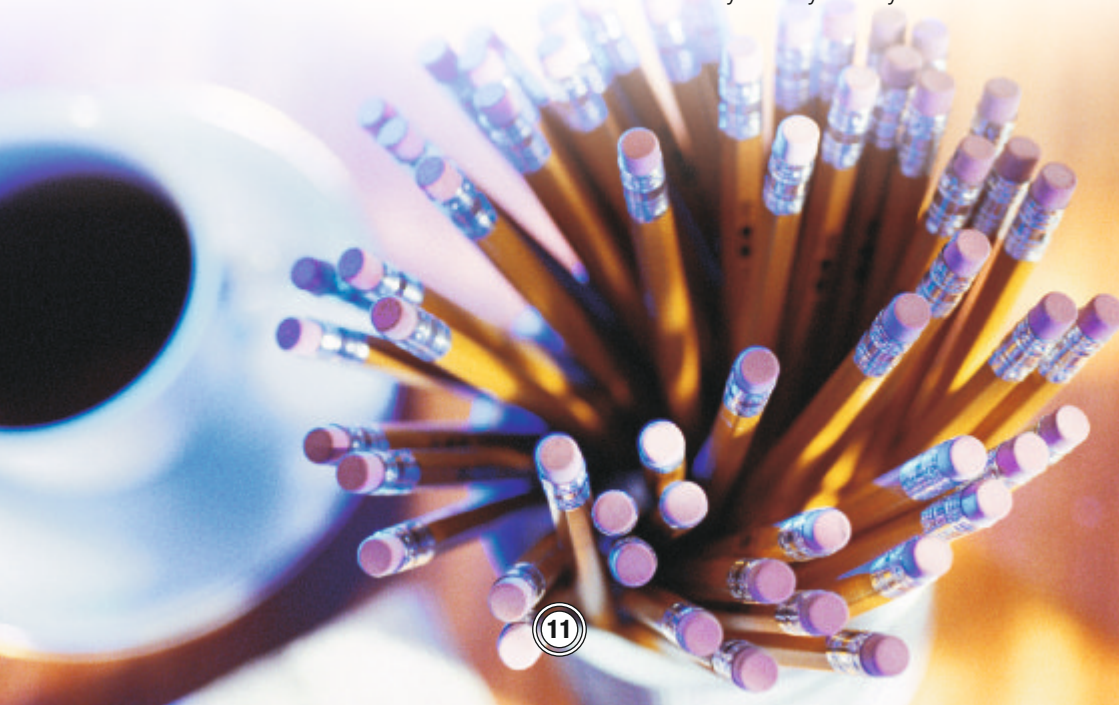
c) If you are working outside remove all outdoor clothing, bag it and leave it near the building entrance. All farm animals should be left where they are, as no special actions need to be taken to protect them at this stage.

If your children are in school or nurseries, do not try to collect them until told to do so. They will be looked after at school and the correct actions taken.

Preparation for evacuation

If you have been told to shelter indoors you should prepare for evacuation should it be necessary. Preparation should include:

- 1) **Pack a suitcase with clothing and toiletries for your entire household for a two-day absence. Include warm clothing if the weather is cold.**
- 2) **Pack valuables including money, jewellery and important personal and / or valuable papers and documents.**
- 3) **Pack any special foods for invalids or babies.**
- 4) **Pack any medicines required by members of the household.**
- 5) **Take contact numbers and/or addresses of any relatives who may need to be assured of your safety. Notify any relatives who may be concerned about you if there is adequate time to do so. Remember to take these items with you.**
- 6) **Before you leave home:**
 - Turn off / unplug non-essential gas and electric appliances.
 - Pay attention to the general security of your house making sure that all doors and windows are closed and locked. Remember to take your keys with you.



Temporary evacuation

If temporary evacuation is advised you should use your own transport wherever possible, however, transport will be arranged if necessary. Police Scotland have identified pick-up-points relative to groups of houses and these will be made known to you at the time.

Drivers of vehicles leaving the evacuation area should ensure that the windows are closed and the heating/ventilation system is off to prevent contamination being drawn into the vehicle.

Members of the public being evacuated or self evacuating would be directed to one of the designated screening units for reassurance monitoring and if necessary for decontamination. Sites for screening units and associated reception centres have been identified at the following places:

The Primary Radiation Screening Unit is:

- Halkirk - Sports Pavillion

The Primary Reception Centre is:

- Halkirk - Ross Institute

If, for any reason, the locations are unsuitable at the time Police Scotland will advise you of an alternative location they will be set up in accordance with the Local Authority's Emergency Support Centres Plan and will be either Thurso or Wick High School.

Special arrangements will be made by the Local Authority and NHS Highland, in liaison with the Police, for the care of the elderly or ill people who have to be moved. You should call 101 and ask to be connected to Wick Police Station if you believe you will have any difficulties in moving any member of your household without assistance. Arrangements will also be made to ensure that the members of your family who were not present when you left home (e.g. school children) are re-united with you as soon as possible.

Radiation screening units

In the event of an incident, public reassurance monitoring may be undertaken at the specified Radiation Screening Unit.

Radiation Screening involves the use of radiation monitoring equipment and safe decontamination of any persons who are found to be contaminated with radioactive material. Decontamination may involve washing, showering and a change of clothing.

Monitoring of the population at Radiation Screening Units is the responsibility of NHS Highland.



Reception centres

Reception Centres are where those affected by an emergency can be brought together, and where their immediate needs can be dealt with. These include the provision of:

- **Short term rest facilities**
- **Light refreshments**
- **Welfare assistance**
- **Information**
- **Medical Centre**

People affected can be re-united with family and friends, and arrangements can be made to return them to their homes as soon as possible or provide them with suitable temporary accommodation.

Farming implications

The Scottish Government Rural Payments and Inspections Directorate (SGRPID) is responsible for emergency planning as it affects agriculture. SGRPID also provides advice on agricultural matters in the event of an incident involving the release of radioactive material in Scotland.

SGRPID has made emergency plans to ensure that appropriate advice and support would be available in the unlikely event of such an incident occurring at Dounreay. These arrangements anticipate the sort of problems that would arise with farm management, tending livestock and with handling farm produce during such an emergency.

In the event that temporary evacuation is advised at short notice, problems could arise with regard to the welfare of farm animals left unattended.

Human safety would take priority over animal welfare. The emergency arrangements, however, have made provision for essential personnel to be allowed back into the evacuation zone under police supervision to carry out specific tasks, such as stock tending duties, when it is safe to do so.

Plans are already prepared for the restriction of distribution and consumption of milk produced in an affected area if advised that this is necessary. These arrangements could be extended should the need arise. Working in conjunction with FSA and SEPA, SGRPID keeps a close watch on other foodstuffs, crops and pasture that could be affected by radioactive deposits. Measures to deal with this would be decided as soon as possible and would depend on the amount and nature of the radioactive material deposited.

Officials of SGRPID will provide both advice and practical assistance and will make every effort to establish personal contact with farmers.



Returning home for short periods

Special arrangements will be made to enable you to return home for short periods should you need to do so and provided access is safe. If you need to return home for any reason you should contact Police Scotland at Wick Police Station.

The Police will need to know what you intend to do at home and how long you need to remain there so that they can advise you on any measures to be taken for your safety.

Police Scotland will control access to the evacuated area.

Food implications

In the event of a local emergency at Dounreay, the Food Standards Agency will lead the Government's response on food safety issues both in assessing the impact of the emergency and in implementing any necessary countermeasures.

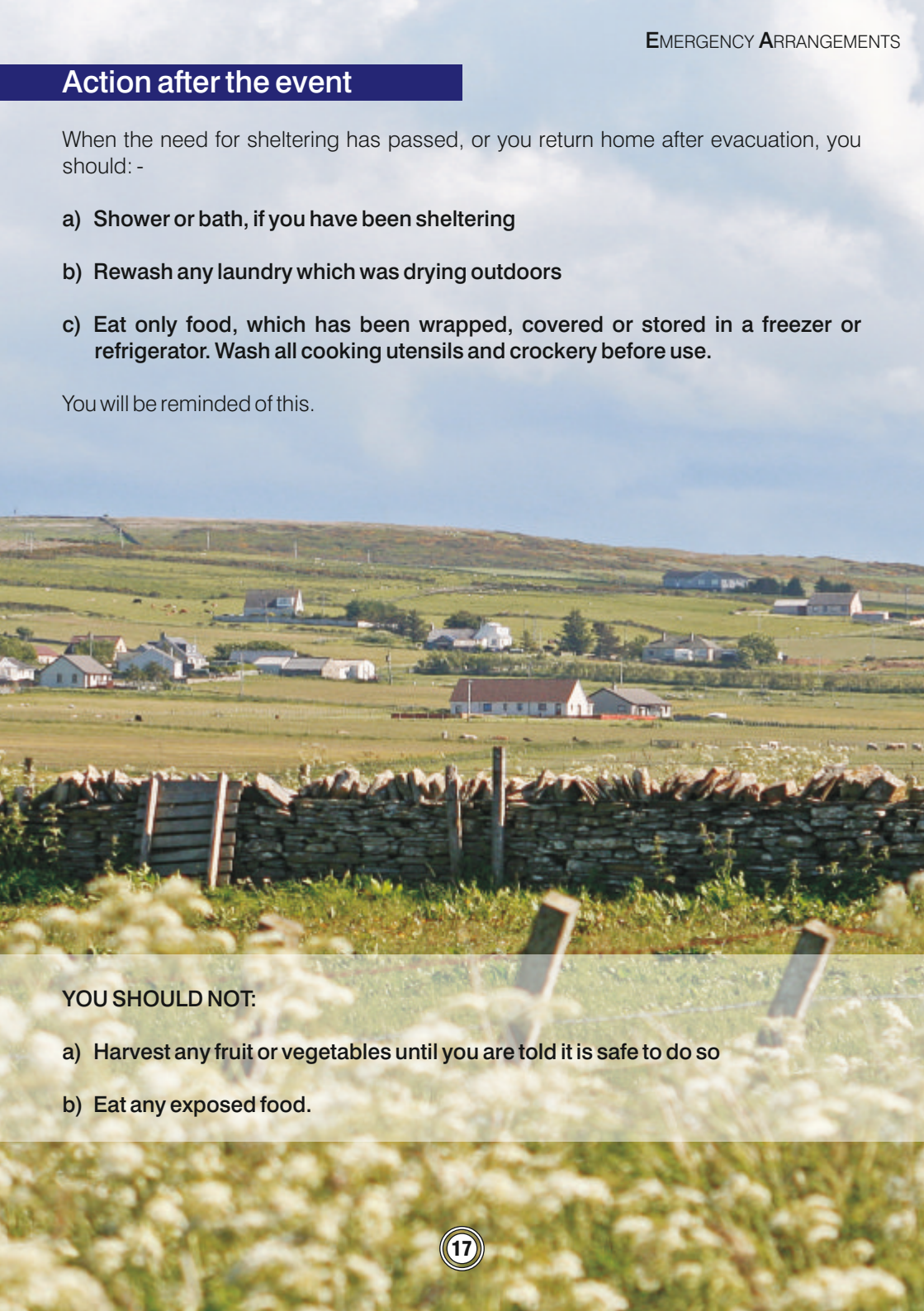
The Food Standards Agency will take advice from the DSRL and the Government Technical Advisor (*or in the case of Vulcan, the Ministry of Defence*) before providing advice for members of the public on food safety issues. This role is continued into the recovery period when they will ensure that all recovery arrangements take full account of food safety issues and when appropriate, they will confirm that emergency restrictions have been lifted.

Action after the event

When the need for sheltering has passed, or you return home after evacuation, you should: -

- a) **Shower or bath, if you have been sheltering**
- b) **Rewash any laundry which was drying outdoors**
- c) **Eat only food, which has been wrapped, covered or stored in a freezer or refrigerator. Wash all cooking utensils and crockery before use.**

You will be reminded of this.



YOU SHOULD NOT:

- a) **Harvest any fruit or vegetables until you are told it is safe to do so**
- b) **Eat any exposed food.**

Basic radiation facts

What is radiation?

Radiation is a fact of life. We live with radiation all around us. Light and heat from the sun are natural forms of radiation which are essential to our existence, so what is radiation? Radiation is a form of energy emitted by unstable atomic nuclei in the form of waves or particles. Radiation can be categorised as ionising or non-ionising according to the effects it produces on matter. Ionising radiation includes cosmic rays, X-rays and radiation from radioactive material. Non-ionising radiation includes ultra violet, radio waves and micro waves. It can originate from natural or artificial sources. It is ionising radiation from artificial sources that is important following a nuclear accident.

Units of radioactivity

As stated already radiation is energy emitted by unstable atomic nuclei. The processes by which this occurs is called radioactivity and results in the transformation of unstable nuclei into stable ones. The act of transformation is called decay and it may take more than one step to attain stability depending on the nuclide involved and the type of radiation emitted. Materials that behave in this manner are described as radioactive and their radioactivity is usually expressed in a unit called the Becquerel, symbol Bq.

One Becquerel is the number of radioactive transformations occurring per second. This is a very small unit and it is normal to use a multiple of this unit such as the mega becquerel or MBq which is one million becquerels.

Radioactive materials decay at different rates and the time it takes for a quantity of material to lose half its activity by decay is termed the half-life. For example the half-life of Iodine – 131 is 8 days i.e. if the original quantity of activity was 10 MBq then after 8 days only 5 MBq would remain.

Effects of ionising radiation on people

Ionising radiation is radiation that produces ionisation in matter. There are different types of ionising radiations emitted during radioactive decay for example, alpha and beta particles, neutrons, gamma rays and x-rays. An important property of ionising radiation is its ability to interact with the medium through which it is passing whether for example it is air, or the human body. The different interaction characteristics of these radiations are important since this determines the degree of hazard they present. For example, alpha radiation cannot penetrate the layer of dead skin cells which exist on the surface of the skin. Therefore alpha radiation will not be a hazard unless it gets into the body where it can contact living tissue. Gamma radiation on the other hand is very

Basic radiation facts

penetrating and will affect all the internal organs even from outside the body.

All ionising radiations have the potential to harm human beings. The interaction of ionising radiation with the human body, as a result of either external exposure from sources outside the body or from internal exposure from radioactive material inside the body, leads to biological effects which may later materialise as clinical symptoms. The nature and severity of these symptoms depends on the amount of radiation absorbed and the rate at which it is received. In addition to the effects on the person receiving the dose there is also the possibility that through damage to the reproductive organs future generations may exhibit hereditary effects. The effects of radiation exposure can be summarised into two types of injury.

Harmful tissue reactions: These are reactions that are not observed below a certain threshold dose. Above that threshold the severity of the effect increases with increasing dose. These effects include for example eye cataracts and skin reddening. This type of damage when caused by acute over exposures will manifest within a short period of time from the time of exposure, typically a few weeks. The exception to this is the development of eye cataracts which may not occur for many years.

Stochastic effects: These are effects which have no threshold dose but where the probability of an effect occurring increases with dose. Such effects include cancer and heritable effects in future generations. Cancer induction will typically take years to occur following exposure.

Although radiation can damage living tissues, human cells however can repair this damage through natural metabolic processes if the absorbed dose is not too high. This recovery depends on the level of initial damage and varies from individual to individual. People must therefore be protected from unnecessary or excessive exposure. Where exposure does occur it is important to be able to assess the impact of the exposure. In order to do this it is necessary to quantify the exposure in terms of dose.

Radiation dose

When considering the effects of radiation on people the unit used for measuring dose is the Sievert, symbol Sv. This quantity is very large and it is normal for smaller sub multiples to be used. For example 1 millisievert, symbol mSv is one thousandth of a Sievert. Every person in the world is exposed daily to radiation and in the UK the annual average dose from all sources is approximately 2.6 mSv. Of this approximately 84% is from natural sources. Naturally occurring radioactivity is taken up by plants and animals with the result that most foodstuffs contain radioactivity contributing 9.5% of

Basic radiation facts

the dose from natural sources. The biggest contribution however comes from radon gases from the ground which accounts for 50% of the dose. Typical annual doses from natural sources are in the following table.

Radiological risk table produced by AEA Technology on behalf of the British Nuclear Industry Forum, published 1994.

Radiological Risk	Dose (1 unit = 1 mSv)	Risk of Death
Living in Cornwall	7.8 units	1 in 3,200
From a brain scan	5 units	1 in 5,000
Average annual dose to people in the UK from all sources	2.6 units	1 in 10,000
Annual average dose received by a coal miner	1.2 units	1 in 23,000
Average annual dose from radon in the home	1 unit	1 in 25,000
Dose from a return flight London – Los Angeles	0.14 units	1 in 230,000
Dose from a one week holiday in Cornwall	0.1 units	1 in 250,000
Dose from drinking a glass of mineral water every day for a year	0.065 units	1 in 500,000
Dose over the next 50 years in the UK from Chernobyl	0.046 units	1 in 500,000
Dose from a single chest X-ray	0.02 units	1 in 1.25 million
Dose from eating 135g bag of Brazil nuts	0.01 units	1 in 2.5 million
Average annual dose from fallout of nuclear weapons testing	0.005 units	1 in 5 million

Basic radiation facts

Only approximately 16% of the total annual dose comes from artificial sources including medical and the nuclear industry.

Working with radiation in the UK is regulated by a number of sets of regulations that address the nuclear industry, medical, waste disposal etc. The default maximum legal limit for a classified radiation worker in the nuclear industry is 20 mSv per calendar year. There is a further restraint in as much that all exposures must be kept as low as reasonably practicable.

Radiation Exposure due to a Nuclear Accident

How would radioactive material get into the environment

Both Dounreay and Vulcan sites have the potential to release radioactive material to the environment due to an accident. As a result of such an accident members of the public could receive a radiation dose either from direct external radiation or from inhalation or ingestion of the released material.

Examples of types of accident that could lead to a release are described below.

1. A reactor accident at Vulcan resulting in core/fuel damage and a breach of reactor containment leading to a release of fission products to the environment.
2. A criticality accident in one of the Dounreay facilities that handle, store or process fissile material. This would result in high transient external dose rates close to the perimeter fence and potentially the release of fission products and other nuclides to the environment either from a building breach or via one of the FCA stacks.
3. Decommissioning operations are by their nature intrusive and involve the dismantling of permanent containment structures. These structures have throughout the operation of the site contained the radioactive materials and prevented a release. The process of decommissioning has the potential for an accidental release within a facility which may eventually be discharged to the outside environment via a discharge stack.

How could this affect the public

Radioactive material released during a nuclear accident can affect the human body via a number of exposure pathways. The material released will be dispersed by the wind

Basic radiation facts

like a smoke plume from a chimney. As it is carried along in the direction that the wind is blowing the dispersion results in the concentration reducing. This is the result of the material spreading out and by material being deposited along the track of the plume. The behaviour of the plume is very much dependant on the weather conditions i.e. wind speed, cloud cover and rain fall all of which will affect how the material in the plume is dispersed and deposited. High wind speeds will spread the plume material further down wind but over a narrower area than a low wind speed. Rain will wash material out of the plume quicker than dry deposition and therefore there will be higher concentrations deposited closer to the source of release than there would be if it were dry. It is this dispersion and deposition of radioactive material in the environment that leads to the exposure of members of the public either by direct radiation or by the intake of activity through inhalation or ingestion.

Direct Radiation

Radioactive material in the plume or deposited on the ground or surfaces will emit radiation. If this radiation is beta or gamma then human beings in the local vicinity of the material and/or the plume will receive a radiation dose. Once the plume has passed over however then there will only be exposure due to the deposited material.

Ingestion of Activity

Radioactive material from the plume will be deposited on land and water. If the land is being used for agriculture then it is possible that the material will be deposited on crops or vegetation which is eaten by livestock. Where this occurs it is possible that the radioactivity is passed on to human beings through contaminated food stuffs and drinking water. Where the accident has released radioactive iodine then this may get into the milk supply through cows grazing on contaminated fields.

Inhalation of Activity

As the plume passes over an area anybody outside in the open will be exposed to the airborne radioactive material carried along in the plume. This material will be breathed in and deposited in the lungs and then transferred around the body.

Basic radiation facts

Countermeasures

How much dose is received by members of the public will depend on how much material has been released, which pathways they have been exposed by and what if any countermeasures have been implemented. Countermeasures include evacuation, sheltering, ban on certain food stuffs and in the case of a reactor accident the taking of stable iodine tablets. These countermeasures have the effect of reducing the exposure to members of the public from the pathways described above.

2014 Alarm/Demo Calendar

Key:

- Scheduled monthly DSRL Alarm tests
- Demonstration Exercise
- Scheduled monthly Vulcan Alarm tests
- Demonstration Exercise

JANUARY

S		5	12	19	26
M		6	13	20	27
T		7	14	21	28
W	1	8	15	22	29
T	2	9	16	23	30
F	3	10	17	24	31
S	4	11	18	25	

FEBRUARY

S		2	9	16	23
M		3	10	17	24
T		4	11	18	25
W		5	12	19	26
T		6	13	20	27
F		7	14	21	28
S	1	8	15	22	

MARCH

S		2	9	16	23	30
M		3	10	17	24	31
T		4	11	18	25	
W		5	12	19	26	
T		6	13	20	27	
F		7	14	21	28	
S	1	8	15	22	29	

APRIL

S		6	13	20	27
M		7	14	21	28
T	1	8	15	22	29
W	2	9	16	23	30
T	3	10	17	24	
F	4	11	18	25	
S	5	12	19	26	

MAY

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M		5	12	19	26
T		6	13	20	27
W		7	14	21	28
T	1	8	15	22	29
F	2	9	16	23	30
S	3	10	17	24	31

JUNE

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M	2	9	16	23	30
T	3	10	17	24	
W	4	11	18	25	
T	5	12	19	26	
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S	7	14	21	28	

JULY

S		6	13	20	27
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T	1	8	15	22	29
W	2	9	16	23	30
T	3	10	17	24	31
F	4	11	18	25	
S	5	12	19	26	

AUGUST

S		3	10	17	24	31
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T		7	14	21	28	
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SEPTEMBER

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OCTOBER

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NOVEMBER

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DECEMBER

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