UKAEA
Restoring our Environment

UNITED KINGDOM ATOMIC ENERGY AUTHORITY

Radiation (Emergency Preparedness & Public Information) Regulations 2001 (REPPIR)

ASSESSMENT REPORT FOR THE DOUNREAY SITE

Issue 3

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Statutory Instrument No. 2975 "The Radiation (Emergency Preparedness and Public Information) Regulations (2001)", Regulation 6.

PREFACE

The UK nuclear industry has a long history of safe operation. The safety standards used in the design, construction, operation and maintenance of nuclear installations reduce to a very low level the risk of accidents that could have a consequence for the general public. Nonetheless, prudence requires the preparation of plans for dealing with such events. The Nuclear Installations Act which is used to control the activities on civil nuclear installations in the UK requires by the licence granted under that legislation that emergency arrangements be in place and that they are adequate.

The principal source of risk to the public from most nuclear accidents will be the release of materials that emit ionising radiation. The risk to health from ionising radiation has been the subject of intensive study and research for many decades. From the results of this work and observation the effects on people exposed to radiation, the International Commission on Radiological Protection (ICRP) has made recommendations on the principles to be adopted for protection against ionising radiation and on a system of dose limitation, both for people exposed to radiation at work and for members of the public in the event of accidents.

Everyone is exposed continuously to natural sources of radiation. Many people receive additional low doses of radiation from artificial sources such as medical X-rays. The principal harmful effect of small doses of radiation is to increase the possibility in cancer in later years, but very high doses can lead to other serious illnesses in the short term. Although a direct relationship between radiation dose and harmful effects has been observed only in people exposed to relatively high doses of radiation, for the purposes of radiological protection it is assumed that any dose of radiation, however small, carries with it some risk to health. In making its recommendation on annual limits of radiation dose to workers and members of the public the ICRP has used this cautious assumption. The National Radiological Protection Board (NRPB), an independent statutory body within the UK, has specified Emergency Reference Levels (ERL) using the ICRP recommendations, which are levels of radiation dose to the public which would justify introducing a given countermeasure to stop people receiving such a radiation dose. The application of the various countermeasures (evacuation, sheltering and the issue of stable potassium iodate tablets and the control of foodstuffs and water supplies) are based on these ERLs. The NRPB has balanced the risk from the potential radiation exposures and those that may be associated with the implementation of any of these countermeasures. The REPPIR Radiation Emergency limit is 5mSv, which is slightly higher than the lowest NRPB sheltering ERL (3mSv).

In the event of an emergency provision is required under The Radiation (Emergency Preparedness and Public Information) Regulations (2001) (REPPIR) for the following five aspects to be included in the response to a Radiation Emergency:

a) The control of the accident at the site.

b) The assessment of the actual and potential accident consequences and alerting the relevant authorities and the public.
c) Introduction of countermeasures to mitigate the consequences as regards
   i. individuals who could be affected in the short term and
   ii. longer-term effects such as the contamination of food supplies, land and adjoining waters.
d) Information to the public affected or likely to be affected by the event.
e) The return to normal conditions.

Agreed Emergency Plans in place for the Dounreay site are adequate to deal with the items above. The Emergency Plans are based on rigorous Fault Study Analysis and are drawn up against identified worst case bounding accident on the premises. Nuclear facilities and operations are designed on the principals of passive safety and defence in depth, such that reasonably foreseeable accident scenarios develop gradually following an initiating fault. The primary concern is always to avoid any radiation exposure to the public and therefore to rectify or mitigate the fault before a threat can develop to the public outside the site. Nevertheless, as soon as the fault occurs, the question of emergency action has to be considered. Pre-determined actions, which may eventually lead to notification of off-site agencies and the public, would begin. Emergency actions to protect the public may therefore be initiated in circumstances where the accident consequences are prevented or mitigated before the accident escalates to the point where a REPPIR Radiation Emergency might have been declared.

The Dounreay emergency actions are based on a) identified bounding accidents and b) the principle of extendibility.

a) A defined zone closely surrounding the installation, the Dounreay Emergency Planning Zone (DEPZ), within which arrangements are put in place to protect the public by introducing countermeasures that are planned in detail.
b) Emergency Plans need to be capable of responding to accidents which, although extremely unlikely, could have consequences beyond the boundaries of the DEPZ.

Whilst events that go beyond the bounding accidents can be postulated, such events are, by definition, not reasonably foreseeable. The measures that are required to extend the detailed arrangements cannot reasonably be anticipated; the nature of an accident and its potential consequences can vary widely, for example according to the ambient weather conditions, and the implemented response would be based upon an assessment of conditions at that time. Such a response would augment the Dounreay Emergency Plan with aspects of local and national plans already prepared to deal with a wide range of emergencies.

In an emergency those who normally provide services/carry out protective functions for the public will continue to do so, but in a co-ordinated manner which has been carefully planned and rehearsed. A considerable number of different authorities will be engaged, each applying its expertise to the situation as it develops. This off site emergency response depends on:

- Co-ordination, both locally and nationally, between centres which will be dealing with public protection and information and those dealing with the incident on the site and
- In particular both a local and national facility for co-ordinating information and for making public the best assessments that can be made.

The national response for dealing with a nuclear accident follows the key principles applied by Government in responding to any civil emergency. Firstly, the initial response should be at a local level where control of an accident and its most immediate effects can be dealt with effectively. Secondly, there should be a single lead department to co-ordinate the Government's response at the national level. For nuclear emergency planning the lead department is the Department of Trade and Industry with the Scottish Executive carrying out this function in response to nuclear sites located within Scotland.

Over the lifetime of the Dounreay site the Emergency Plans have been rehearsed and tested during numerous emergency exercises, both on site and off site, to the satisfaction of the Nuclear Installations Inspectorate (NII), the industry Regulators. The Emergency Plans are regularly reviewed in consultation with the relevant agencies.

1 INTRODUCTION

This document is the report to the Nuclear Installations Inspectorate (NII) of the hazard identification and risk evaluation for the UKAEA Dounreay licensed site [2] as required under regulation 6(4) of The Radiation (Emergency Preparedness and Public Information) Regulations 2001 [1].

Section 2 gives the location and brief description of the site. Section 3 lists the major radionuclide inventories on site and Section 4 the safety controls designed to ensure that they are no major releases of radioactivity from the site. The sequences that could lead to a release of radioactivity from site are described in Section 5 and the implications of such releases in Section 6. Section 7 gives a summary and presents some conclusions.

2 LOCATION AND ENVIRONMENT

The operator of the Dounreay Licensed Nuclear Site is:-

UKAEA
B521 Harwell
Didcot
Oxfordshire
OX11 0RA

The postal address of the premises is:-

UKAEA
Dounreay
Thurso
Caithness
Scotland
KW14 7TZ

The Local Authority is:-

The Highland Council
Glenurquhart Road
Inverness IV3 5NX.

UKAEA Dounreay is a Nuclear Licensed site [2] located approximately 12km west of Thurso. The Nuclear Licensed site is some 54 hectares in area and is built on the site of a former Admiralty airfield and adjacent farmland.

The Vulcan Naval Reactor Test Establishment (NRTE) is located immediately west of the UKAEA Dounreay Licensed Nuclear Site. The boundaries of the UKAEA Dounreay licensed site and Vulcan NRTE are as indicated in Figure 1. Nuclear hazards presented by Vulcan NRTE are addressed within its own REPPIR submission [4].

Over the first 20 years that the site was opened, three reactors were built – the Dounreay Fast Reactor (DFR), Prototype Fast Reactor (PFR) and the Dounreay Materials Test Reactor (DMTR). All are now closed and being decommissioned

Management at the site is now focussed on decommissioning of the reactors, ancillary nuclear facilities and the restoration of the environment.

Aqueous discharges are via a pipeline discharging into the Pentland Firth.

Airborne discharges are via designated stacks.

The site is subject to regular inspection and approval by the HSE's Nuclear Installations Inspectorate (NII).

The site has been operational since 1955.

Figure 2 shows the Dounreay Emergency Planning Zone around the site. Within the 5km Dounreay Emergency Planning Zone there are approximately 200 households (a permanent population of about 550 people), including:

- Reay village.
- Achvarasdal care home.

Also within the 5km radius Dounreay Emergency Planning Zone (DEPZ) are:

- Reay Primary School.
- Reay Golf Course.
- Dounreay Visitor Centre.
- Vulcan NRTE (an MoD shore-based submarine reactor test establishment).

The prevailing wind direction is north westerly

The underlying bedrock at Dounreay is primarily Devonian sandstone and geology is particularly stable. Dounreay is, therefore, less susceptible to significant seismic events than is the case elsewhere in the UK.

The prevailing wind direction is from the north-west.

A stream, the Mill Lade, flows south to north through the Dounreay site to the Pentland Firth. Groundwater flow is towards the Mill Lade and towards the north coast.

Two fuel reprocessing plants have operated at Dounreay for the recovery of fissile material from irradiated nuclear fuel. Both are now shut down, undergoing post-operational clean out in preparation for decommissioning.

Operations and facilities on the Dounreay site include:

- Storage of irradiated fuel.
- Storage of high active liquid waste.
- Storage of unirradiated fuel.
- Uranium fuel element production.
- Processing and storage of liquid and solid intermediate level waste.
- Processing and storage of solid low level waste.

Other processes and facilities at Dounreay are geared to support these operations.

Continued processing and manufacture of nuclear material is required to:-

- Reduce the holdings of fissile material on-site.
- To convert radioactive waste holdings to a form suitable for long-term storage in accordance with HM Government Policy.

3 RADIOACTIVE SUBSTANCES ON-SITE

The diverse nature of operations on the Dounreay Site has resulted in the presence of a wide range of radioactive materials, including uranium, plutonium, fission products and neutron activation products. The on-site inventories of radioactive and fissile material have been assessed by the Dounreay Site Restoration Plan [3]. The main parts of the site radioactive material inventory are as follows:

- Irradiated Fuel
- Unirradiated Fuel
- High Level Waste
- Intermediate Level Waste

These sources of radioactivity are controlled and are stored on site. Permitted discharges and waste disposals to the environment associated with the work of the site are controlled in accordance RSA93, and are governed by Authorisations issued by SEPA.

All discharges are a small fraction of the authorised limits agreed with the Scottish Environment Protection Agency (SEPA).

Dounreay has an established history of nuclear operations, which will continue for some time as the Dounreay Site Restoration Plan [3] is implemented. The on-site inventory will reduce over the next 50-60 years as material is moved off-site for disposal, storage or processing in accordance with HM Government Policy. After that time, any remaining radioactive material at Dounreay will have been processed and packaged into a non-dispersible, and hence in a passively safe, form suitable for long term storage.

Dounreay stores or processes nuclear material in quantities that exceed Schedules 2 and 3 of REPPIR [1]. It is, therefore, concluded that facilities and operations at Dounreay must be assessed under REPPIR and that the provisions of that Act fully apply.

4 SAFETY CONTROLS

Any plant commissioned in the UK must be supported by a safety case that demonstrates:

- that the plant is safe in normal operation,
- that the design is robust enough to ensure that any departures from normal operation do not lead to accidents, and
- that provisions are made to intercept accidents as they develop or to mitigate their consequences.

The design of the plant is based upon the fundamental requirement of radiological safety to do all that is reasonably practicable to minimise operational doses, risks and the initiation of abnormal events. The last factor requires consideration of how to prevent deviations from the planned normal operations escalating to major accidents. This is achieved by careful design

with redundancy, diversity and segregation of safety functions to minimise dependencies between the protective systems, which deal with deviations from the planned operating envelope. Further, mitigation is applied to minimise, so far as is reasonably practicable, the consequences of any accident. Hence there is a philosophy of having defence in depth in all nuclear plant to ensure, so far as is reasonably practicable, the safety of all people in and around the plant.

The primary design concept is to contain the radioactive material and radiation. This includes, where appropriate having material in a form which intrinsically retains radioactivity within the normal range of operational temperatures and environments. Extra containment barriers can be used to restrict the release of any radioactivity that does escape from its normal location. These barriers can be passive or dynamic. As appropriate, approved codes of practice are implemented for the design and operation of ventilation systems, decontamination systems or pressure vessels to allow work with radioactive materials without contamination of the normally manned working areas or of the wider environment. Massive barriers are used when radiation shields are required. The maintainability and fault tolerance of these safeguards is an integral part of the design process.

There are many barriers, engineered and procedural, to ensure that the release of radioactivity to the environment is kept as low as reasonably achievable. These ensure that the equipment used is well designed, built and maintained and is operated within its safe working range. The required number of such barriers and the types of barriers implemented are determined in accordance with the assessed hazards and risks.

4.1 ENGINEERING CONTROLS

All safety critical equipment is carefully designed, well built, thoroughly tested and examined, operated under carefully considered limits, maintained according to a maintenance schedule and operated within specification by trained staff. The safety arguments for the equipment and its operation are prepared by suitably qualified and experienced personnel and subjected to careful review both internally and external to UKAEA. All new equipment or changes in the operating envelope are considered by a nuclear safety committee containing external experts and as well as UKAEA representatives, including internal regulators. This committee expects all papers and designs submitted to it to have been subjected to rigorous safety assessment and independent Peer Review

4.2 SYSTEMATIC ANALYSIS

The UKAEA Safety Case production process provides for a systematic review process identifying the factors, which could potentially lead to a major release of radioactivity. This provides a comprehensive schedule of initiating events and analysis of the potential consequences and probabilities of each. The Safety Case process is applicable to continued operation of existing plant, modifications and new construction as well as the ultimate decommissioning of redundant facilities.

The first consideration is to do all that is reasonably practicable to avoid the initiating event occurring, or at least to minimise its likelihood. Wherever possible, nuclear facilities and processes are selected on the basis of passive intrinsic safety, such as the avoidance of high pressure or temperature processes and, wherever practicable, multiple physical containment barriers. Process design will be such that processes follow a logical sequence with potential deviations designed out.

Having done all that is reasonably practicable to prevent the initiating event from occurring there may still be some identified events with the potential to develop into a major release. In these cases further protection is provided to enhance safety. The safety philosophy ensures that protection provided is commensurate with the risks involved. Thus for potentially serious events there must be both redundancy and diversity in the methods used to identify the initiation of the fault and to bring the system back into a safe condition. These safety systems are segregated such that the likelihood of all barriers being compromised is minimised.

4.3 DETECTION AND MITIGATION

UKAEA is required to sample and monitor all radioactivity discharge points. Stack discharges are continuously monitored giving additional rapid warning of abnormal plant conditions.

Radioactive aqueous activity discharges are sampled and analysed by the originating facility prior to sentenced discharge to drain. The collected liquor is further sampled and analysed prior to discharge to sea, giving a further opportunity to detect abnormal plant conditions and to undertake appropriate remedial actions.

Furthermore, there are a number of on and off-site airborne activity and radiation monitoring stations, which again assist early detection of abnormal conditions.

Most radiation accidents will occur as a result of an identifiable plant event during a process where operational personnel are present. On-site emergency services and incident response teams will, therefore, mobilise rapidly in accordance with established and regularly practised on-site emergency procedures.

Following a minor on-site accident, the UKAEA incident control team may deploy an off-site radiological survey team. This will verify the incident magnitude.

4.4 MANAGEMENT SYSTEM

All designs and modifications of nuclear plant are subjected to detailed safety reviews of the engineered systems and the operating/maintenance procedures. When relevant this extends to reviewing changes to organisational structures and resources. Independent expertise is used to check major changes within plant. The whole process is scrutinised by the Dounreay Nuclear Safety Committee.

The Director is responsible for the safe operation of UKAEA Dounreay, and has overall responsibility for ensuring that adequate numbers are staff are present on site to operate the plants and ancillary plant in a safe manner, and that these staff are suitably qualified and experienced.

4.5 STAFFING

Each department has a team of personnel, all of whom are suitably qualified and experienced for the work which they are expected to perform. Nuclear Site Licence condition 36 requires that changes to the structure or number of employees that are utilised by UKAEA and that could impact on safety are assessed and approved by the NII.

A continuous shift system operates at Dounreay which ensures that there are adequate staff resources available at all times to operate the site safely and to deal with any emergency

situations which might arise. This includes shift cover provided by a dedicated on-site full-time professional Fire Brigade and Ambulance Service, fully trained in responding to any emergency, including radiological incidents. The shift teams are supported by a callout system that ensures that additional suitably trained and appointed staff can be summoned at all times to support, augment and relieve the shift staff.

4.6 PROCEDURES

It is a requirement of the Nuclear Site Licence that adequate quality assurance arrangements are made and implemented for all matters potentially affecting safety. These arrangements are specified in the top tier of a multi-tiered system, and define the requirements for procedures and instructions for the site as a whole. The lower levels are described below.

Dounreay Procedures apply to activities common to or involving all departments, where overall site control is required.

The top tier requirements for procedures and instructions are further developed on a departmental basis. Each head of department is responsible for the preparation and issue of sufficient procedures and instructions to adequately cover the work of their department.

Conditions for the safe operation of the plant are provided by the Safety Management Requirements, derived directly by the systematic Safety Case production process. The work needed to maintain the plant in a safe and reliable condition is specified by the maintenance schedules, which are optimised to meet the requirements demanded by the facility Safety Case.

4.7 REGULATORY CONTROL

The civil Nuclear Industry, which includes UKAEA, has a strong regulator in the NII which has an assigned Site Inspector for each licensed site. This Inspector has the right to inspect any equipment or procedure at short notice and the right to require UKAEA to provide information. The NII can order the shutdown of any process that it considers unsafe.

The NII require that the safety of plant and operations is considered in a systematic manner at all stages from planning, building, operating and decommissioning and that the safety case is subject to both continuous review and formal periodic review.

4.8 EMERGENCY ORGANISATION

UKAEA Dounreay has emergency plans that ensure that suitably qualified and experienced people are available at all times to respond to any events that cause the various plants to deviate from their normal operating conditions. The provision of an on-site plan and suitably qualified and experienced staff to respond to unusual events further reduces the probability of a major release of radioactivity to the environment.

The UKAEA Dounreay emergency plans are agreed with the NII and exercised regularly. Emergency Planning is discussed at meetings of the Nuclear Emergency Planning Liaison Group (NEPLG) and Nuclear Emergency Arrangements Forum (NEAF) which bring together nuclear operators (including UKAEA), government bodies, independent advisors and local authorities to ensure that best practice in emergency planning is communicated to all stakeholders.

5 POTENTIAL HAZARD SEQUENCES

The majority of potential faults which are identified cannot result in a Radiation Emergency, by virtue of the prevention and protection provisions described above. For significant off-site radiation exposure to be possible it is necessary that there be failures in each of the protective or mitigating barriers or controls. Significant public radiation exposure is credible only when failures of engineered systems and/or of managerial controls are compounded

5.1 CREDIBLE RADIATION EMERGENCIES

The systematic assessment of potential hazards ensured by the UKAEA Safety Case production process results in rigorous identification and assessment of a number of bounding accidents for the Dounreay Site, in particular accident sequences with potential for public exposure >5mSv are highlighted.

With progressive shut-down and decommissioning of facilities underway on the Dounreay Site, there are now very few reasonably foreseeable accident scenarios that could lead to a REPPIR Radiation Emergency, and even those few that remain are being gradually eliminated.

- No operational reactors remain on the Dounreay Site. A serious reactor accident leading to the release of short-lived fission products is impossible. Accidents during the handling or processing of "short-cooled" irradiated material are similarly impossible.
- Inadvertent discharges or leakage of stored liquid wastes at Dounreay cannot credibly result in a public exposure exceeding REPPIR thresholds.
- Radioactive material remains accumulated at locations on the Dounreay Site. A breach of containment could result in a release and off-site exposure >5mSv.
- Implementation of the Dounreay Site Restoration Plan requires that radioactive material be transported between facilities on the Dounreay site. An accident during such transport is credible.
- Whilst fissile material remains at Dounreay, UKAEA is obliged to assess the possibility and consequences of a criticality accident.

5.2 VULCAN NRTE

The Ministry of Defence operates a shore based Pressurised Water Reactor (PWR) at Vulcan NRTE, immediately west of and adjoining the Dounreay Site. Vulcan NRTE is subject to a separate REPPIR submission [4], but its proximity to Dounreay has resulted in close co-ordination of Dounreay and Vulcan NRTE Emergency Arrangements. A Radiation Emergency on one site will result in a proportionate emergency response from the other.

There have been no operational nuclear reactors at Dounreay since shut down of the Prototype Fast Reactor (PFR) in April 1994 and hence a major reactor accident at Dounreay involving the release of short-lived fission products, in particular ^{131}I, is impossible. There is, however, such potential from the operational PWR at Vulcan NRTE.

Pre-distribution of potassium iodate tablets is unnecessary to mitigate potential Radiation Emergencies originating from Dounreay, but is required to address a potential Radiation Emergency at Vulcan NRTE. The Vulcan NRTE 2km Pre-Planned Countermeasures Zone encompasses the Dounreay Licensed site and potassium iodate tablets are pre-distributed at Dounreay, attached to Site Emergency respirators.

6 IMPLICATIONS

It is recognised that despite the careful and systematic manner in which nuclear operations are conducted, and the multiple layers of protection, there remains the remote possibility of a radiation exposure to a member of the public from an accident at UKAEA Dounreay.

The severity of a radiological accident depends upon its location, the quantity of radioactive material involved, its chemical and physical properties, its isotopic composition, the nature of the accident, the immediate incident response and the prevailing weather conditions. Table 1 summarises the prediction of consequences of a Dounreay Radiation Emergency in respect of the imposition of dose aversion counter-measures in relation to NRPB recommended ERLs. Where the accident results in an airborne activity release, the assessment assumes Dounreay average weather conditions. Category D weather corresponds to a period with little sun with significant cloud cover and occurs about 75% of the time at Dounreay.

UKAEA policy is to undertake "worst case" bounding assessments with consequences encompassing all reasonably foreseeable eventualities. Pessimistic assumptions would include worst case release fractions, failure of engineering system and failure to prevent escalation. Radiological consequences identified by such assessments will over-estimate reality, but are nonetheless essential to define the credible accident envelope and hence the scope of the required Emergency Plan.

6.1 BREACH OF CONTAINMENT.

A breach of containment with a fire at a facility handling radioactive material is assumed. leading to an airborne release and exposure of persons downwind, primarily via inhalation.

The bounding assessment indicates that potential consequences >5mSv extend up to 250m from the accident.

6.2 CRITICALITY.

A criticality accident in an unshielded facility would have off-site consequences >5mSv, although the shielding provided by other structures on the Dounreay Site give significant mitigation of the potential consequences.

The energy released during an initial short duration criticality burst usually disrupts the critical assembly, stopping the chain reaction and limiting actual dose uptakes.

The bounding assessment indicates that persons within 1.2km could receive a dose >5mSv, however exposure following a criticality event is highly unlikely since there would almost certainly be no ongoing nuclear reaction following the initial very short duration radiation burst.

6.3 CONSEQUENCES AND REQUIREMENT FOR COUNTER-MEASURES.

Radiological accidents can occur over periods varying from a few seconds to several hours, depending upon the particular circumstances of the incident and the level of damage. Accidents resulting in declaration of a Radiation Emergency can reasonably be expected to last several hours with the emergency response implemented over a similar timescale. An incident duration of four hours has been assumed in formulation of the Dounreay Emergency Plan.

Table 1 indicates the bounding accidents and compares them to the REPPIR 5mSv Radiation Emergency level and derives the applicable distance for which countermeasures could be imposed by comparison with the applicable NRPB Emergency Reference Level (ERL).

Table 1 Bounding Accident Summary – Breach of Containment

Dose Aversion Mechanism		**Averted Dose Potential (mSv)**	**Distance from point of Release (m)**
Shelter (CED)	Lower ERL	3	350
	Upper ERL	30	100
Evacuation (CED)	Lower ERL	30	100
	Upper ERL	300	50
Potassium Iodate Tablets	Lower ERL	No ^{131}I release potential from UKAEA Dounreay.	
	Upper ERL		

In the unlikely event of a Radiation Emergency at UKAEA Dounreay, the dose to the general public can be reduced by the appropriate imposition of appropriate countermeasures including instructions to shelter, which reduces inhalation dose and direct radiation, and evacuation, which removes people from the affected area.

Controls may be also applied to locally produced food under instructions from the Food Standards Agency. Since food production techniques can concentrate some radioisotopes it is possible that food bans could be imposed over a wider area than evacuation or shelter instructions.

Historically, UKAEA Dounreay has adopted a 5km radius DEPZ centred upon an operational reactor. With all reactors at Dounreay now shut down and the progressive shut down, post-operational clean out and decommissioning of other facilities at Dounreay, radiological consequences of reasonably credible faults no longer demand such a large DEPZ. Potential Radiation Emergencies could, however, originate from a variety of locations across the Dounreay Site and a conservative 5km radius DEPZ, now centred upon the geographical centre of the Dounreay nuclear licensed site is retained (see Figure 2). This, by default, addresses all reasonably credible potential Dounreay radiological emergencies.

Implementation of a conservative 5km radius DEPZ creates no significant problems for UKAEA at Dounreay:

- the area around Dounreay is sparsely populated.
- retention of a 5km radius DEPZ perpetuates established offsite Emergency Arrangements.
- UKAEA Dounreay resourcing is geared to a 5km DEPZ

It is highly unlikely that any person beyond the DEPZ could be exposed to a dose high enough to require prompt countermeasures to be applied, although restrictions on the sale of food may apply over a larger area.

The timely imposition of countermeasures would require the existence of an off-site emergency plan. It is therefore concluded that there is merit in maintaining such a plan.

Higher consequence events than those envisaged by the DEPZ can be postulated, however their occurrence is not reasonably credible. Despite this, it is concluded that such events can

be met by extension of the Dounreay Offsite Emergency plan beyond the DEPZ as warranted by circumstances.

7 SUMMARY

Assessments demonstrate that it is extremely unlikely that there will be a Radiation Emergency at UKAEA Dounreay. The facilities on site are carefully designed, built and operated in a manner that assures safe operation.

As discussed in this report, internal scrutiny of safety of design and operation is intense and the NII is a regulator with powers to demand improvements and to shutdown operations if appropriate.

Even so it is considered prudent to have adequate emergency plans to protect the general public in the event of a Radiation Emergency. The scale of these plans is guided by the potential off-site release of radioactivity in the event of a "bounding accident".

The bounding accident could lead to doses in excess of 5mSv to unprotected members of the public out to a range of about 250m. Shelter and evacuation are prompt countermeasures that could be applied to reduce the dose uptake by the general public. Food restrictions initiated by the Food Standards Agency may affect a wider area and for longer.

Conservatively, a 5km radius DEPZ is perpetuated and centred upon the geographic centre of the site to bound the requirements of all reasonably credible radiological emergencies, as is the option of implementation of short-term countermeasures further afield.

The off-site emergency plan will be maintained to ensure the timely and orderly imposition of those countermeasures that would be of benefit in the event of an accidental release of radioactivity.

8 REFERENCES

[1] Statutory Instrument 20001 No. 2975 "The Radiation (Emergency Preparedness and Public Information) Regulations 2001".

[2] Site Licence No: Sc6 "Nuclear Installations Act 1965 (As Amended) Nuclear Site Licence United Kingdom Atomic Energy Authority Dounreay".

[3] DSRP(00)P001 "Dounreay Site Restoration Plan": Volume 6.

[4] "Ministry of Defence. Vulcan Naval Reactor Test Establishment (NRTE). Report of the Assessment of the Hazard Identification & Risk Evaluation. Radiation (Emergency Preparedness & Public Information) Regulations Regulation 6 & Schedule 5." Issue 1, February 2002.

Figure 1 Dounreay Site Plan (including NRTE Vulcan).

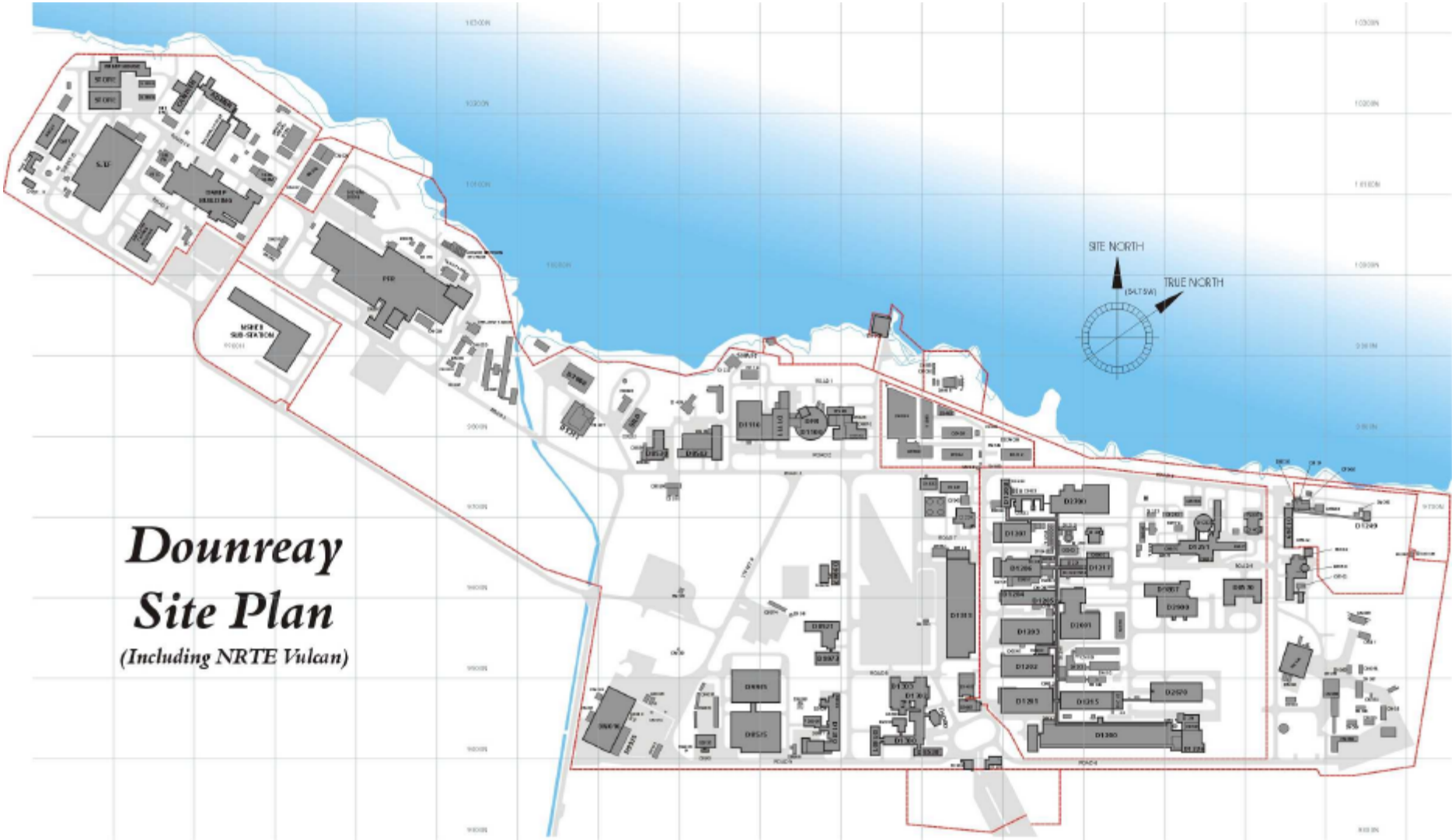

Figure 2 Dounreay Emergency Planning Zone.