
NORTH AYRSHIRE COUNCIL

27th September 2022

Cabinet

Title:	Determination of the Detailed Emergency Planning Zone (DEPZ) for Hunterston A and B Nuclear Power Stations
Purpose:	To agree the extent of the Detailed Emergency Planning Zone (DEPZ) for Hunterston A and B Nuclear Power Stations, under the Radiation (Emergency Preparedness and Public Information) Regulations 2019 (REPPiR).
Recommendation:	Cabinet agrees to (1) determine the DEPZ for Hunterston A as 0km as recommended by the Operator and (2) determine the boundary of the DEPZ for Hunterston B to 1.08km and to be extended to utilise the natural roads and topography as shown delineated in blue on the plan at Appendix 4 attached to this report.

1. Executive Summary

- 1.1 The Radiation (Emergency Preparedness and Public Information) Regulations 2019 (REPPiR) requires the Council to determine the boundaries of the DEPZs (Detailed Emergency Planning Zones) around Hunterston A and B Nuclear Power Stations.
- 1.2 The boundaries of the DEPZs must be **‘on the basis of’** the Operators’ recommendations contained within their ‘Consequences Report’. The Consequences Report for Hunterston A has been reviewed in accordance with the Regulations and the recommendation of the Operator is that the DEPZ for Hunterston A should remain at 0km.
- 1.3 As the defueling process has commenced at Hunterston B, a revised Consequences Report was required. This revised report recommends a reduction in the distance in which protective measures are required to 1.08km. The Council has limited powers to extend the boundary beyond that which it is recommended.

2. Background

- 2.1 The REPPiR legislation became part of UK law on 22 May 2019. It applies to all nuclear sites across the UK and is not specific to Hunterston. Regulation 8 places a duty on local authorities to determine the size and shape of the DEPZ around such sites. This duty was previously held by the Office of Nuclear Regulation (ONR) as regulator.
- 2.2 Regulation 8 of REPPiR requires that the Council determines the boundary of DEPZs **“on the basis of”** the Operator’s recommendation. It is the duty of the Operator (Magnox for Hunterston A and EDF for Hunterston B), not the Council, to assess the risks in relation to the sites through “hazard evaluation”. The DEPZ can only be extended in the following circumstances:
- a) local geographic, demographic and practical implementation issues;
 - b) the need to avoid, where practicable, the bisection of local communities; and
 - c) the inclusion of vulnerable groups immediately adjacent to the area proposed by the operator

The Council therefore has limited discretion in setting the zone.

Hunterston A

- 2.3 Hunterston A is a decommissioning site and was no longer considered a risk under REPPiR 2001 in 2016. The DEPZ for Hunterston A was set at 0km with the outline Planning Zone set, in terms of the regulations, at 1km. In terms of REPPiR 2019, the Operator still requires to review its hazard evaluation and a revised Consequences Report has been prepared which is attached at Appendix 1.
- 2.4 The Consequences report concludes that the DEPZ for Hunterston A should remain at 0km. The OPZ is set at 1km in accordance with REPPiR

Hunterston B

- 2.5 Hunterston B entered the defueling process on 7 January 2022. This resulted in the Operator reviewing the hazard evaluation in accordance with REPPiR. During generation phase, the protection measures in place within the DEPZ were:

- Sheltering;
- Evacuation;
- Administration and distribution of stable iodine

2.6 The Operator's Consequences Report following a hazard evaluation to take into account the significant operational change at Hunterston B, is attached at Appendix 2. It concludes that:

- Stable Iodine is now no longer justifiable as an appropriate protection action due to a reduction in radioiodine isotopes.
- evacuation is only required within a radius of 300M from the reactor. There are no permanently / regularly occupied residences or commercial properties within this distance and therefore it is not recommended that planning is conducted to evacuate in this area.
- a 1.08 km zone for sheltering (rather than 2km previously recommended and set at 2.4km)

2.7 All residents living within the DEPZ currently receive a calendar every year advising them of what to do if an emergency is declared. EDF provide a telephone warning service whereby residents can register to be notified by telephone if an emergency is declared and they can shelter in their homes. This provision will continue. Arrangements will require to be in place to consider transient individuals who may be using the coast path as there is no appropriate shelter available and this is included in the off site contingency plan.

2.8 In an emergency, immediate advice will be provided within the DEPZ to restrict consumption of leafy green vegetables, milk and water from open sources / rainwater. Planning arrangements will include consideration that this may be extended to a distance of 41km after taking appropriate advice.

2.9 The Outline Planning Zone for Hunterston B has not changed and remains the same as when Hunterston B was in its generating phase (30km). This boundary is set by REPPIR.

The Extent of the Discretion Available to the Council

2.10 Under the REPPIR regulation 8, the Council's duty does not stand alone and forms part of a wider series of duties exercised by other bodies. The Council cannot exercise functions of these other bodies and vice versa.

2.11 To fully understand the extent of the discretion available to the Council, it is necessary to detail the various functions involved in REPPIR, and who exercises them. REPPIR sets out the following approach to the different responsibilities of Council and Operator:-

- Firstly it is the duty of the Operator, not the Council, to assess the risks from generation of nuclear power at the site. In terms of Regulation 4 this is referred to as the hazard evaluation.
- Secondly, UK Health Security Agency (UKHSA) (formerly Public Health England (PHE)) determines the thresholds or Emergency Reference Levels (ERLs) which are relevant to sheltering and evacuation. This is relevant as the DEPZ is the area within which it is necessary to shelter to meet these Emergency Reference Levels. Emergency Reference Levels are a system designed primarily for the planning of protective actions as a means to decide whether, on balance, the action does more good than harm. ERLs are expressed in *averted dose*, that is the amount of radiation dose which can be saved as a result of implementation of the protective action. This averted dose reduces the risk from radiation but must be balanced against the potential harm that is associated with the protective action itself. The ERL system takes into account this non-radiation harm, and so presents a simplified approach to support decision making and planning. Each of the three protective actions (sheltering, evacuation, stable iodine) has an upper and lower ERL. UKHSA's advice is to always plan to use the lower ERL which maximises the protection of the public and represents the largest justifiable area or radius. If the calculated averted dose is below the lower ERL then, on balance, the protective action may introduce more harm than good. If the averted dose is greater than the upper ERL then the protective action can nearly always be justified on balance.
- Thirdly, under Regulations 5 and 7, the Operator submits a Consequences Report to the Council. The details of what must be considered in this Consequences Report assessment are contained in Schedule 3 of REPPiR.
- The last step in this process is that under Regulation 8, the Council's determination of the boundary of the DEPZ. This must be '**on the basis of**' the operator's recommendation which can only be extended in limited circumstances. The Council also must have regard to the REPPiR Approved Code of Practice. Relevant extracts from this in relation to a local authority's duties under Regulation 8 (determination of DEPZ) appear in Appendix 3.

2.12 In its Consequences Report, EDF, for Hunterston B has considered a range of accident scenarios, taken from their hazard evaluation and have selected a candidate release as the basis of the consequences assessment. The candidate release assumes the most pessimistic attributes from a number of fault sequences in terms of time to release and quantity of activity released. It covers faults in all facilities on site and including the defueling operations.

EDF have therefore recommended the largest justifiable distances. The respective distances from their Consequences Report are:

- 300m for evacuation (although there are no houses within this distance) and;
- 1.08km for sheltering.

2.13 The Council cannot consider the risks from defueling operations at Hunterston; nor can the Council change the Emergency Reference Levels (ERLs) set by UKHSA. The Council is obliged to accept these and accept the Operator's Consequences Report. Essentially our role is restricted to fine tuning the boundary to align it with geographical features, avoid bisecting communities etc.

2.14 In exercising its limited discretion, the Council also needs to balance the benefits and disadvantages of any proposed boundary. As regards evacuation, having a wider DEPZ evacuation zone is something which could stop those within the immediate area from evacuating.

Determination of the DEPZ

2.15 The Council has received the Consequences Reports from both Operators. REPIR defines the factors which must be taken into account in any such Report. EDF Energy has considered a wide range of accident scenarios in the hazard evaluation process. It covers faults in all facilities on site including the defueling operations at the site.

2.16 The new recommended Minimum Geographical Extent distance for Hunterston B is now 1.08km. There are 14 properties contained within this area in which protective actions are required. The existing DEPZ as set in 2020 contains 54 properties. Any properties which will no longer be included within the DEPZ will be contacted and informed that they are no longer included and that protective actions are not required.

2.17 It is expected that as the defueling continues, the Consequences Report will indicate a lesser DEPZ until such times as there is no DEPZ (as is the case with Hunterston A).

2.18 There is no duty on the Council to consult widely in setting the DEPZ. However, all residents within the current DEPZ for Hunterston B have received notification of the proposed changes. At the time of writing this report, there have been no representations from the residents.

2.19 As stated above, the Council's role is to base the DEPZ on the Operator's Consequences Report, and to fine tune these boundaries based on the factors detailed in Regulation 8, namely:-

- a) local geographic, demographic and practical implementation issues;

- b) the need to avoid, where practicable, the bisection of local communities; and
- c) the inclusion of vulnerable groups immediately adjacent to the area proposed by the operator.

2.25 With regard to criterion (a) local geographic, demographic and practical implementation issues, this only allows Council to fine tune the boundaries which have been taken into account in proposing the recommended DEPZ to ensure inclusion of roadways as shown in Appendix 4.

In terms of (b) and (c) above, there are no communities bisected by the proposed 1.08km limit for Hunterston B and no vulnerable premises adjacent to it.

3. Proposals

- 3.1 To determine that the DEPZ for Hunterston A remains at 0 km in view of its decommissioning status and in accordance with the recommendation of the Operator's Consequences Report.
- 3.2 To determine that the DEPZ for Hunterston B, be set at 1.08km in accordance with the recommendation of the Operator's Consequences Report, with minor geographical revisions, as outlined on the plan in Appendix 4 of this report.

4. Implications/Socio-economic Duty

Financial

- 4.1 There are no financial implications as this work is chargeable to EDF under REPPIR.

Human Resources

- 4.2 It is not expected that this will result in any additional staffing requirements, but any such resources would be chargeable to EDF as Operator of Hunterston B

Legal

- 4.3 The Council requires to set the DEPZ in accordance with its statutory obligations as set out in REPPIR.

Equality/Socio-economic

- 4.4 There are no significant equalities or socio-economic implications of this report.

4.4.1 Children and Young People:

There are no significant implications of this report. Effective emergency planning arrangements support responders to deal with an emergency, and address the impact of an emergency on the population as a whole, children and young persons included.

Climate Change and Carbon

4.5 This report advises about revised emergency planning duties in relation to Hunterston A and B. Effective emergency planning arrangements support responders to deal with the environmental and other impacts of an emergency. It is important to recognise that this report is not about wider issues of the sustainability, hazards or environmental impact of nuclear power.

Key Priorities

4.6 Implementation of REPPiR as a whole will support the Council Plan theme of:

- Helping all of our people to stay safe, healthy, and active

Community Wealth Building

4.7 None

5. Consultation

5.1 There has been consultation with local Category 1 and 2 emergency planning partners, the Communications Manager, relevant officers in neighbouring authorities. Local residents within the DEPZ for Hunterston B have been advised of the content of the Consequences Report. Once the decision is made by the Council, those within the revised and current DEPZ For Hunterston B will be written to in order to inform them of the change and how this might affect them. There has also been consultation with UK Health Security Agency who are the authority who provide independent radiation advice to Councils across the UK.

Aileen Craig
Head of Democratic Services

For further information please contact **Aileen Craig, Head of Democratic Services**, on **01294 324125**.

Background Papers

- 1- Consequences Report for Hunterston A
- 2- Consequences Report for Hunterston B

- 3- REPPIR Code of Practice Extract
- 4- Proposed DEPZ area for Hunterston B

Radiation (Emergency Planning and Public Information) Regulations 2019

Consequences Report for Hunterston A Decommissioning Site

The following report is provided to the North Ayrshire County Council in accordance with REPPiR 2019, Regulation 7(5), with the particulars of the report in accordance with REPPiR 2019 Schedule 4.

Factual Information

(a) The name and address of the operator:

Mr M Blackley, Site Director,
Magnox Ltd.,
Hunterston A Decommissioning Site,
West Kilbride
Ayrshire
KA23 9RA

(b) The postal address of the premises:

Hunterston A Decommissioning Site,
West Kilbride
Ayrshire
KA23 9RA

Hunterston A is a decommissioning nuclear power plant site, without a significant presence of irradiated fuel.

(c) The date on which it is anticipated that work with ionising radiation will commence:

Work with ionising radiation is already underway at the premises.

Recommendations

(a) The proposed minimum geographical extent, if any

There is no distance beyond the site's boundary fence within which urgent protective action to mitigate harm from the unintended release of radioactive material may be needed.

It is recommended that no detailed off-site emergency planning is required.

Rationale

(a) The rationale for the above recommendation on the minimum distance for which urgent protective action may be needed is as follows:

Assessment carried out by Magnox Ltd has established that there is no event, whether caused by error or omission by the operators or caused by external factors, which can credibly result in the release of sufficient radioactive material from the Hunterston A site to the atmosphere to cause public serious harm. As such, there is no scenario where urgent protective action to reduce public dose uptake is needed.

There is a region close to the site where protective actions to mitigate public dose uptake could be considered in the highly unlikely event of a large aircraft impacting the site. If the impact were directly onto waste bunker 1 (a relatively small facility on the site), the resultant aviation fuel fire will cause the release of some radioactive particulates into the air. For members of the public within 80m of the site boundary, their dose could possibly exceed the lower ERL for sheltering (the point where the option to shelter the public should be considered) but nowhere beyond the site fence will it exceed the upper ERL for sheltering (the point where urgent protective action should normally be taken).

It has been established by assessment that in the most unfavourable weather conditions, the consequences of a large aircraft impact directly on to bunker 1 could lead to a dose of up to 13mSv.

This is for a member of the public who is as close as possible to the event, and who remains there for the whole period that the fires continue. The consequences of the scenario reduce with distance. For unfavourable weather conditions, the dose received during the whole course of the event will only exceed 5mSv within a distance of 180m from the centre of the site (effectively, this covers a 200m stretch of the public road passing the site; and only when the wind is blowing from the East). For people beyond this distance, the dose is sufficiently small it is unnecessary to take any action to mitigate the dose. It is likely that any actions taken by the authorities, such as requiring the public to shelter or to evacuate the area, will do more harm than that arising from the unmitigated dose. The majority of this dose uptake will arise whilst the fires in the bunker continue to burn, with the dose uptake caused by inhalation of the radiologically contaminated smoke. Whilst it would be appropriate to consider asking the public at this close location to take shelter to avoid dose uptake, given the true nature of the event (a catastrophic aircraft impact with a debris radius likely to be of the order of a few hundred meters) and the trivial health significance of the predicted dose, it would be difficult to judge this action should be a priority.

However, if the weather was typical for the location (i.e. a moderate breeze), the dose would not exceed 5mSv beyond the site fence and therefore would be below the lower ERL for sheltering.

Bunker 1 is currently being emptied of radioactive materials. It is anticipated that by the end of 2025, the bunker will have been emptied and after that time there will be no further scope for an event, of any credible nature, to result in a significant release of radioactive material from the Hunterston A site.



Hunterston B Power Station

Hunterston B Power Station REPPIR Consequences Report

The Radiation (Emergency Preparedness and Public Information) Regulations 2019

Originated By:	Emergency Planning Group	Date:	May 2022
Reviewed By:	Emergency Preparedness Engineer	Date:	May 2022
Approved By:	Technical and Safety Support Manager	Date:	May 2022

Revision	Amendment	Date
000	Full revision of the consequence report for the defuelling site status.	May 2022

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Purpose

This consequence report is required in regulation 7 of Radiation (Emergency Preparedness and Public Information) Regulations (REPPIR) 2019 for the Local authority to determine a Detailed Emergency Planning Zone (DEPZ). It sets out the technical justification for the minimum distance for the DEPZ around Hunterston B nuclear power station.

The key priority for EDF Energy Nuclear Generation Ltd (EDF NG) is the safe, reliable generation of electricity. Generating safely means the prevention of accidents, recognising the potential hazardous situations or malicious acts that may cause harm to the public, our staff, the environment, or the reputation of the company and managing these events should they occur

The likelihood of an event occurring at Hunterston B power station is minimised through safety considerations in the siting, design, construction and operation and the granting and compliance with a nuclear site licence regulated by the Office for Nuclear Regulation (ONR). A Nuclear Site Licence is granted only after the ONR has fully satisfied that the licensee is a capable operator and has made an adequate safety case for the station and developed appropriate safety standards. The implementation of these standards demonstrates that an accidental event which might lead to the release of even small amounts of radioactivity is extremely low.

Despite constant vigilance, the safeguards incorporated into the design and operation of plant and support systems, and a positive accident prevention culture, hazardous situations that challenge control can occur. Having well-rehearsed emergency arrangements in a state of readiness, as required by REPPIR 2019, provides an additional layer of protection to mitigate the effects of unforeseen events.

This consequences report is developed from REPPIR regulations 4 and 5, requiring the operator, EDF Energy, to conduct an evaluation of the work with ionising radiation at Hunterston B power station to identify the hazards which could cause a radiation emergency, as defined in REPPIR regulation 2 and to assess the potential consequences of a full range of emergencies.

This revised consequences report has been completed in line with regulation 6 of REPPIR due to the occurrence a material change in the work with ionising radiation at Hunterston B Power Station. Regulation 6 (1) requires that when a material change in the work with ionising radiation occurs, a review of the hazard evaluation is completed.

On the 7th January 2022 Hunterston B ceased generation permanently and moved into its “defueling phase”. EDF considers that this is a material change and has therefore reviewed the hazard posed by the site and the consequences of that hazard. The results of this reassessment are set out in this report.

1 Consequence Report

1.1 Name and Address of the Operator	EDF Energy Nuclear Generation Ltd. Barnett Way Barnwood Gloucester Gloucestershire GL4 3RS	
1.2 Premises details	Address	Hunterston B power station West Kilbride Ayrshire KA23 9QX
	Location	All distances mentioned in this report are a radius from the premises centre point Grid Reference NS 18570 51455, which is the centre of the reactor building and the location of the Irradiated Fuel Disposal Facility.
	Date of commencement of work with ionising radiation	Work with ionising radiation has already commenced at Hunterston B. The construction of the station started in 1968 and the station started generating electricity in 1976. Hunterston B permanently ceased generating electricity on the 7 th January 2022 and moved into its defueling phase.

1.3	Recommended Minimum Geographical Extent – Detailed Emergency Planning (DEPZ)	The Detailed Emergency Planning Zone for the site should be no smaller than 1.08km from the centre point noted above in section 1.2.
1.4	Recommended Distances for Urgent Protective Actions (sheltering, stable iodine tablets & evacuation)	<p>The rationale for the distances and timings for the recommendations in this section are set out in section 1.7.</p> <p>The assessments required under REPIR indicate detailed planning is justified for the urgent protective action of sheltering within a distance of 1.08km from the site for protection of the public.</p> <p>The protective action should be capable of being enacted as soon as is practical after the declaration of a Radiation Emergency has occurred to maximise the averting of dose.</p> <p>Stable iodine is not justifiable as an appropriate protective action due to a reduction in radioiodine isotopes.</p> <p>Appropriate arrangements should be considered in this area for individuals for whom it is not possible to offer appropriate shelter in solid buildings. This may include transient individuals, such as those using local recreational facilities.</p> <p>The assessments indicate evacuation is justified within 300m. This area does not include permanently/regularly occupied residences or commercial properties, therefore it is not recommended that planning is conducted in detail to evacuate the public as a default action within the detailed emergency planning zone. Evacuation within the DEPZ should be considered in outline planning arrangements in the event of a severe accident.</p> <p>It is recommended that immediate advice be issued to restrict consumption of leafy green vegetables, milk and water from open sources/rain water in all sectors of the Details Emergency Planning Zone and considered within 24 hours downwind of the site to a distance of 41km after taking appropriate expert advice.</p>

<p>1.5 Recommended Minimum Geographical Extent – Outline Emergency Planning (OPZ)</p>	<p>It is recommended that the Outline Planning Zone for the site be set as per REPPiR regulation 9 (1) a) and schedule 5 – (category 2) at 30km.</p> <p>Urgent protective actions, other than consideration of food restrictions, are not recommended within the OPZ. Outline planning should consider the implementation of protective actions in the OPZ for a radiation emergency which is considered extremely unlikely.</p> <p>It is recommended that that the outline plan consider the process for the implementation of shelter and evacuation uniformly throughout the OPZ, with or without a warning period.</p> <p>Planning in outline will enable implementation of protective actions based on the assessments made during an event and determined as appropriate based on the justification of the potential for averting exposure.</p>
<p>1.6 Environmental pathways at risk</p>	
	<p>A radiation emergency at Hunterston B would take the form of a gaseous or particulate plume containing radioactive material. This would put the following environmental pathways at risk:</p> <ul style="list-style-type: none"> • Grown foods – direct surface contamination and soil to plant • Animal products via ingestion • Water supplies through direct contamination and contaminated runoff
<p>1.7 Rationale</p>	
	<p>SELECTION OF SOURCE TERM</p> <p>EDF Energy has considered a wide range of accident scenarios in the hazard evaluation process and selected a candidate release as the basis of the consequences assessment. The candidate release assumes the most pessimistic attributes from a number of fault sequences in terms of time to release and quantity of activity released it, therefore, does not correspond to the release from a specific individual fault. It covers faults in all facilities on site, and is specific to the defueling operations at the site.</p>

POPULATION VARIABLES

As recommended by the UK Health Security Agency the exposure to the following population groups has been considered

- infants (0-1 year)
- children (1-10 years)
- Adults

Adults have been identified as the most vulnerable group.

Dose to the foetus and to breast-fed infants has been considered and it has been determined that the protective measures required for these do not exceed those required by the most vulnerable group identified above.

IMPACT OF WEATHER VARIABLES

The most significant consequences off site will occur from airborne radioactivity. The impact of the consequences is dominated by the weather conditions transporting the radioactive material off site. Extremes of weather, in this context, relates to the amount of dilution of the radioactive material that occurs during transportation. While higher wind speeds transport radioactivity over greater distances, the plume tends to move faster and affects a narrower area. Slow moving wind, with little or no turbulence, reduces the dilution of the radioactivity and presents the worst-case conditions for a release of radioactive material, as the release of radioactivity remains more concentrated as it moves off the site.

This becomes relevant in terms of the potential exposure through inhalation (amount of radiation per breath) and direct exposure as the release cloud or plume passes overhead. A full range of the atmospheric conditions occurring in the UK have been considered, along with the impact of rain, as this can 'wash' radioactivity out of the cloud or plume leading to a build-up of deposited activity where the rain falls raising levels of radiation in the environment and the potential of increased exposure through ingestion and direct exposure. The weather conditions used to develop the distances recommended in this report account for over 95% of the expected conditions at Hunterston B from an assessment of historic weather data. This aligns with the UK Health Security Agency recommended methodology to take account of pessimistic consequences due to unfavourable weather conditions as set out in report PHE-CRCE-50.

EMERGENCY RESPONSE TIME VARIABLES

The effectiveness of the urgent protective actions is determined by when implementation is achieved relative to the release and passage of the radioactive material. It is assumed that the most limiting scenario occurs when the release commences before emergency plans are activated.

Despite best efforts to rapidly assemble the emergency response organisation to determine the protection strategy and to notify members of the public to take action, the delay in doing this will reduce the effectiveness of the protective measures. A conservative time factor for implementing the protective measures of

2 hours has been considered when assessing distances determined by the effectiveness of protective actions. However the distances recommended in this report are based on a best-case scenario where protective actions can be implemented in advance of exposure occurring.

No assumptions should be made about the availability of a warning period to enact the emergency response and protective actions. Whilst faults could develop which would give a warning period before a release of radiation from the site it should not be assumed that this would be the case. Therefore any protective actions and emergency plans should be based on the conservative basis that no warning period would be available and should therefore be capable of being activated as soon as possible.

PUBLIC PROTECTION GUIDANCE

The UK Health Security Agency provide the UK guidance for emergency planning thresholds on dose for guiding decisions on actions. Emergency Reference Levels (ERL's) are dose criteria that apply to the justification and optimisation of sheltering-in-place, evacuation and administration of stable iodine. These are most appropriately expressed in terms of averted dose and are given in the table below.

Recommended ERLs for the planning of sheltering-in-place, evacuation and administration of stable iodine protective actions

	Effective dose or organ dose	Averted dose (mSv) ^a	
		Lower	Upper
Sheltering	Effective	3	30
Evacuation	Effective	30	300
Stable iodine	Thyroid ^b	30	100

^a In recognition of their higher cancer risk, the doses are those potentially averted in young children

^b mSv equivalent dose to the thyroid

The key objective with planning and deploying urgent protective actions is to achieve more good than harm in context of the risks from radiation exposure and the risks associated with the protective measure. Hence the arrangements in place should be proportionate to the risk and offer a trade-off between protection against radiation dose and the detriments that protective actions can have when implemented.

APPLICATION OF THE EMERGENCY REFERENCE LEVELS

The recommended minimum distance for detailed emergency planning is based on consideration of distances to which it would be proportionate to administer the urgent protective actions of evacuation, shelter and stable iodine based on the potential for those protective actions to avert dose in line with the Emergency Reference Level methodology.

As indicated in REPPIR, the lower ERLs are used in the determination of the distance for justifying detailed planning for implementing urgent public protective measures.

DISTANCE TO LOWER ERL FOR STABLE IODINE

One of the most significant hazard changes that occurs at a defueling nuclear power station is the reduction in radioactive iodine isotopes. Whilst these isotopes make up the largest part of a potential release from a generating nuclear reactor, once that reactor is shut down they reduce very quickly through the normal process of radioactive decay. Around 90 days after the process of fission stops within the reactor there is no longer sufficient radioactive iodine to give enough of a thyroid dose to justify the use of stable iodine tablets as a protective action.

The second reactor at Hunterston B shut down for the final time on the 7th January 2022. Therefore after the 7th April 2022 it is no longer justifiable to recommend stable iodine as a protective action for Hunterston B for either detailed or outline planning.

The assessments show that at 200m from the release point (roughly the site fence) an infant (the most vulnerable group for this specific exposure) would receive a maximum of 0.35mSv thyroid dose. It would therefore not be possible to avert sufficient dose to meet the lower reference level to justify stable iodine prophylaxis.

Furthermore, any residual radio-iodine in the source term will continue to decay with time, which will diminish the risk even further as the defueling programme progresses

DISTANCE TO LOWER ERL FOR SHELTERING

The distance across which it is justifiable to recommend shelter as a protective action has been calculated as ~1080m from the centre point between each reactor based on the lower emergency reference level for an adult, identified as the most vulnerable group. This distance is calculated accounting for the Dose Reduction Factors set out in Schedule 3 of REPPiR.

DISTANCE TO LOWER ERL FOR EVACUATION

The distance across which it is justifiable to recommend evacuation as a protective action has been calculated as ~300m from the centre point between each reactor based on the lower emergency reference level for an adult, identified as the most vulnerable group.

This area is contained within the site fence in a number of directions and exceeds it by approximately 150m elsewhere. This distance falls some way short of the nearest residential building (~700m) and does not reach the boundary with Hunterston A Power Station (~350m). It is therefore judged that the use of evacuation as a default urgent protective action within the Detailed Emergency Planning Zone is not justified. Evacuation within the DEPZ should be considered in outline planning arrangements in the event of a severe accident.

DISTANCES FOR FOOD RESTRICTIONS

Averting exposure to radiation through ingestion of locally produced food stuffs and drinking water within the DEPZ is recommended, however due to the delay in exposure and the significant variables advice to areas beyond the DEPZ should be issued within 24 hours from the start of the release and should consider advice given by relevant expert organisations.

Assessments indicate that the radiation concentrations in milk under the most onerous dispersion conditions would exceed the Euratom Maximum Permitted Levels (MPL) to a distance of ~19km and concentrations in unprocessed leafy green vegetables would exceed the MPLs to a distance of ~41km. It is recommended that expert advice is sought in the setting of food restrictions outside of the DEPZ due to the number of variables involved.

Analysis shows that the distance to which food restrictions would be required will vary significantly based on the weather factors on the day with the presence of rain having a significant influence. Whilst it may be necessary to implement food bans beyond the distances recommended it is considered proportionate to plan for the extent suggested, which can then be reviewed and adjusted as necessary by the appropriate authority once an appropriate emergency organisation has been established.

OTHER EMERGENCY PLANNING CONSIDERATIONS

Appropriate arrangements should be considered in the DEPZ to a distance of 1080m for individuals for whom it is not possible to offer appropriate shelter in solidly built buildings. This may include transient populations such as users of local recreational areas.

Whilst potential dose to such individuals is not expected to exceed the lower ERL for evacuation, the doses could be above the lower ERLs for sheltering. Appropriate arrangements will therefore be needed to ensure that any individuals that fall into this category can be adequately protected, which may be most practically achieved by removing them from the immediate area.

The likely characteristics of a release from the defueling station differ from those of a generating station. For the generating station the radiation emergency releases were dominated by the faults from a pressurised reactor which would have been most likely to lead to a discharge of hot CO₂ carrying radiation lasting in the region of 2-8 hours. For the defueling site the faults are dominated by issues involving the movement of spent nuclear fuel around the site – the “fuel route”. Faults on the fuel route are typically less dynamic with a slower release lasting over several days if unmitigated. These faults can offer more opportunities to mitigate or terminate the event before the majority of the radiological material has been released.

There are a range of potential events which could occur at the site which relate to conventional industrial hazards (e.g. fires, chemical spill) which may require an emergency response, including off site support, but do not lead to a release of radioactive material. These would be declared as a Site Incident. It is understood that such events could be perceived as a radiation emergency by the public, and

therefore all such events will include necessary notifications to relevant organisation so that reassurance requirements can be enacted.

SUMMARY OF RECOMMENDATIONS

The assessments indicate that detailed planning is justified at Hunterston B power station within at least 1080m and the urgent protective action of sheltering are justified within a maximum distance of 1080m from the site for protection of the public.

1080m is the minimum distance for the DEPZ. The local authority can choose to extend this in line with Regulation 8(1). It is not recommended that urgent protective actions be extended beyond the distances specified in this report without taking appropriate public protection advice as increasing protective actions beyond the recommended distances could do more harm than good.

The protective actions should be capable of being enacted as soon as is practical after the declaration of a Radiation Emergency (Off Site Nuclear Emergency) or before a release starts to maximise the averting of exposure.

Evacuation is not considered to be justified as a default protective action in the DEPZ.

Stable Iodine Tablets are not justified as a protective action for the defueling power station.

These recommendations demonstrate a significant reduction from the recommendations made during the implementation of REPPIR 19 in January 2020. The recommendation for the generating station were a DEPZ of at least 2000m.

It is also important to note that the assessments used in the development of the minimum distances are based on a 90 days post shutdown reactor. The longer from shutdown, the more the hazard reduces. Therefore the distances given are to be considered bounding and would be demonstrated to be reduced if the assessments were conducted again at a later date.

2 Distribution

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TSSM		Allison Adamson	EDF – Hunterston B Station
QMGH		Colin McCallum	EDF – Hunterston B Station
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TSSM (Equivalent)	External	TSSM (Equivalent)	Hunterston A Station

Figure 1 – Recommended Minimum Distance for Detailed Emergency Planning



Hunterston B Power Station

Hunterston B Power Station REPPIR Consequences Report

The Radiation (Emergency Preparedness and Public Information) Regulations 2019

Originated By:	Emergency Planning Group	Date:	May 2022
Reviewed By:	Emergency Preparedness Engineer	Date:	May 2022
Approved By:	Technical and Safety Support Manager	Date:	May 2022

Revision	Date
002	May 2022

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Purpose

This consequence report is required in regulation 7 of Radiation (Emergency Preparedness and Public Information) Regulations (REPPiR) 2019 for the Local authority to determine a Detailed Emergency Planning Zone (DEPZ). It sets out the technical justification for the minimum distance for the DEPZ around Hunterston B nuclear power station.

The key priority for EDF Energy Nuclear Generation Ltd (EDF NG) is the safe, reliable generation of electricity. Generating safely means the prevention of accidents, recognising the potential hazardous situations or malicious acts that may cause harm to the public, our staff, the environment, or the reputation of the company and managing these events should they occur

The likelihood of an event occurring at Hunterston B power station is minimised through safety considerations in the siting, design, construction and operation and the granting and compliance with a nuclear site licence regulated by the Office for Nuclear Regulation (ONR). A Nuclear Site Licence is granted only after the ONR has fully satisfied that the licensee is a capable operator and has made an adequate safety case for the station and developed appropriate safety standards. The implementation of these standards demonstrates that an accidental event which might lead to the release of even small amounts of radioactivity is extremely low.

Despite constant vigilance, the safeguards incorporated into the design and operation of plant and support systems, and a positive accident prevention culture, hazardous situations that challenge control can occur. Having well-rehearsed emergency arrangements in a state of readiness, as required by REPPiR 2019, provides an additional layer of protection to mitigate the effects of unforeseen events.

This consequences report is developed from REPPiR regulations 4 and 5, requiring the operator, EDF Energy, to conduct an evaluation of the work with ionising radiation at Hunterston B power station to identify the hazards which could cause a radiation emergency, as defined in REPPiR regulation 2 and to assess the potential consequences of a full range of emergencies.

This revised consequences report has been completed in line with regulation 6 of REPPiR due to the occurrence a material change in the work with ionising radiation at Hunterston B Power Station. Regulation 6 (1) requires that when a material change in the work with ionising radiation occurs, a review of the hazard evaluation is completed.

On the 7th January 2022 Hunterston B ceased generation permanently is moved into its “defueling phase”. EDF considers that this is a material change and has therefore reviewed the hazard posed by the site and the consequences of that hazard. The results of this reassessment are set out in this report.

1 Consequence Report

1.1 Name and Address of the Operator	EDF Energy Nuclear Generation Ltd. Barnett Way Barnwood Gloucester Gloucestershire GL4 3RS	
1.2 Premises details	Address	Hunterston B power station West Kilbride Ayrshire KA23 9QX
	Location	All distances mentioned in this report are a radius from the premises centre point Grid Reference NS 18570 51455, which is the centre of the reactor building and the location of the Irradiated Fuel Disposal Facility.
	Date of commencement of work with ionising radiation	Work with ionising radiation has already commenced at Hunterston B. The construction of the station started in 1968 and the station started generating electricity in 1976. Hunterston B permanently ceased generating electricity on the 7 th January 2022 and moved into its defueling phase.

1.3 Recommended Minimum Geographical Extent – Detailed Emergency Planning (DEPZ)

The Detailed Emergency Planning Zone for the site should be no smaller than 1.08km from the centre point noted above in section 1.2.

1.4 Recommended Distances for Urgent Protective Actions (sheltering, stable iodine tablets & evacuation)

The rationale for the distances and timings for the recommendations in this section are set out in section 1.7.

The assessments required under REPIR indicate detailed planning is justified for the urgent protective action of sheltering within a distance of 1.08km from the site for protection of the public.

The protective action should be capable of being enacted as soon as is practical after the declaration of a Radiation Emergency has occurred to maximise the averting of dose.

Stable iodine is not justifiable as an appropriate protective action due to a reduction in radioiodine isotopes.

Appropriate arrangements should be considered in this area for individuals for whom it is not possible to offer appropriate shelter in solid buildings. This may include transient individuals, such as those using local recreational facilities.

The assessments indicate evacuation is justified within 300m. This area does not include permanently/regularly occupied residences or commercial properties, therefore it is not recommended that planning is conducted in detail to evacuate the public as a default action within the detailed emergency planning zone. Evacuation within the DEPZ should be considered in outline planning arrangements in the event of a severe accident.

It is recommended that immediate advice be issued to restrict consumption of leafy green vegetables, milk and water from open sources/rain water in all sectors of the Detailed Emergency Planning Zone and considered within 24 hours downwind of the site to a distance of 41km after taking appropriate expert advice.

<p>1.5 Recommended Minimum Geographical Extent – Outline Emergency Planning (OPZ)</p>	<p>It is recommended that the Outline Planning Zone for the site be set as per REPPIR regulation 9 (1) a) and schedule 5 – (category 2) at 30km.</p> <p>Urgent protective actions, other than consideration of food restrictions, are not recommended within the OPZ. Outline planning should consider the implementation of protective actions in the OPZ for a radiation emergency which is considered extremely unlikely.</p> <p>It is recommended that that the outline plan consider the process for the implementation of shelter and evacuation uniformly throughout the OPZ, with or without a warning period.</p> <p>Planning in outline will enable implementation of protective actions based on the assessments made during an event and determined as appropriate based on the justification of the potential for averting exposure.</p>
<p>1.6 Environmental pathways at risk</p>	
	<p>A radiation emergency at Hunterston B would take the form of a gaseous or particulate plume containing radioactive material. This would put the following environmental pathways at risk:</p> <ul style="list-style-type: none"> • Grown foods – direct surface contamination and soil to plant • Animal products via ingestion • Water supplies through direct contamination and contaminated runoff
<p>1.7 Rationale</p>	
	<p>SELECTION OF SOURCE TERM</p> <p>EDF Energy has considered a wide range of accident scenarios in the hazard evaluation process and selected a candidate release as the basis of the consequences assessment. The candidate release assumes the most pessimistic attributes from a number of fault sequences in terms of time to release and quantity of activity released it, therefore, does not correspond to the release from a specific individual fault. It covers faults in all facilities on site, and is specific to the defueling operations at the site.</p>

POPULATION VARIABLES

As recommended by the UK Health Security Agency the exposure to the following population groups has been considered

- infants (0-1 year)
- children (1-10 years)
- Adults

Adults have been identified as the most vulnerable group.

Dose to the foetus and to breast-fed infants has been considered and it has been determined that the protective measures required for these do not exceed those required by the most vulnerable group identified above.

IMPACT OF WEATHER VARIABLES

The most significant consequences off site will occur from airborne radioactivity. The impact of the consequences is dominated by the weather conditions transporting the radioactive material off site. Extremes of weather, in this context, relates to the amount of dilution of the radioactive material that occurs during transportation. While higher wind speeds transport radioactivity over greater distances, the plume tends to move faster and affects a narrower area. Slow moving wind, with little or no turbulence, reduces the dilution of the radioactivity and presents the worst-case conditions for a release of radioactive material, as the release of radioactivity remains more concentrated as it moves off the site.

This becomes relevant in terms of the potential exposure through inhalation (amount of radiation per breath) and direct exposure as the release cloud or plume passes overhead. A full range of the atmospheric conditions occurring in the UK have been considered, along with the impact of rain, as this can 'wash' radioactivity out of the cloud or plume leading to a build-up of deposited activity where the rain falls raising levels of radiation in the environment and the potential of increased exposure through ingestion and direct exposure. The weather conditions used to develop the distances recommended in this report account for over 95% of the expected conditions at Hunterston B from an assessment of historic weather data. This aligns with the UK Health Security Agency recommended methodology to take account of pessimistic consequences due to unfavourable weather conditions as set out in report PHE-CRCE-50.

EMERGENCY RESPONSE TIME VARIABLES

The effectiveness of the urgent protective actions is determined by when implementation is achieved relative to the release and passage of the radioactive material. It is assumed that the most limiting scenario occurs when the release commences before emergency plans are activated.

Despite best efforts to rapidly assemble the emergency response organisation to determine the protection strategy and to notify members of the public to take action, the delay in doing this will reduce the effectiveness of the protective measures. A conservative time factor for implementing the protective measures of

2 hours has been considered when assessing distances determined by the effectiveness of protective actions. However the distances recommended in this report are based on a best-case scenario where protective actions can be implemented in advance of exposure occurring.

No assumptions should be made about the availability of a warning period to enact the emergency response and protective actions. Whilst faults could develop which would give a warning period before a release of radiation from the site it should not be assumed that this would be the case. Therefore any protective actions and emergency plans should be based on the conservative basis that no warning period would be available and should therefore be capable of being activated as soon as possible.

PUBLIC PROTECTION GUIDANCE

The UK Health Security Agency provide the UK guidance for emergency planning thresholds on dose for guiding decisions on actions. Emergency Reference Levels (ERL's) are dose criteria that apply to the justification and optimisation of sheltering-in-place, evacuation and administration of stable iodine. These are most appropriately expressed in terms of averted dose and are given in the table below.

Recommended ERLs for the planning of sheltering-in-place, evacuation and administration of stable iodine protective actions

	Effective dose or organ dose	Averted dose (mSv) ^a	
		Lower	Upper
Sheltering	Effective	3	30
Evacuation	Effective	30	300
Stable iodine	Thyroid ^b	30	100

^a In recognition of their higher cancer risk, the doses are those potentially averted in young children

^b mSv equivalent dose to the thyroid

The key objective with planning and deploying urgent protective actions is to achieve more good than harm in context of the risks from radiation exposure and the risks associated with the protective measure. Hence the arrangements in place should be proportionate to the risk and offer a trade-off between protection against radiation dose and the detriments that protective actions can have when implemented.

APPLICATION OF THE EMERGENCY REFERENCE LEVELS

The recommended minimum distance for detailed emergency planning is based on consideration of distances to which it would be proportionate to administer the urgent protective actions of evacuation, shelter and stable iodine based on the potential for those protective actions to avert dose in line with the Emergency Reference Level methodology.

As indicated in REPPiR, the lower ERLs are used in the determination of the distance for justifying detailed planning for implementing urgent public protective measures.

DISTANCE TO LOWER ERL FOR STABLE IODINE

One of the most significant hazard changes that occurs at a defueling nuclear power station is the reduction in radioactive iodine isotopes. Whilst these isotopes make up the largest part of a potential release from a generating nuclear reactor, once that reactor is shut down they reduce very quickly through the normal process of radioactive decay. Around 90 days after the process of fission stops within the reactor there is no longer sufficient radioactive iodine to give enough of a thyroid dose to justify the use of stable iodine tablets as a protective action.

The second reactor at Hunterston B shut down for the final time on the 7th January 2022. Therefore after the 7th April 2022 it is no longer justifiable to recommend stable iodine as a protective action for Hunterston B for either detailed or outline planning.

The assessments show that at 200m from the release point (roughly the site fence) an infant (the most vulnerable group for this specific exposure) would receive a maximum of 0.35mSv thyroid dose. It would therefore not be possible to avert sufficient dose to meet the lower reference level to justify stable iodine prophylaxis.

Furthermore, any residual radio-iodine in the source term will continue to decay with time, which will diminish the risk even further as the defueling programme progresses

DISTANCE TO LOWER ERL FOR SHELTERING

The distance across which it is justifiable to recommend shelter as a protective action has been calculated as ~1080m from the centre point between each reactor based on the lower emergency reference level for an adult, identified as the most vulnerable group. This distance is calculated accounting for the Dose Reduction Factors set out in Schedule 3 of REPPiR.

DISTANCE TO LOWER ERL FOR EVACUATION

The distance across which it is justifiable to recommend evacuation as a protective action has been calculated as ~300m from the centre point between each reactor based on the lower emergency reference level for an adult, identified as the most vulnerable group.

This area is contained within the site fence in a number of directions and exceeds it by approximately 150m elsewhere. This distance falls some way short of the nearest residential building (~700m) and does not reach the boundary with Hunterston A Power Station (~350m). It is therefore judged that the use of evacuation as a default urgent protective action within the Detailed Emergency Planning Zone is not justified. Evacuation within the DEPZ should be considered in outline planning arrangements in the event of a severe accident.

DISTANCES FOR FOOD RESTRICTIONS

Averting exposure to radiation through ingestion of locally produced food stuffs and drinking water within the DEPZ is recommended, however due to the delay in exposure and the significant variables advice to areas beyond the DEPZ should be issued within 24 hours from the start of the release and should consider advice given by relevant expert organisations.

Assessments indicate that the radiation concentrations in milk under the most onerous dispersion conditions would exceed the Euratom Maximum Permitted Levels (MPL) to a distance of ~19km and concentrations in unprocessed leafy green vegetables would exceed the MPLs to a distance of ~41km. It is recommended that expert advice is sought in the setting of food restrictions outside of the DEPZ due to the number of variables involved.

Analysis shows that the distance to which food restrictions would be required will vary significantly based on the weather factors on the day with the presence of rain having a significant influence. Whilst it may be necessary to implement food bans beyond the distances recommended it is considered proportionate to plan for the extent suggested, which can then be reviewed and adjusted as necessary by the appropriate authority once an appropriate emergency organisation has been established.

OTHER EMERGENCY PLANNING CONSIDERATIONS

Appropriate arrangements should be considered in the DEPZ to a distance of 1080m for individuals for whom it is not possible to offer appropriate shelter in solidly built buildings. This may include transient populations such as users of local recreational areas.

Whilst potential dose to such individuals is not expected to exceed the lower ERL for evacuation, the doses could be above the lower ERLs for sheltering. Appropriate arrangements will therefore be needed to ensure that any individuals that fall into this category can be adequately protected, which may be most practically achieved by removing them from the immediate area.

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therefore all such events will include necessary notifications to relevant organisation so that reassurance requirements can be enacted.

SUMMARY OF RECOMMENDATIONS

The assessments indicate that detailed planning is justified at Hunterston B power station within at least 1080m and the urgent protective action of sheltering are justified within a maximum distance of 1080m from the site for protection of the public.

1080m is the minimum distance for the DEPZ. The local authority can choose to extend this in line with Regulation 8(1). It is not recommended that urgent protective actions be extended beyond the distances specified in this report without taking appropriate public protection advice as increasing protective actions beyond the recommended distances could do more harm than good.

The protective actions should be capable of being enacted as soon as is practical after the declaration of a Radiation Emergency (Off Site Nuclear Emergency) or before a release starts to maximise the averting of exposure.

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Stable Iodine Tablets are not justified as a protective action for the defueling power station.

These recommendations demonstrate a significant reduction from the recommendations made during the implementation of REPPIR 19 in January 2020. The recommendation for the generating station were a DEPZ of at least 2000m.

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Josh Tarling		Emergency Planning Group	EDF
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Jane McGeorge	External	Coordinator	Ayrshire Civil Contingencies Team
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Stuart Fannin	External	Site Inspector	ONR
REPP19Compliance@onr.gov.uk	External	REPP19 Compliance Lead	ONR
David Hanratty	External	Principal Inspector EP&R	ONR
TSSM (Equivalent)	External	TSSM (Equivalent)	Hunterston A Station

Figure 1 – Recommended Minimum Distance for Detailed Emergency Planning





Appendix 3
REPIR Code of Practice
Extracts from Guidance relating to Regulation 8 (Duty of Local Authority to determine DEPZ)

In relation to setting the DEPZ the Code says:-

“190 The detailed emergency planning zone must be based on the minimum geographical extent proposed by the operator in the consequences report and should:

- (a) be of sufficient extent to enable an adequate response to a range of emergencies; and
- (b) reflect the benefits and detriments of protective action by considering an appropriate balance between;
 - i. dose averted; and
 - ii. the impact of implementing protective

194 The zone should be set as the minimum area the operator considers should be covered by the local authority's off-site plan in accordance with paragraph 2 of Schedule 4, as well as by the local authority applying local geographic, demographic and practical implementation factors and considering relevant protective action in the area. The emergency arrangements for the zone should be identified in the off-site plan as per Schedule 6, Part 2, Chapter 1.

195 The local authority should accept the operator's recommendation of the minimum geographical extent of the detailed emergency planning zone. The local authority should only change that area to extend it because of local geographic, demographic and practical implementation issues, the need to avoid bisecting communities or to include vulnerable groups at the outer limit of the area. The local authority is not required to have the expertise to verify the technical basis for the minimum extent set by the operator.

197Although, undertaking protective action can reduce the dose received, this needs to be balanced against the stress caused to affected people and the potential harm to them that could result from this action. The size of the detailed emergency planning zone and the protective action planned in it should not put people at risk of harm from unnecessary action. An excessively large area could also divert important resource from affected areas which require the most attention. If it is considered by the operator that the local authority has increased the detailed emergency planning zone excessively so that the increase is detrimental to the effectiveness of the off-site plan, this should be discussed with the local authority and the regulator.

Appendix 4:

