Nuclear Generation Limited

The Radiation (Emergency Preparedness and Public Information) Regulations 2019

Dungeness B Power Station Consequences Report

Originated By:	Rob Breeze Emergency Planning Group	**Date:**	Dec 2023
Reviewed By:	Stephen Bryan Emergency Preparedness Engineer	**Date:**	See AMS
Approved By:	Katherine Berry Technical and Safety Support Manager	**Date:**	See AMS

Revision	Amendment	Date
000	Full revision of the Consequences Report for Dungeness B Power Station	Dec 2023

Contents

Purpose

This consequence report is required under 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 Dungeness 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 Dungeness 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 consequence 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 Dungeness 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 “both on the premises and outside the premises considering any variable factors which have the potential to affect the severity of those consequences”.

This consequences report reflects the operating state of Dungeness B as a defueling site. Dungeness B has been shut down since 2018, initially for a double reactor outage which then resulted in a company decision announced on the 7th June 2021 not to bring the units back into operation as a generating site.

1 Consequence Report

1.1 Name and Address of the Operator		EDF Energy Nuclear Generation Ltd. Javelin House (Building 1420) Charlton Court Gloucester Business Park Gloucester GL4 4AE
1.2 Premises details	Address	Dungeness B Power Station EDF Energy Nuclear Generation Ltd Dungeness Romney Marsh Kent TN29 9PX
	Location	All distances mentioned in this report are a radius from the premises centre point Grid Reference TR 08150 16879, which is the centre of the reactor building.
	Date of commencement of work with ionising radiation	Work with ionising radiation has already commenced at Dungeness B Power Station. The construction of the station started in 1965 and the station started generating electricity in 1983. The station formally moved into defueling in 2021.

1.3 Recommended Minimum Geographical Extent – Detailed Emergency Planning (DEPZ)	EDF recommends that the current DEPZ is reduced now that the site has started active defueling operations. The rationale for this is set out in section 1.7. Based on the technical assessments, the Detailed Emergency Planning Zone should be set no smaller than 300m from the centre point noted in section 1.2. However, it should be noted that setting the DEPZ at this minimum distance would create a very small area for public protection with limited meaningful planning options. Because the REPPIR assessments indicate that detailed planning for public protection is necessary for Dungeness B, it is recommended that the local authority set a nominal distance for the DEPZ in excess of 300m, sufficient to provide the basis for a meaningful off site plan.

1.4 Recommended Distances for Urgent Protective Actions (sheltering, stable iodine tablets & evacuation)	The assessments required under REPPIR indicate detailed planning is justified for the urgent protective action of the implementation of sheltering within a distance of 300m 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 or before a release starts to avert the maximum dose and justify the deployment of the protective action. Appropriate arrangements should be considered in this area for individuals for whom it is not possible to offer appropriate shelter in solid buildings. This is likely to include a small number of transient individuals, such as those using local recreational facilities or beaches. The rationale for the distances and timings for recommending the detail planning for implementation of urgent protective actions is provided below in section 1.7. Stable iodine tablets are not recommended as an urgent protective action as radioactive iodine isotopes are no longer a hazard at the site. Evacuation is not recommended as an urgent protective action due to the fact that the dose contour for such action would be within the site fence for all weather conditions. Evacuation within the DEPZ should be considered in outline planning arrangements in the event of a severe accident. It is recommended that advice be issued within 24 hours 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 downwind of the site to a distance of 15km.

1.5 Recommended Minimum Geographical Extent – Outline Emergency Planning (OPZ)	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) – 30km. Default urgent protective actions, other than consideration of food restrictions, are not recommended within the OPZ. Outline planning should consider the implementation of urgent protective actions in the OPZ for a radiation emergency which is considered extremely unlikely. 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. Planning in outline will enable implementation based on the assessments made during an event and determined as appropriate based on the justification of the potential for averting exposure.
1.6 Environmental pathways at risk	
	A radiation emergency at Dungeness B would take the form of a gaseous plume containing radioactive particulates. This would put the following environmental pathways at risk: • Grown foods – direct surface contamination and soil to plant • Animal products via ingestion • Water supplies through direct contamination and contaminated runoff
1.7 Rationale	
	SELECTION OF SOURCE TERM 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 all modes of plant operation.

POPULATION VARIABLES

As recommended by Public Health England the exposure to the following population groups has been considered

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

Particular attention is given to the exposure to infants 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 Dungeness B from an assessment of historic weather data. This aligns with Public Health England's recommended methodology to take account of pessimistic consequences due to unfavourable weather conditions as set out in report PHE-CRCE-50.

EMERGENCY RELEASE AND 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. The duration of the candidate release is approximately 5 hours at which point the release will effectively terminate because the depressurisation of the Reactor Coolant System results in limited motive force to expel radioactivity, or because emergency actions have re-established containment.

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 optimal for the aversion of dose, and assume that the protective actions are implemented before exposure to give the maximum possible benefit.

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 of an hour or more 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

Public Health England (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.

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.

APPLICATION OF THE EMERGENCY REFERENCE LEVELS

The recommended minimum distance for detailed emergency planning has been based on consideration of distances to which it would be proportionate to administer the urgent protective actions of evacuation & shelter (Stable Iodine no longer required).

The nature of a radiation emergency at Dungeness B has changed, and means that iodine radionuclides are no longer a significant hazard. Therefore, the distance to which the administration of shelter is considered proportionate has become the greatest of any of the protective actions and is the distance most appropriate to use to determine the minimum size of the Detailed Emergency Planning Zone. This is smaller than the distance which was recommended when iodine radionuclides dominated the release.

Therefore EDF recommends that the current Detailed Emergency Planning Zone is reduced to reflect the reduction in hazard.

DISTANCE TO LOWER ERL FOR STABLE IODINE

Radioactive iodine isotopes are produced as a by-product when a nuclear reactor is operating. Once the nuclear reaction ceases these isotopes start to reduce as part of the natural process of radioactive decay. The predominant radioactive iodine isotope - I131 - has a short half-life of 8 days and decays rapidly.

The Dungeness B reactors have not been operational since August and September 2018. During this time, the quantities of radioactive iodine within the reactors have decayed to the point where stable iodine is no longer a justifiable protective action for any age group at any distance from the site.

Stable Iodine has been removed for both on-site and off-site following the Consequences Report submission in June 2021.

DISTANCE TO LOWER ERL FOR SHELTERING

The distance across which it is justifiable to recommend shelter as a protective action has been calculated as 300m from the centre point of the site based on the lower emergency reference level for an infant, identified as the most vulnerable group.

DISTANCE TO LOWER ERL FOR EVACUATION

The distance to the lower ERL for evacuation has been calculated at less than 200m from the centre point noted in section 1.2 This does not extended onto public access land and therefore evacuation is not recommended as an urgent protective action in the DEPZ.

DISTANCES FOR FOOD RESTRICTIONS

Averting exposure to radiation through ingestion of locally produced food stuffs and drinking water can reduce a significant proportion of the dose an individual could receive. Therefore advice should be issued to restrict consumption of appropriate food stuffs within 24 hours from the start of the release.

Under the most pessimistic conditions, the maximum distance to which food restrictions would be required is 15km. This is under moderately unsettled atmospheric conditions with light rain. For all dry atmospheric conditions the maximum distance for restrictions would be approximately 5km.

Any contamination of food stuffs or water sources will be significantly influenced by weather conditions on the day of any release and it is recommended that the distances here act as a guide for planning, to be supported by monitoring and assessment following any release.

In summary, the distances to MPLs for milk and processed/unprocessed green vegetables are all well within the default 30Km OPZ.

OTHER EMERGENCY PLANNING CONSIDERATIONS

Appropriate arrangements should be considered in the DEPZ 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 facilities or beaches.

There are a range of potential events which could occur at the site which relate to conventional industrial hazards (e.g. fires, chemical spills) 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 organisations so that reassurance requirements can be enacted.

SUMMARY RECOMMENDATIONS OF DISTANCE TO LOWER ERL

The assessments indicate that the lower ERL for the urgent protective action of implementation of sheltering could be exceeded to a distance of 300m and therefore this action is justified for the protection of the public to this distance

The local authority can choose to extend this minimum distance in line with Regulation 8(1) and it is recommended that they do so in this instance to provide the basis for a meaningful off-site plan 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. Stable iodine no longer needs to be considered for pre-distribution to residents in the area. Evacuation and stable iodine tablets are not considered to be justified as a default protective actions in the DEPZ.

2 Distribution

DNB		
Gavin Lancaster	**Station Director**	**EDF Energy**
Katherine Berry	**TSSM**	**EDF Energy**
Sarah Covey-Crump	**QMGH**	**EDF Energy**
Steve Bryan	**EPE**	**EDF Energy**

EPG		
Josh Tarling	**Head of Emergency Planning**	**EDF Energy**
Rob Breeze	**Emergency Planning Group**	**EDF Energy**

EXTERNAL		
Adam Feacey	**Kent County Council Emergency Planning**	**Kent County Council**
Tony Harwood	**Kent County Council Emergency Planning**	**Kent County Council**
Jason Crook	**Site Inspector**	**ONR**
REPPIR19Compliance@onr.gov.uk	**REPPIR Compliance Lead**	**ONR**
	Dungeness A TSSM (Equivalent)	**Nuclear Restoration Services (NRS)**

Figure 1 – Minimum Distance for Detailed Emergency Planning (300m Contour)