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Pre-Construction Safety Report

Chapter 32

Emergency Preparedness

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32.1 List of Abbreviations and Acronyms

ALARP	As Low As Reasonably Practicable
CCA	Civil Contingencies Act, 2004
DEC	Design Extension Condition
DiD	Defence in Depth
ECC	Emergency Control Centre
EOP	Emergency Operating Procedure
GDA	Generic Design Assessment
IAEA	International Atomic Energy Agency
LC	Licence Condition
MCR	Main Control Room
NPP	Nuclear Power Plant
ONR	Office for Nuclear Regulation (UK)
OSC	Operation Support Centre
PCSR	Pre-Construction Safety Report
REPPIR	Radiation (Emergency Preparedness and Public Information) Regulations
RGP	Relevant Good Practice
RSS	Remote Shutdown Station
SAMG	Severe Accident Management Guideline
SQEP	Suitably Qualified and Experienced Person
TSC	Technical Support Centre
UK HPR1000	UK version of the Hua-long Pressurised Reactor

32.2 Introduction

The purpose of this chapter is to present the design information of emergency preparedness for the UK version of the Hua-long Pressurised Reactor (UK HPR1000) Nuclear Power Plant (NPP).

The emergency arrangements are established to prepare for a radiation emergency and mitigate the consequences in case of an occurrence by taking all reasonably

practicable measures. Emergency preparedness is a key link of Defence in Depth (DiD) (the fifth and final level) applied in the design of the UK HPR1000 (see Pre-Construction Safety Report (PCSR) Chapter 4 Sub-chapter 4.4).

In addition, the emergency arrangements will evolve as the NPP moves through its lifecycle. Once pre-loaded, a radiological release is conceivably possible. Therefore, emergency arrangements apply to the lifecycle after the fuel is pre-loaded. It will be reviewed periodically as required by *The Radiation (Emergency Preparedness and Public Information) Regulations* (REPPIR) *2019* Reference [1] and International Atomic Energy Agency (IAEA) specific safety guidance, *Periodic Safety Review for Nuclear Power Plants*, SSG-25 Reference [2]. Transport of radioactive substances is out of scope of Generic Design Assessment (GDA), Reference [3]. The detailed emergency arrangements will be developed during the nuclear site licencing phase as well as those relating to the transport of radioactive substances.

32.2.1 Chapter Route Map

The ***Fundamental Objective*** of the UK HPR1000, which is presented in PCSR Chapter 1 Sub-chapter 1.6.2, is that: *The Generic UK HPR1000 could be constructed, operated, and decommissioned in the UK on a site bounded by the generic site envelope in a way that is safe, secure and that protects people and the environment.*

To underpin this objective**,** five high level claims (Level 1 claims) and a number of Level 2 claims are developed and presented in Chapter 1. This chapter supports the ***Claim 3.2.5*** derived from the high level ***Claim 3 and Claim 3.2***.

Claim 3*: The design and intended construction and operation of the UK HPR1000 will protect the workers and the public by providing multiple levels of defence to fulfil the fundamental safety functions, reducing the nuclear safety risks to a level that is As Low As Reasonably Practicable (ALARP).*

Claim 3.2*: A comprehensive fault and hazard analysis has been used to specify the requirements on the safety measures and inform emergency arrangements.*

This sub-chapter provides an overview of the claims and arguments based on the IAEA SSG-25 Safety Factor 13, Reference [1]. Descriptions for each argument to support the overall claim are contained in each section covering the individual argument. The IAEA preamble to Safety Factor 13: Emergency Planning states:

The design and operation of a nuclear power plant should prevent or otherwise minimise releases of radioactive substances that could affect the health of workers or the public or harm the environment. Emergency Planning for the possibility of such releases is a prudent and necessary action, not only for the operating organisation but also for local and national authorities.

The IAEA objective for the review of emergency planning is to determine:

Whether the operating organisation has adequate plans, staff, facilities and equipment for dealing with emergencies;

Whether the operating organisation's arrangements have been adequately coordinated with local and national systems and are regularly exercised.

The IAEA objective and other information presented in the *IAEA General Safety Requirements No. GSR Part 7*, Reference [4], have been reviewed and set out in a Claim, Argument and Evidence structure. In deriving the PCSR claim, it is important to note that the detailed review of the NPP design, at the GDA stage, has not been finalised and is therefore subject to further change. Therefore this chapter relies on the plant design and layout in PCSR Chapter 2 Sub-chapter 2.15 and aspects of other chapters.

It is particularly important for emergency planning with respect to internal arrangements of the future operator and external organisations, including the emergency services, local government and health services arrangements.

To support the Claim 3.2 and Claim 3, the resulting Claim 3.2.5 for PCSR Chapter 32 is presented, as follows:

Claim 3.2.5*: Emergency arrangements will be in place, prior to commissioning, that will be in accordance with up-to-date standards in the event of a release of radioactive substances.*

The PCSR claim has been reviewed in order to formulate a list of arguments for use in the PCSR for the UK HPR1000 GDA submission to Office for Nuclear Regulation (ONR). Additionally, the tasks and methodology in IAEA SSG-25, Reference [2], have been reviewed, in order to ensure that the list of arguments is complete insofar that the final design has not been completed. Where tasks and methodologies are addressed by other PCSR chapters, a cross reference is made. The IAEA tasks and methods of SSG-25 Safety Factor 13, Reference [2], are utilised here and modified to take account of PCSR.

This chapter aims to demonstrate that adequate emergency arrangements are in place prior to fuel pre-load, addresses how they are implemented and determines whether these correspond to good practice, so as to verify that they do not present an unacceptable gap.

There are five arguments based on IAEA Safety Factor 13: Emergency Planning in Reference [2] that supports Chapter 32. They are listed as follows:

a) ***Argument 3.2.5SC32-A1****: Emergency arrangements adequately consider current safety analyses and accident mitigation studies.*

   The detailed descriptions are presented in the Sub-chapter 32.5 and 32.6. Safety analyses and accident mitigation studies will be considered in the

design of emergency facilities and the preparation of accident management procedures in the nuclear site licensing phase.

b) ***Argument 3.2.5SC32-A2****: Emergency arrangements include adequate on-site and off-site equipment and facilities, including the provision of technical and operational support centres and their communication systems.*

The detailed descriptions are presented in Sub-chapter 32.4 (in general and structure in figure F-32.4-2) and Sub-chapter 32.5.

c) ***Argument 3.2.5SC32-A3****: Emergency arrangements include effective interaction with relevant off-site organisations.*

The detailed descriptions are presented in Sub-chapter 32.3 (*Civil Contingencies Act, 2004* (CCA) requirement) and Sub-chapter 32.4 (figure F-32.4-1).

d) ***Argument 3.2.5SC32-A4****: Emergency arrangements are tested and reviewed regularly and comprehensively, and lessons learned, are adopted in order to be effective when operations commence and maintained during the life of the plant.*

The detailed descriptions are presented in Sub-chapter 32.3 (refer to details on training) and Sub-chapter 32.4 (refer to details on training). It becomes important during operating.

e) ***Argument 3.2.5SC32-A5****: Emergency arrangements are in accordance with current standards, methods and good practices.*

The detailed description is presented in Sub-chapter 32.3.

The evidence to support the arguments will be developed in the nuclear site licencing phase, such as hazard evaluation, consequence assessment, consequences report, on-site emergency plan and the detailed design and information of on-site emergency response facilities.

32.2.2 Chapter Structure

The structure of PCSR Chapter 32 is as follows:

a) Sub-chapter 32.1 Lists the Abbreviations and Acronyms:

This section lists the abbreviations and acronyms that are used in the PCSR Chapter 32.

b) Sub-chapter 32.2 Introduction:

This section gives a brief introduction of Chapter 32.

c) Sub-chapter 32.3 Applicable Codes and Standards:

This section describes the applicable codes and standards of Chapter 32.

d) Sub-chapter 32.4 Emergency Management:

This section describes the emergency management and the framework of emergency organisations and responsibilities.

e) Sub-chapter 32.5 On-site Emergency Response Facilities:

This section describes the basic functions of the main on-site emergency response facilities.

f) Sub-chapter 32.6 On-site Accident Management:

This section identifies the current accident management procedures.

g) Sub-chapter 32.7 ALARP Assessment:

This section presents the Relevant Good Practices of Chapter 32.

h) Sub-chapter 32.8 Concluding Remarks:

This section summarises the concluding remarks.

i) Sub-chapter 32.9 References:

This section lists the supporting references of Chapter 32.

32.2.3 Interfaces with Other Chapters

The interfaces with other chapters are listed in the following table.

T-32.2-1 Interfaces between Chapter 32 and Other Chapters

PCSR Chapter	Interface
Chapter 1 Introduction	Chapter 1 provides the Fundamental Objective, Level 1 Claims and Level 2 Claims, Chapter 32 provides chapter claims and arguments to support relevant high level claims that are addressed in Chapter 1.
Chapter 2 General Plant Description	Chapter 2 provides a brief introduction to the emergency facilities of the plant.
Chapter 4 General Safety and Design Principles	Chapter 4 provides the concept of Defence in Depth and the selection of appropriate standards. Emergency preparedness is located at level 5 of defence in depth.
Chapter 8 Instrumentation and	Chapter 32 provides emergency response functional

PCSR Chapter	Interface
Control	description of Main Control Room (MCR), Remote Shutdown Station (RSS) and Technical Support Centre (TSC). Chapter 8 provides the design information of I&C systems related to emergency response.
Chapter 9 Electric Power	Chapter 9 provides the design information of communication systems which is related to emergency response.
Chapter 10 Auxiliary Systems	Chapter 32 introduces the emergency function of the MCR and TSC. Chapter 10 provides the design information of the DCL system for the MCR and TSC in section of the Sub-chapter 10.6.
Chapter 13 Design Extension Conditions and Severe Accident Analysis	Chapter 13 provides the basic strategy of Severe Accident Management Guidelines for Emergency Arrangements.
Chapter 22 Radiological Protection	Emergency preparedness including emergency operations, on-site accident management and emergency facilities is described in Chapter 32. Chapter 22 presents information of post-accident accessibility which is connected with emergency operations.
Chapter 30 Commissioning	Chapter 30 provides the information of commissioning which considers the requirements of emergency arrangements.
Chapter 31 Operational Management	Chapter 31 presents the arrangement of the Emergency Operating Procedure (EOP) and the Severe Accident Management Guideline (SAMG) which shall be carried out by operator in a radiation emergency.
Chapter 33 ALARP Evaluation	Chapter 32 demonstrates that the safety risks are reduced to the level that is ALARP by considering emergency preparedness, which supports the overall

PCSR Chapter	Interface
	ALARP demonstration addressed in Chapter 33.

32.3 Applicable Codes and Standards

For selection of applicable codes and standards, the statutory instruments in the UK are chosen, such as REPPIR, Reference [1]. The relevant requirements and guidance are chosen to provide the detailed information, such as *Licence Condition* (LC) 11, Reference [5], *Japanese Earthquake and Tsunami: Implications for the UK Nuclear Industry*，Reference [6] and the associated underpinning guidance. International good practice or Relevant Good Practice (RGP) recognised by UK regulators has also been selected along with the up-to-date versions of codes and standards. The IAEA safety standards are chosen to support the emergency arrangements of the UK HPR1000. The detailed principles for the selection of appropriate standards for this chapter is presented in PCSR Chapter 4. The applicable codes and standards are listed in T-32.3-1.

The CCA, Reference [7], is the primary legislative document among the emergency planning procedures in the UK. The Act, constituted by three parts, defines the meaning of “emergency” as well as obligations of certain organisations, grants the government emergency power, and provides supplementary legislation in support of the first two parts. To support the CCA, there are some accompanying regulations of the CCA and supplementary documents, Reference [8], [9] and [10]. The definition for emergency is relatively broad in the UK. A major incident may be declared by any emergency response organisation in Reference [11]. A leak of radioactive substances outside a NPP requiring the off-site plan to be initiated would be a major incident.

The licencee of each NPP site is required to establish an emergency plan to manage emergencies arising from activities on site. These plans are to be submitted to, and approved by, the ONR in accordance with LC 11, Reference [5]. Approved arrangements must not be altered or amended unless ONR has approved such alteration or amendment. If emergency arrangements need assistance and cooperation with other persons, local authority or organisations, the licencee has responsibilities to consult with them on such arrangements.

Emergency arrangement exercises are required to be performed on a regular basis. All persons who have duties in connection with emergency arrangements are properly instructed in the performance and the precautions. There are some detailed expectations in *Safety Assessment Principles for Nuclear Facilities*, Reference [12], fundamental principle FP.7 and accident management and emergency preparedness principle AM.1. These “adequate arrangements” are expected to be detailed in the operator’s site-specific emergency plans and associated documentation.

The REPPIR and its supporting guidance, Reference [1] and [13], aim to establish a

legal framework for emergency arrangements, for the protection of the public from radiation emergency, and ensure that relevant public are supplied with the prior information specified in REPPIR before and during a radiation emergency.

The quantities of radioactive materials or fissile materials associated with specific NPP based on the UK HPR1000 design will be evaluated and compared with the threshold limits provided in REPPIR during the nuclear site licencing phase. In the GDA stage, the regulations associated with operators are assumed to apply. REPPIR regulations require that the on-site emergency plan is the responsibility of the operator and the off-site emergency plan is the responsibility of the local authority. These provisions have imposed requirements on the operator and the local authority to ensure that the on-site emergency arrangements are in place, drills and exercises are conducted on a regular basis, and countermeasures are developed for an emergency. These responsibilities mainly include：

a) Carrying out an evaluation of the hazards arising from the work undertaken on the premises to determine whether they have the potential to cause a radiation emergency;

b) Making a further assessment to evaluate a full range of consequences of such a radiation emergency;

c) Undertake review of its evaluation and make a further assessment if there is proposal to change the work with ionising radiation;

d) Preparing and sending a consequence report to the local authority which should include a proposed detailed emergency planning zone;

e) Preparing an emergency plan where the evaluation shows that a radiation emergency may arise;

f) Reviewing and testing on-site emergency planning;

g) Cooperating with the local authority and other employers;

h) Condition of implementing emergency plans and informing about the implementation;

i) Making a full assessment of consequences of any radiation emergency and effectiveness of the emergency plans after implementation;

j) Reference levels of effective doses in a radiation emergency;

k) Information to be provided to the public in an area covered by a detailed emergency planning zone and in the event of an emergency respectively;

l) Requiring employers to consult radiation protection advisors.

It is noted that REPPIR Regulation 18 in Reference [1] states that emergency

intervention employees should be given appropriate training and equipment. Nuclear Suitably Qualified and Experienced Person (SQEP) is a British nuclear industry requirement. In addition, ONR LC10 (Training) requires the operator to provide suitable training for all employees who have a responsibility for safety, Reference [5]. This will be undertaken for the operator of the UK HPR1000 prior to commissioning. The REPPIR and its supporting guidance may be updated in the future which may cause a revision to the emergency arrangements.

The UK government has issued nuclear emergency planning guidance in Reference [14] to help local emergency planners, HM government departments, devolved administrations of Scotland and Wales and other agencies that carry out nuclear emergency planning. The nuclear emergency planning and response guidance is the primary source of guidance for local emergency planners to enable them to prepare effective plans. This document covers the guiding principles and phases of emergency management. The ONR has also issued lessons of the Fukushima accident on emergency preparedness, which in particular provides advice on the on-site emergency control, Reference [6].

An important point in the CCA, Reference [7], which is not contained in REPPIR, is the requirement for the operator to provide a representative to attend, and be part of, the local resilience forum for the geographic area where the NPP is situated. This is contained in The Civil Contingencies Act 2004 *(Contingencies Planning) (Amendment) Regulations 2012*, Reference [9], which reiterates the REPPIR Regulation 11, that the operator must co-operate with off-site emergency organisations, that is the local resilience forum. Each site holds its own Emergency Planning Consultative Committee (with some local resilience forum attendees) to meet the requirements of REPPIR.

The IAEA has established a number of requirements and safety guidelines on the subject of emergency management, including *GSR Part 7 Preparedness and Response for a Nuclear or Radiological Emergency*, Reference [4], GS-G-2.1 *Arrangements for Preparedness for a Nuclear or Radiological Emergency*, Reference[15], which establishes the requirements and guidance on infrastructure and function of emergency preparedness, and *Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency*, Reference [16].

To analyse the suitability of codes and standards applied to the UK HPR1000 emergency preparedness Sub-topic area, according to the principles and processes presented in *General Principles for Application of Laws, Regulations, Codes and Standards*, Reference [17], the relevant codes and standards are collected, screened and assessed. Codes and standards are considered to be applicable in the emergency preparedness Sub-topic area in the UK HPR1000. To ensure the design requirements of the selected codes and standards used in the UK HPR1000 design can be applied adequately, the compliance analysis in the emergency preparedness Sub-topic area has

been performed. Compliance analysis provides confirmation and justification of design requirements of the main selected design codes and standards, where they have been used and the compliance with the design of the UK HPR1000 in the emergency preparedness Sub-topic area. According to the compliance analysis with codes and standards in the UK HPR1000 emergency preparedness Sub-topic area, the UK HPR1000 design is generally in compliance with the requirements.

T-32.3-1 List of Applicable Codes and Standards

No.	Standard No.	Title	Date Issued
1	---	Civil Contingencies Act 2004	2004
2	---	The Civil Contingencies Act 2004 (Contingency Planning) Regulations 2005	2005
3	---	The Civil Contingencies Act 2004 (Contingency Planning) (Amendment) Regulations 2012	2012
4	No.703	The Radiation (Emergency Preparedness and Public Information) Regulations 2019	2019
5	---	Licence Condition Handbook	2017
6	ONR-FR-REP-11-002	Japanese Earthquake and Tsunami: Implications for the UK Nuclear Industry	2011
7	ISBN 9780717667284	Approved Code of Practice and Guidance For The Radiation (Emergency Preparedness and Public Information) Regulations 2019	2019
8	---	The Fit with Other Legislation, Revision to Emergency Preparedness Chapter 19	2011
9	ISBN 1 874447 42 X	Dealing with Disaster	2003
10	---	Nuclear Emergency Planning and Response Guidance	2015
11	---	Civil Contingencies Act Enhancement Programme 2012, Annex 7B: Lead Responsibility for Warning and Informing the Public	2012
12	No. SSG-25	Periodic Safety Review for Nuclear Power Plants, Specific Safety Guide	2013
13	No. GSR Part 7	Preparedness and Response for a Nuclear or Radiological Emergency, General Safety Requirements	2015
14	Safety Guide No.GS-G-2.1	Arrangements for Preparedness for a Nuclear or Radiological Emergency	2007
15	General Safety Guide No. GSG-2	Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency	2011

32.4 Emergency Management

The UK HPR1000 operator will establish an on-site emergency response organisation and define its obligations according to the requirements of relevant regulations (such as fire-fighting and medical services). The relationship between the on-site and off-site emergency organisations is shown in F-32.4-1. The detailed description of each party's responsibilities will be included in the specific on-site emergency plan. The main requirements and duties within the plan include, but are not limited to, the following:

a) Specify the tasks and interfaces of emergency response organisations;

b) Determine the nuclear emergency action level, and co-ordinate the nuclear emergency response within the plant;

c) Undertake control measures to mitigate the accident consequences;

d) Monitor radiation on site, and, if necessary, off site as well;

e) Report as soon as possible the accident conditions to national and local authority nuclear emergency organisations, competent authorities, and national nuclear safety regulatory departments and designated departments, and maintain close contact during the accident;

f) Ensure provision of information to the public who might be affected by a radiation emergency;

g) Cooperate and assist the local authority nuclear emergency organisations in the nuclear emergency response, during planning and providing liaison personnel at the Strategic Coordination Centre, Reference [11], which also applies to exercises;

h) Conduct emergency training, emergency testing, review and revision of emergency plans, and management of emergency facilities, equipment, and instruments to ensure the emergency response capabilities of the NPP.

A typical structure of the NPP nuclear emergency organisation is shown in F-32.4-2. It consists of the Duty Controller and Deputy Controller of the NPP and several emergency response groups including the operation control group, the technical support group, the maintenance service group, the radiological protection group and the administration and logistics group. Each group is staffed with different duty-holders, such as the administration and logistics group consists of industrial safety personnel, fire fighters, occupational medical technicians and duty occupational medical and health physicists.

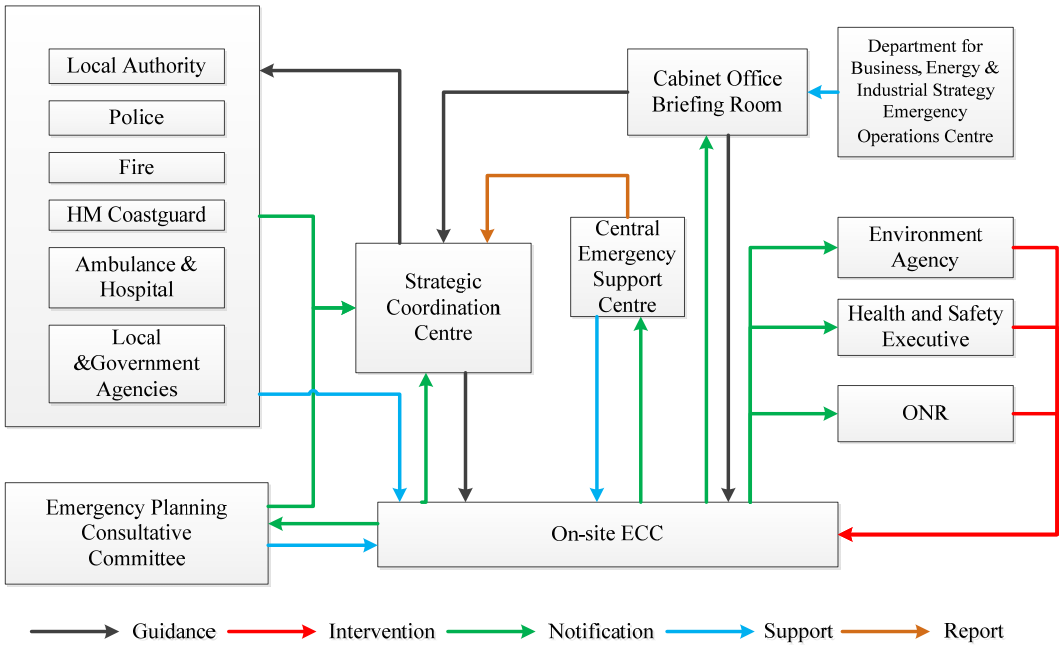
The On-site Emergency Control Centre (ECC) is staffed with a Duty Controller, a Deputy Controller and several other members. The range of work of the emergency response groups cover communication, emergency operation, safety analysis,

environmental monitoring, accident consequence evaluation, managing operations in a radiation emergency, mitigatory actions, security, logistics support, fire-fighting and medical aid.

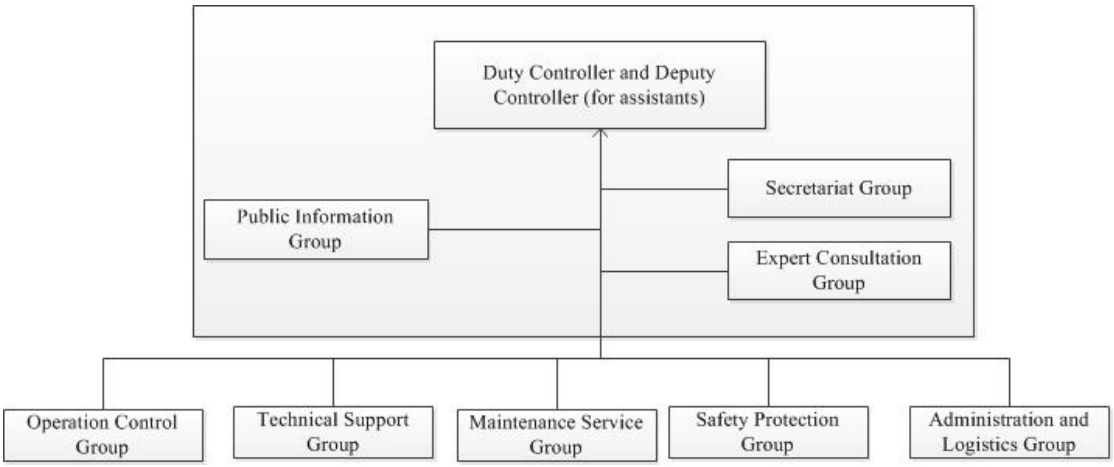
The staffing and qualification of the emergency response organisation will be described in detail in the on-site emergency plan. In the UK, all emergency managers, responders and control centre support personnel must be SQEP, Reference [5].

Emergency response personnel are trained to become competent in use of emergency equipment and emergency procedures, and in particular communications equipment. Training, drills and exercises for emergency arrangements are conducted to demonstrate the overall response capability and capacity of the emergency organisations. These include arrangements for continuous refresher training on an appropriate schedule and arrangements for ensuring that personnel assigned to positions with responsibilities in an emergency response undergo the specified training. The personnel responsible for critical response functions participate in drills and exercises on a regular basis so as to ensure their ability to take their actions effectively, as the requirement of Reference [4]. These will be described in detail in the on-site emergency plan. Records of training and exercises are maintained by the Human Resources Department. The detailed roles and arrangements will be further developed in the nuclear site licensing phase.

As required in REPPIR, Reference [1], before work with ionising radiation is carried out for the first time, a hazard evaluation will be performed and written to identify and assess all hazards which could cause a potential radiation emergency. A full range of possible consequences of the identified radiation emergencies will be considered and assessed. Based on the hazard evaluation and the consequence assessment, the consequences report will be prepared and completed. The emergency plan, amongst other things, forms part of the operational documentation and it is subject to the same quality assurance programme and must comply with site conditions regarding record keeping. These tasks need to combine with specific site conditions and will be performed in the nuclear site licensing phase.



F-32.4-1 Example of the Relationship between NPP Emergency Organisation and Off-site Emergency Organisations



F-32.4-2 Example of the NPP Emergency Organisation Structure

Note: The schematic diagram F-32.4-1 and F-32.4-2 will be changed as emergency planning arrangements for specific areas change. The precise off-site emergency response arrangements will be formulated prior to commissioning.

32.5 On-site Emergency Response Facilities

This sub-chapter describes the basic functions of the main on-site emergency response facilities. In support of the on-site emergency management response arrangements, the UK HPR1000 on-site emergency plan will consider providing available emergency response facilities to coordinate and manage site actions. The main on-site

emergency response facilities are described below as well as their preliminary general design requirements. It is noted that further design requirements for these facilities are still under development and will not be finalised during GDA. In terms of the plant layout, the locations of emergency facilities will be determined in the nuclear site licensing phase.

32.5.1 Main Control Room

The MCR is the workplace for the operation control group staff, where they perform relevant functions in an emergency. The functions of the MCR are as follows:

a) Provide control measures for the operator to maintain or restore the safety status of the NPP.

b) Serve as the major facility for emergency response command before start-up of the On-site ECC centre.

The MCR design ensures the effective delivery of its functions under internal and external hazards and meets the personnel habitability requirements throughout the duration of the postulated accidents. The design information of the MCR is presented in PCSR Chapter 8 Sub-chapter 8.13 and Chapter 10 Sub-chapter 10.6.11.

32.5.2 Remote Shutdown Station

The RSS design is such as to ensure that the reactor can be placed and maintained in a shutdown state, residual heat can be removed and essential plant variables can be monitored if there is a loss of ability to perform these essential safety functions in the MCR. The RSS has the same (duplicated) communications to the On-site ECC as the MCR. The design information of RSS is presented in PCSR Chapter 8 Sub-chapter 8.13.

32.5.3 On-site Emergency Control Centre

The On-site ECC is a strategic centre and the workplace for the ECC controller and his/her staff to control and coordinate the emergency response to the extent that the on-site emergency response is efficiently managed and co-ordinated with the off-site emergency response. The On-site ECC is equipped with communication facilities with various functions, which all have interfaces to facilitate communication with on-site departments and facilities, other authorities as well as national and off-site emergency organisations.

The On-site ECC is located separately from both the MCR and the RSS to safeguard its function, ensure it will not interfere with other on-going response actions and can be secured. The On-site ECC design will satisfy the requirements for personnel habitability throughout the duration of the postulated accidents. The UK HPR1000 On-site ECC has been improved with Fukushima lessons incorporated to ensure that the main structure has sufficient seismic capacity, Reference [6]. This improvement is

in line with relevant good practice.

32.5.4 Technical Support Centre

During the emergency response phase, the TSC is the workplace for the staff of the technical support group where they initiate and implement emergency response actions. The staff carry out the power plant status diagnosis, prediction and evaluation, radiological consequence evaluation and provide technical support to the operating personnel in MCR in an emergency from the TSC. The TSC is located above the MCR, and these two facilities can accessible with each other. The design information of the TSC is presented in PCSR Chapter 8 Sub-chapter 8.13.

32.5.5 Operation Support Centre

During the emergency response period, the Operation Support Centre (OSC) serves as the workplace for the staff of the maintenance service group and administration and logistics group for emergency response. The OSC standby point is co-located with the on-site ECC but is an independent room in the event of a radiation emergency.

The maintenance service group assembles in the OSC to carry out their duties during the on-site and off-site emergency states.

The administration and logistics group organises and controls emergency response actions, including on-site radiation monitoring, emergency radiation control, security support, fire protection coordination, rescue, first aid, decontamination of injured personnel and medical emergency treatment.

32.5.6 Public Information Centre

The Public Information Centre is the workplace for the staff of the public information group to communicate with the On-site ECC by telephone, fax, video and network. The Public Information Centre is able to hold press conferences and receive the public and news media. It can also collect and issue emergency related public information and gather feedback, and release the emergency information about the nuclear power plant.

The operator should provide the information as the input to local authority for preparing or revising prior information, Reference [13]. The briefings for the news media will be coordinated between the facilities and the off-site officials in the Public Information Centre, Reference [15]. This is usually coordinated with the police and local authorities that have statutory responsibility for warning and informing the public, Reference [18].

32.5.7 Communication Systems

The UK HPR1000 communication systems (see PCSR Chapter 9 Sub-chapter 9.7) are designed to provide reliable and efficient communications. Effective means of communication are provided throughout the NPP to facilitate safe operation in all

modes of normal operation and to be available for use after all postulated initiating events and in accident conditions. Suitable and diverse means are provided to ensure that reliable and consistent information can be passed correctly and without delay to the interaction with organisations outside the plant, including the public. Testing and maintenance of the system equipment will be done periodically according to the manufacturer's specification. The communication systems also include regular update checks on contact numbers and for NPP personnel, linked to personnel records.

32.6 On-site Accident Management

32.6.1 Emergency Operating Procedures

The EOPs denote an important part of NPP DiD concept (including Design Extension Conditions (DEC) A). It supports and guides personal activities in preventing and managing incidental and accidental conditions (see PCSR Chapter 31 Sub-chapter 31.4).

The EOPs are based on the state oriented approach. The fundamental objective of an emergency operation is to ensure the six basic safety functions:

a) Sub-criticality;

b) Primary pressure and temperature;

c) Primary water inventory;

d) Steam generator integrity;

e) Water inventory in steam generator;

f) Containment integrity.

All the initial states of the plants are covered in the EOPs. Different human-system interfaces are also considered in the EOPs so as to minimise potential human or technical failures. The radiological protection issues under post-accident conditions are presented in PCSR Chapter 22 Sub-chapter 22.11.

The EOPs need to take account of developments in adjacent sites during construction and commissioning, particularly where the new site is co-located with an existing nuclear licenced site, whether fully operational or undergoing decommissioning. An incident, nuclear or otherwise, may have important implications for both sites. It is good practice to recognise this possibility at an early stage of development.

32.6.2 Severe Accident Management Guidelines

While the EOPs focus on protecting core integrity, the SAMG pays attention to ensure containment integrity and limiting the release of fission products to the environment. The SAMG, whose general objective is to reach a controlled and stable state, should cover all the DEC-B scenarios using realistic assumptions. Furthermore, the

equipment required for severe accident mitigation should be qualified for the conditions and the necessary mission time.

Severe accident scenarios considered in safety analysis are analysed based on realistic assumptions, and dedicated severe accident mitigation measures are designed to mitigate the risk mentioned in PCSR Chapter 13 Sub-chapter 13.5. Operational guidance for severe accidents is described in PCSR Chapter 31 Sub-chapter 31.4. The arrangements will provide the framework for extending the response but they will not be as detailed as those for radiation emergency.

32.7 ALARP Assessment

The following table summarises RGPs identified in Chapter 32, along with source legislation and guidance to meet the ALARP requirement.

T-32.7-1 Summary of Relevant Good Practice

Item	Relevant Good Practice	Source	Gap Analysis
1	Suitable training for emergency response employees and those called on during their normal duty to make an emergency decision. Although not defined precisely, it is RGP to provide a high standard of training at all levels of response, including refresher training.	REPPIR, Regulation 18.	No gap. The relevant description is presented in 32.3, 5th paragraph.
2	To keep plans up to date with experience of other accidents and changing practices.	REPPIR, Regulation 12.	No gap. The relevant description is presented in 32.3, 6th paragraph.
3	The provision of a liaison person to the local resilience forum during planning and review and to the Off-site Emergency Control Centre, which should be a technical person with sufficient seniority to advise.	CCA, Regulation 4 as 4(2) and 4(9) and amended. REPPIR, Regulation 11.	No gap. The relevant description is presented in 32.3, 7th paragraph.
4	The maintenance of training records for SQEP.	British nuclear industry requirement, see	No gap. The relevant description is

Item	Relevant Good Practice	Source	Gap Analysis
		also Nuclear Emergency Planning Liaison Group for guidance notes.	presented in 32.4.
5	Adopting lessons learned from disasters, e.g. Fukushima.	Japanese Earthquake and Tsunami: Implications for the UK Nuclear Industry	No gap. The relevant description is presented in 32.5.3.
6	Emergency operations facilities should be remote from the reactor facility and depending on function may need to be off-site. Standby facilities should not be co-located with the main facilities as there is a risk that both could be put out of action – common mode failure.	IAEA No. GSR Part 7 Requirement 24.	No gap. The relevant description is presented in 32.5.
7	Public Information Centre should be off-site and have facilities for media/press conference and interface with public. This should be done in co-operation with the local authorities who have a statutory duty on this issue.	Generally accepted in emergency planning in UK. For dissemination of information: REPPIR, Regulation 21 and CCA.	No gap. The relevant description is presented in 32.5.6.
8	When producing press statements this should be agreed with the local authorities. This is an operational issue and strictly not GDA but it is worth mentioning as a new site is developed.	REPPIR, Regulation 21.	No gap. The relevant description is presented in 32.5.6.

Item	Relevant Good Practice	Source	Gap Analysis
9	Updating of emergency contacts for NPP staff should be done with the Personnel Department as they should have latest contact details, especially via payroll and salaries section. Maintaining up-to-date emergency contact details is tedious but essential for efficient response.	Generally recognised as a good emergency planning and general management process.	No gap. The relevant description is presented in 32.5.8.
10	It is important to review the EOPs more frequently during the construction phase and commissioning where the new site will be co-located with an existing nuclear facility, whether operational or undergoing decommissioning. Although a site specific issue it needs recognising during the GDA.	REPPIR, Regulation 12.	No gap. The relevant description is presented in 32.6.1.

This section complies with the source legislation and guidance. It is considered that the emergency preparedness complies with RGPs in this chapter. No gap has been identified at this stage.

32.8 Concluding Remarks

In summary, the UK HPR1000 emergency arrangements will meet the requirements of the relevant UK legislation, regulations, guidelines and standards, and of applicable standards of international organisations such as IAEA, before the commissioning.

The UK HPR1000 emergency facilities design has also considered the lessons from the Fukushima accident. The Emergency Preparedness Plan will include information necessary to comply with REPPIR regulations, Reference [1], in the nuclear site licensing phase.

32.9 References

[1] Health and Safety Executive, The Radiation (Emergency Preparedness and Public Information) Regulations 2019, No.703, May 2019.

[2] IAEA, Periodic Safety Review for Nuclear Power Plants, Specific Safety Guide No. SSG-25, March 2013.

[3] General Nuclear System Limited, HPR-GDA-REPO-007, Scope for UK HPR1000 GDA Project, Rev. 001, July 2019.

[4] IAEA, Preparedness and Response for a Nuclear or Radiological Emergency, General Safety Requirements No. GSR Part 7, November 2015.

[5] ONR, Licence Condition Handbook, February 2017.

[6] ONR, Japanese Earthquake and Tsunami: Implications for the UK Nuclear Industry, Final Report, ONR-FR-REP-11-002, Rev 2, September 2011.

[7] Civil Contingencies Act 2004 Chapter 36, 2004.

[8] Cabinet Office, The Civil Contingencies Act 2004 (Contingency Planning) Regulations 2005, November 2005.

[9] Cabinet Office, The Civil Contingencies Act 2004 (Contingency Planning) (Amendment) Regulations 2012, April 2012.

[10] Cabinet Office, The Fit with Other Legislation, Revision to Emergency Preparedness Chapter 19, February 2011.

[11] Cabinet Office Civil Contingencies Secretariat, Dealing with Disaster, Revised Third Edition, ISBN 1 874447 42 X, 2003.

[12] ONR, Safety Assessment Principles for Nuclear Facilities, Revision 0, 2014.

[13] Health and Safety Executive, Approved Code of Practice and Guidance For The Radiation (Emergency Preparedness and Public Information) Regulations, ISBN 9780717667284, September 2019.

[14] UK Department for Business, Energy & Industrial Strategy, Nuclear Emergency Planning and Response Guidance, October 2015.

[15] IAEA, Arrangements for Preparedness for a Nuclear or Radiological Emergency, Safety Guide No.GS-G-2.1, May 2007.

[16] IAEA, Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency, General Safety Guide No. GSG-2, May 2011.

[17] China General Nuclear Power Corporation, General Principles for Application of Laws, Regulations, Codes and Standards, GHX00100018DOZJ03GN, Rev. F, August 2018.

[18] Cabinet Office Civil Contingencies Secretariat, Civil Contingencies Act Enhancement Programme 2012, Annex 7B: Lead Responsibility for Warning and Informing the Public, 2012.