

GIBRALTAR RADIATION EMERGENCY RESPONSE PLAN

Environmental Agency Gibraltar

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HM Government
of Gibraltar

GIBRALTAR RADIATION EMERGENCY RESPONSE PLAN

for an incident from

H M Naval Base Gibraltar
Operational Berths

OFF-SITE EMERGENCY ARRANGEMENTS

GIBRALTAR RADIATION EMERGENCY RESPONSE PLAN

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FOREWORD

The Operational Berths of HM Naval Base Gibraltar are designated for the berthing of Nuclear Powered Warships (NPW). The HM Naval Base Gibraltar is owned and operated by the Ministry of Defence on behalf of Her Majesty's Government. In February 2011 the Ministry of Defence undertook a *Hazard Identification and Risk Evaluation* ¹ as part of their compliance with *The Radiation (Emergency Preparedness and Public Information) Regulations 2004* (REPPiR 2004) ². The assessment report concluded that the operator continued to need an Operator's Emergency Plan. This plan is termed the "On-site" plan.

It follows, therefore, that an off-site emergency plan is required. This emergency response plan fulfills the requirements of *The Radiation (Emergency Preparedness and Public Information) Regulations 2004* (REPPiR 2004) ² and is designated as the **Gibraltar Radiation Emergency Response Plan (GRERP)** to distinguish it from other emergency plans. The former off-site emergency arrangements were prepared by the Ministry of Defence (MoD) and known as *GIBPUBSAFE*. This plan replaces *GIBPUBSAFE* and links with the MoD HM Naval Base on-site emergency plan. This plan is designed to integrate with all other emergency response plans in Gibraltar, especially the Gibraltar Major Incident Response Plan and the Nuclear Emergency Response Organisation (NERO) of MoD.

HM Naval Base Gibraltar has two alongside Operational Berths, designated as berths 49 and 50, for use by UK and foreign nuclear vessels.

This Gibraltar Radiation Emergency Response Plan has been produced by Serco Assurance, Safety Management Systems, B150 Harwell International Business Centre, Didcot, Oxfordshire, OX11 0RA, UK under contract no: SERCO/SMS/3684 with the Environmental Agency Gibraltar. The Plan was amended by the Environmental Agency in 2016 to reflect the strengthening of current contingent capabilities against radiological hazards by seeking to best employ capacity and capability within Gibraltar. A further update (Version 6) was made in October 2019 mainly to reflect changes in UK civil protection terminology.

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ACKNOWLEDGEMENTS

This document has been produced using the technical information contained in the *Report of Assessment of the Hazard Identification & Risk Evaluation*, Ministry of Defence¹ produced under *The Radiation (Emergency Preparedness and Public Information) Regulations 2004 (REPPIR 2004)*², and with the cooperation and contribution of the following

Minister for Civil Contingencies

Minister for Environment

Environmental Agency Gibraltar

Royal Gibraltar Police

Gibraltar Fire and Rescue Service

Airport Fire & Rescue Service

Gibraltar Ambulance Service

Gibraltar Health Authority

Office of Civil Contingencies

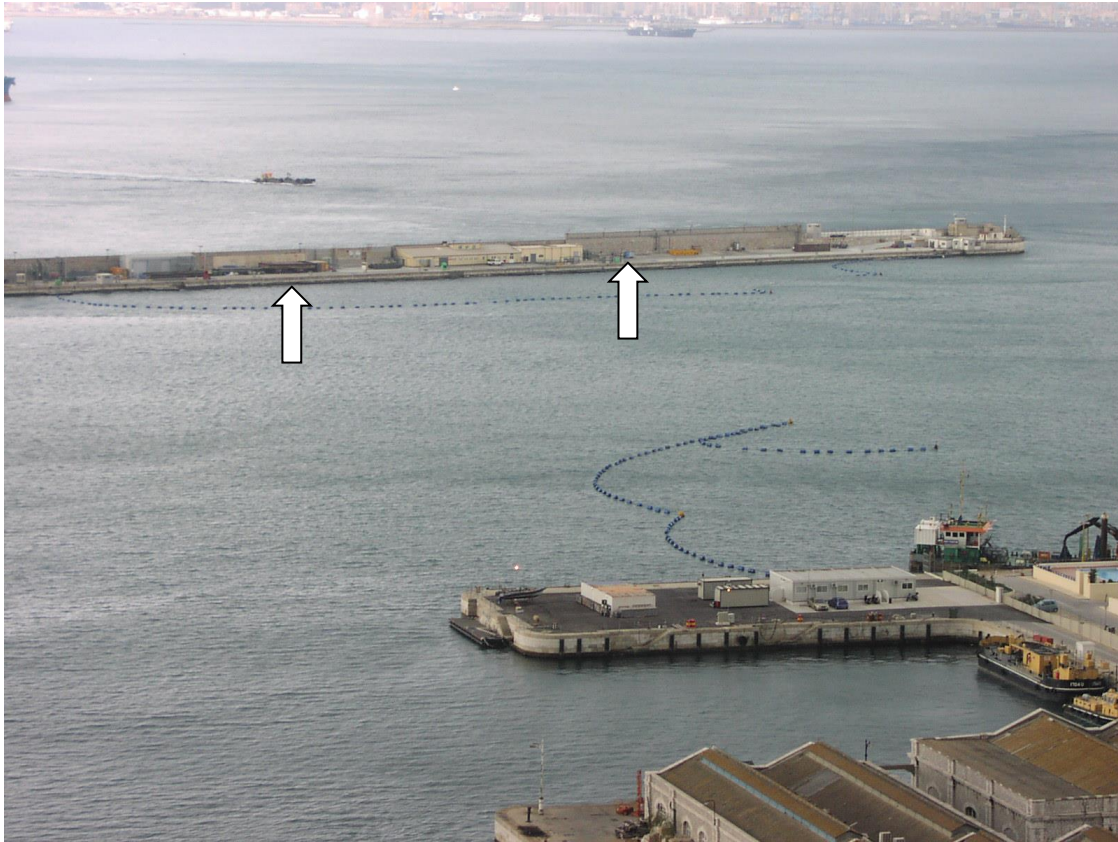
Gibraltar Port Authority

Ministry of Defence - (Royal Navy and HM Naval Base Gibraltar)

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OPERATIONAL BERTHS



HM Naval Base Gibraltar, Operational Berths 49 & 50 MoD HM Naval Base

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ABBREVIATIONS

ACMZ	Automatic Counter Measure Zone (site operator)
AFRS	Airport Fire & Rescue Service
AIO	Ambulance Incident Officer
BCA	Borders and Coastguard Agency
C3	Civil Contingencies Coordinator
DPH	Director of Public Health
ECC	Emergency Control Centre
EAG	Environmental Agency Gibraltar
EZRC	Exclusion Zone Reception Centre
GAS	Gibraltar Ambulance Service
GFRS	Gibraltar Fire & Rescue Service
GHA	Gibraltar Health Authority
GMIRP	Gibraltar Major Incident Response Plan
GPA	Gibraltar Port Authority
GRERP	Gibraltar Radiation Emergency Response Plan
HM Customs	HM Customs
HM GoG	Her Majesty Government of Gibraltar
HPA	Health Protection Agency (UK)
HSE	Health and Safety Executive (UK)
IAEA	International Atomic Energy Agency
IUPAC	International Union of Pure and Applied Chemistry
MACA	Military Aid to Civil Authorities
MoD	Ministry of Defence (UK)
NERO	Nuclear Emergency Response Organisation (MoD, UK)
NPW	Nuclear Powered Warship
OSNE	Off-Site Nuclear Emergency
PTSD	Post Traumatic Stress Disorder
RAF	Royal Air Force
RCG	Recovery Coordinating Group
REPPIR	Radiation (Emergency Preparedness and Public Information) Regulations, Gibraltar, 2004

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RGP	Royal Gibraltar Police
RG	Royal Gibraltar Regiment
RNGS	Royal Navy Gibraltar Squadron
RSA	Reactor Safety Alert
SCC	Strategic Coordination Centre
SCG	Strategic Coordinating Group
SITs	Stable Iodine Tablets
TCC	Tactical Coordination Centre
TCG	Tactical Coordinating Group

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AMENDMENTS

Date	Page Number / Nature of Amendment / Change Notice Reference	Date amended	Name of person making amendment
27/10/2016	Page 11 Addition of AFRS, Senior Fire Officer to distribution list	27/10/2016	Glen Banda
04/08/2017	Page 38 Deletion of 12.2d	04/08/2017	Glen Banda Leslie Edmonds
04/08/2017	Page 39 Deletion of 12.3b	04/08/2017	Glen Banda Leslie Edmonds
04/08/2017	Page 87 Inclusion of Email Contacts Directory	04/08/2017	Glen Banda Leslie Edmonds
04/08/2017	Page 7 Email Contacts Directory	04/08/2017	Glen Banda Leslie Edmonds
04/08/2017	Page 11 Addition of Minister for Health to distribution list	04/08/2017	Glen Banda Leslie Edmonds
20/02/2018	Pages 8, 30, 31, 43, 47 & 86 Change from Potassium Iodate Tablets to Stable Iodine Tablets	20/02/2018	Glen Banda
20/02/2018	Pages 5, 8, 15, 19, 22, 23, 24, 43, 47, 48 & 86 Change from PITs to SITs	20/02/2018	Glen Banda
13/07/2018	Page 87 Change of names and emails to contacts directory	13/07/2018	Jamie Catania Christopher Segovia
29/10/2019	Whole document reviewed. Aligned to UK civil protection terminology. Inserted section for AFRS. Updated email contact directory and references.	29/10/2019	Ivor Lopez Jamie Catania Christopher Segovia

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06	Gibraltar Health Authority, Medical Director
07	Gibraltar Health Authority, Director of Public Health
08	Gibraltar Ambulance Service, Chief Ambulance Officer
09	HM Government of Gibraltar, Chief Technical Officer
10	Gibraltar Fire & Rescue, Chief Fire Officer
11	HM Government of Gibraltar, Director of Education
12	HM Government of Gibraltar, Principal Housing Officer
13	HM Government of Gibraltar, Media Officer
14	HM Government of Gibraltar, Civil Contingencies Coordinator
15	Gibraltar Port Authority, Captain of Port
16	Gibtelecom, Chief Executive Officer
17	AquaGib Ltd., Managing Director
18	Gibraltar Electricity Authority, Chief Executive Officer
19	Ministry of Defence – Commander British Forces
20	Ministry of Defence – Staff Officer (Nuclear)
21	Airport Fire & Rescue Service, Senior Fire Officer
22	HM Government of Gibraltar, Minister for Health

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1 INTRODUCTION

This emergency response plan is designed to stand-alone from other emergency and contingency plans applying to Gibraltar. Nevertheless, this plan, by virtue of its nature, must draw on the Gibraltar Major Incident Response Plan³ and the Gibraltar Nuclear Operator's Emergency Plan, HM Naval Base⁴.

1.1 THE LEGISLATION

This document has been produced under [The Radiation \(Emergency Preparedness and Public Information\) Regulations 2004 \(REPPIR 2004\)](#)².

1.2 BACKGROUND

There has been a Royal Navy and British military presence in Gibraltar since 1704. The Ministry of Defence (MoD), which includes the Armed Forces, has reduced its presence and capability in Gibraltar in recent years. However, the MoD maintain a capability for receiving Nuclear Powered Warships (NPW) within the confines of HM Naval Base at two mooring points designated as "Operational" berths 49 and 50 on the South Mole. Nuclear Powered Warships have been visiting Gibraltar for over 30 years. Such visits require emergency response plans to be in place specifically for a nuclear accident involving the nuclear power plant of a vessel. The local berth (on-site) plan is produced by the MoD in Gibraltar.

It follows, therefore, that this "Off-site" Radiation Emergency Response Plan will take into account the MoD's "On-site" plan. It should be noted that the risk of releasing radioactive fission products from a NPW in a reactor incident is deemed remote, principally due to the design and operation. However, it is also recognised that no process involving hazardous components can be entirely safe so the MoD have established the Nuclear Emergency Response Organisation (NERO). The NERO is maintained at one hour's notice in Gibraltar throughout all NPW visits, with additional specialist back-up support and technical advisory groups on standby in the UK ready to respond in the event of an incident.

It has been agreed with the MoD that any casualties' that are either actually or suspected of being contaminated may be de-contaminated in the Exclusion Zone Reception Centre (EZRC) or mobile de-contamination facility. This will also include all casualties arising from within the affected area outside the HM Naval Base.

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2 AIM and OBJECTIVES

2.1 AIM

The aim of this plan is to safeguard the public, as far as it is practicable, in the event of an on-site incident involving the release of radioactive fission products associated with a nuclear power plant in a Nuclear Powered Warship.

2.2 OBJECTIVES

The objectives of this plan, as required under the REPPIR 2004 regulations² are to:

- minimise the effects, and to limit injury to persons, the environment and property from an on-site incident;
- implement measures necessary to protect persons from the effects of a radioactive material dispersion and in particular the transfer of radioactive substances to individuals from the environment;
- communicate the necessary information to the public in a threatened area through the Emergency Services and HM Government of Gibraltar;
- provide for the long-term surveillance and medical care of persons exposed to radioactive material;
- provide for the restoration and clean-up of the environment following a radioactive material deposition.

It should be noted that in meeting these objectives the prevention or minimisation of deposition of radioactive material from the incident site is not within the control of this plan, and consequently the environment may be contaminated to a greater extent than the population.

- To meet the requirements of an off-site emergency plan as specified in the REPPIR 2004 regulations², Part 2, Sections 9, 10, 13, 16 and 17.
- To make provision for the evacuation of people from a non-radiological incident, which might take place at the same time, to a place of safety.
- To make available sufficient information to prevent the emergency services and other organisations from exposing themselves unnecessarily to the hazards of radioactive contamination.
- To provide a link into the Gibraltar Major Incident Response Plan³ and other incident plans that may be implemented.
- To integrate this plan with the existing procedures already followed by the emergency services and others when dealing with emergencies involving the

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release of radioactive material into the environment of Gibraltar. These other documents and link plans include:

- Gibraltar Nuclear Operator's Emergency Plan, HM Naval Base Gibraltar.
- HM Naval Base Gibraltar, Major Incident Plan (BFGIB SOP Part III Section 2)
- HM Government of Gibraltar, Gibraltar Major or Emergency Advisory Booklet⁵
- Gibraltar Health Authority Major Incident Plan
- Gibraltar Port Authority Emergency Plans
- Airport Emergency Plans

2.3 PLAN CONSTRUCTION

This plan is constructed to take into account the following aspects which are specific to radiation emergency response plans and as advised by the International Atomic Energy Agency⁶. However, in this particular case it is recognised that the off-site effects and response will be substantially less with respect to radiation injuries when compared with the site of an incident. This off-site plan has no influence on the on-site emergency response.

- To maintain control of the situation outside of HM Naval Base;
- To assist in prevention or mitigation of consequences at the scene, if requested by the MoD;
- To prevent the occurrence of deterministic health effects in workers and the public;
- To manage the treatment of radiation injuries that may occur, if required, and provide first aid should it be required, although this is most unlikely;
- To prevent, to the extent practicable, the occurrence of stochastic health effects in the population;
- To prevent, to the extent practicable, the occurrence of non-radiological effects on individuals and among the population;
- To protect, to the extent practicable, property and the environment;
- To prepare, to the extent practicable, for the resumption of normal social and economic activity.

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2.4 HM GOVERNMENT OF GIBRALTAR AND MOD COMMAND AND CONTROL (C2) RELATIONSHIP

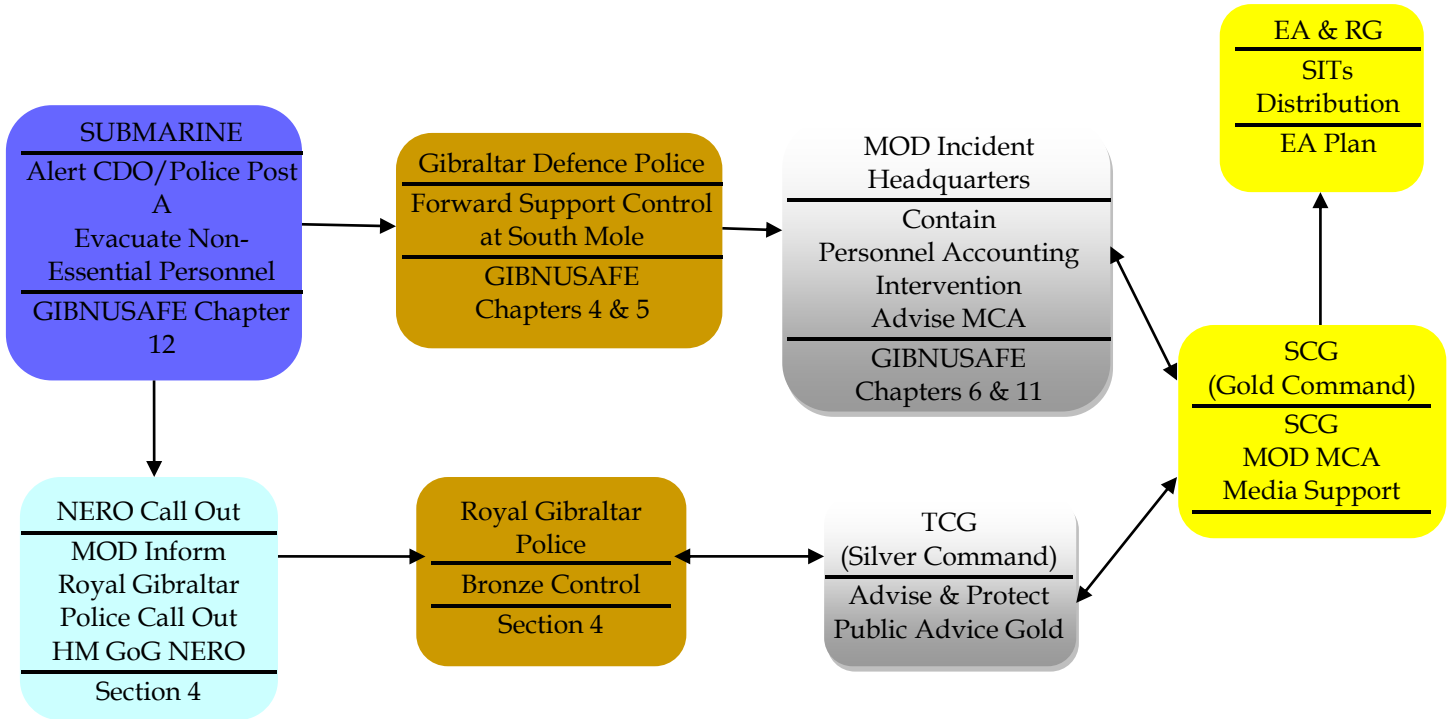


Figure 1. Command and Control (C2) relationship

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3. CATEGORISATION AND INCIDENT DEFINITION

3.1 States of Emergency

Incidents in HM Naval Base, Definitions

The following definitions apply to an event in a reactor in a Nuclear Powered Warship that could result in a Nuclear Reactor Emergency.

- An **Off-Site Nuclear Emergency** is defined as:
"A hazardous condition which requires the implementation of urgent countermeasures to protect the public".
- Once an Off-Site Nuclear Emergency has been declared the following qualifiers will be used in conjunction with the definition of an Off-Site Nuclear Emergency.
 - (i) **Radiation hazard confirmed** – an Off-Site Nuclear Emergency in which a radiation hazard has been detected.
 - (ii) **Release of radioactive material confirmed** – an Off-Site Nuclear Emergency in which a release of radioactive material to the environment has been detected.

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4. PLAN ACTIVATION

The Radiation Emergency Response Plan will be fully activated when the alert by HM Naval Base has been raised to “Off-Site Nuclear Emergency”. The emergency response activation will follow the schematic diagram figure 2, shown below; this is similar to the Major Incident Response Plan.

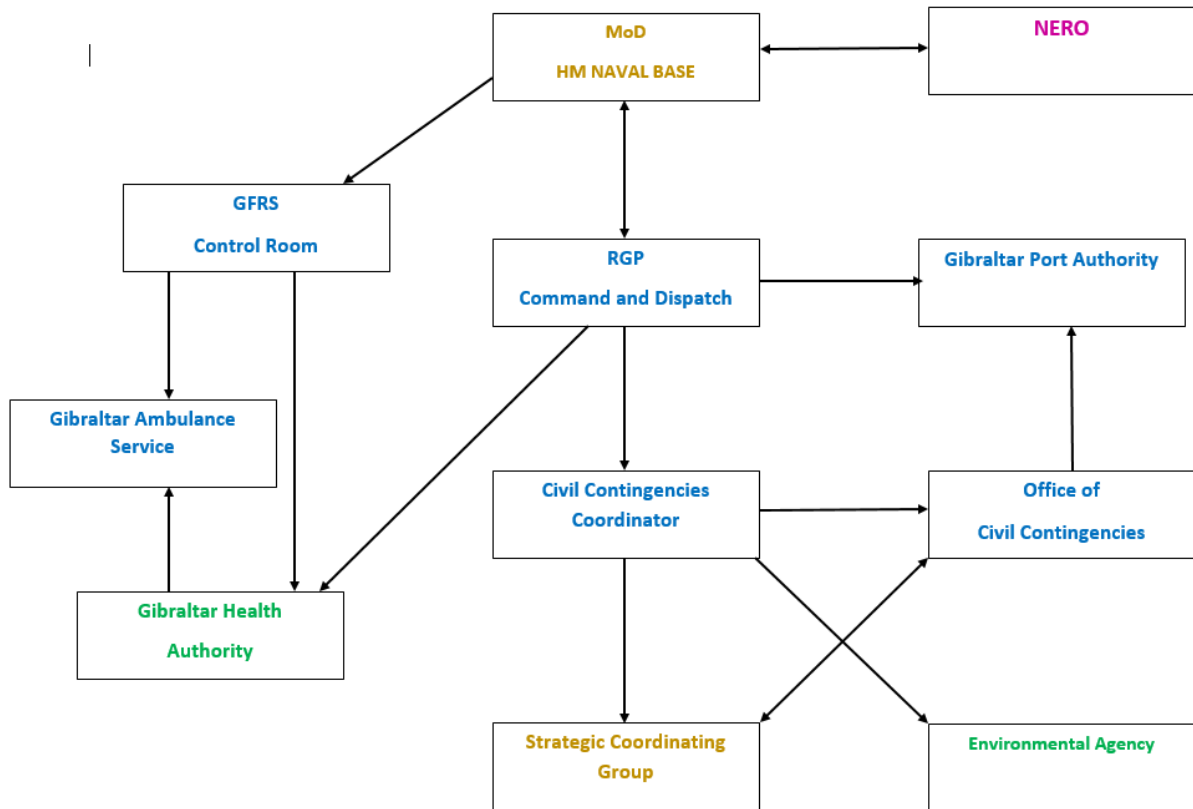


Figure 2. Activation of Emergency Plan

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4.1 Initial Actions

Royal Gibraltar Police HQ Operations Room

a) When alerted by the MoD Incident Control that an Off-Site Nuclear Emergency has been declared, the Police HQ Operations Room will immediately open a log of events and ascertain from HQBF the following:

- Confirm the location of the incident;
- A description of the incident and the current situation;
- The radioactive material released, and any other hazardous substances;
- The wind direction and speed;
- The likely threatened area;
- Safe access routes and Rendezvous Point(s);
- Any special contact numbers in use;
- Who else has been informed.
- Establish background radiation levels with the help of MOD monitors.

b) Contact the HM GoG Civil Contingencies Coordinator and alert him/her of the incident.

c) Contact other organisations as are appropriate to the incident (see Figure 2 on Page 20).

d) Despatch Police Unit(s) to the pre-identified traffic control points via a safe route. The first Senior Police Officer at the Command Centre should consult with the Senior GFRS Officer to identify the threatened areas, which should have been notified by the MoD.

e) Establish a Tactical Coordination Centre at the New Mole House (wind direction to be considered).

f) Deploy other responders to Strategic Coordination Centre, Tactical Coordination Centre and Operation Command (Bronze), as necessary.

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4.2 Operational Command (Bronze)

- a) As directed by Senior Officers of the responding emergency services.

4.3 Tactical Coordinating Group (Silver)

- a) Act as SCG until the Chairman of SCG informs that SCG is fully manned.
- b) Establish the Tactical Coordination Centre, normally at New Mole House (wind direction to be considered)
- c) Manage traffic control.
- d) Establishment of a casualty bureau.
- e) Maintain a record of incident.

4.4 Strategic Coordinating Group (Gold)

- a) Close up and gather information.
- b) Devise strategy to protect the public.
- c) Initiate SITs Plan.

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5. COMMAND AND CONTROL ARRANGEMENTS

HM GoG, Royal Gibraltar Police, Gibraltar Fire & Rescue Service and other responders to emergency incidents have adopted the UK concept of Strategic, Tactical and Operational command and control for all civil emergency incidents. This is often referred to as the "Gold, Silver and Bronze" system and in Gibraltar is operated as follows:

- **Strategic Coordinating Group (Gold)** where strategy and policy is determined. Normally at a Strategic Coordination Centre away from the scene. Meetings will normally be co-ordinated by the Minister for Civil Contingencies as Chairman of the SCG. In Nuclear Emergency incidents, the Minister for the Environment will normally chair the SCG.
- **Tactical Coordinating Group (Silver)** where the strategy set by SCG is implemented by the issue of tactical instructions and the allocation of resources.
- **Operational (Bronze)** where resources are deployed and operational tasks performed in accordance with TCG's' tactical instructions.

5.1 Location of Commands:-

- **Strategic Coordinating Group** – Strategic Coordinating Centre – No.6 Convent Place.
- **Tactical Coordinating Group** – Will initially be located at Police Operations, New Mole House but may require relocating depending on how the incident develops.
- **Operational Command** – Response by Gibraltar's Emergency Services is limited to off-site mitigatory actions. Any response/support to on-site mitigatory action can only proceed with the explicit consent of the SCG.

5.2 Areas of responsibility:-

- The onsite scene involving any incident on a NPW berthed at an operational berth HM Naval Base is entirely under the control of the MOD. Effects outside HM Naval Base arising from an incident at an operational berth come under the control of the RGP on behalf of HM GoG.
- Other responding organisations mentioned in this Plan will carry out their specialist duties in accordance with their own roles and responsibilities.
- HM GoG is responsible for the overall coordination of personnel and all resources through the Strategic Coordinating Group.

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5.3 Emergency Exposure Levels:-

Only the Gibraltar Fire & Rescue Service and Airport Fire & Rescue Service have been identified from HM GoG Emergency Services as personnel that may be subjected to an emergency exposure. It is envisaged that this emergency exposure would only be incurred if they were already partaking in a “conventional” emergency situation onboard the Nuclear Powered Warship (for example fire-fighting) which then developed into a radiation emergency. The Airport Fire and Rescue Service personnel would be utilised to undertake any intervention tasking.

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6. INITIAL EMERGENCY RESPONSE

The initial emergency response will be activated by an alert from HM Naval Base. This will be a telephone call to the Royal Gibraltar Police Operations Room. The alert will state the nature of the incident, which may be categorised as follows.

Emergency Category	Definition	Level of Emergency Response
Reactor Safety Alert (RSA)	An abnormal event which poses a potential threat to, or causes serious concern for, reactor plant safety	When declared by the submarine, an RSA will have the effect of closing-up specialist technical support in order to assist in dealing with the problem. It is emphasised that an RSA does not constitute a reactor emergency or require the initiation of either the On-site or Off-site plans. However, it has been agreed that the MoD will inform the Civil Contingencies Coordinator. Incident Commanders responsibility (Annex F, Paragraph 2.2 of the Nuclear Operator's Emergency Plan.
Off-Site Nuclear Emergency (OSNE)	An engineering hazard on board and no radioactive hazard. On board situation reported to Naval Base Emergency Organisation, who alerts MoD NERO, RGP Operations Room, and Gibraltar Fire & Rescue Service Control.	Activate Emergency Plan, Tactical and Operational level responders called to 'Stand-by'. Consider deploying Emergency Services to place of safety. Strategic Coordinating Group advised. SITs plan activated. SITs will be issued by RG in downwind sectors. Public advised to shelter.
Off-Site Nuclear Emergency - Radiation hazard confirmed	Radiation monitoring equipment on board and / or on jetty detect an increase in radiation levels restricted to HMNB. Naval Base Emergency Organisation informs the Strategic Coordinating Group.	Activate Emergency Plan with Strategic and Tactical Commands. Deploy operational level responders to predefined locations. SITs distribution and immediate consumption to the entire population will be authorized by the SCG on the advice of the Director of Public Health beginning with the downwind sector. Public advised to shelter.
Off-Site Nuclear Emergency - Release of radioactive material confirmed	Highest alert state. Radioactive material released from outside area of HMNB. Naval Base Emergency Organization informs SCG.	Activate Emergency Plan with Strategic and Tactical Commands. Deploy Operational level responders to predefined locations. Public advised to shelter. Consider distribution of SITs to other sectors.

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Emergency Category	Countermeasure
Off Site Nuclear Emergency	<ul style="list-style-type: none"> • Advise the whole population of Gibraltar to shelter by staying indoors and closing all doors and windows. – RGP & HM GoG Media • 2. Consider method of SITs distribution. Priority to be given to residents sheltering, in sectors expanding out from the downwind sector. – RG & EAG
Off Site Nuclear Emergency – Radiation Hazard Confirmed	<ul style="list-style-type: none"> • Advise the whole population of Gibraltar to shelter by staying indoors and closing all doors and windows. – HM GoG Media • SITs to have been distributed for immediate consumption. Priority to be given to residents sheltering, in sectors expanding out from the downwind sector.– RG & EAG
Off Site Nuclear Emergency – Release of Radioactive Material Confirmed	<ul style="list-style-type: none"> • As above • Consider requirement to extend countermeasures, depending on radiation monitoring results and release duration. - SCG

Figure 3. Summary of Countermeasures versus Emergency Category

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7. MEASURES TO PROTECT THE PUBLIC

7.1 SITS Distribution

- SITS distribution will be authorised by the SCG on the advice of the DPH once an Off-Site Nuclear Emergency is declared.
- SITS are stored by the RG on behalf of the Chief Environmental Health Officer and will be distributed by the RG in accordance with the agreed distribution Plan held by the EA and RG.
- Distribution Centres manned by the RG may be used to distribute SITS if particular circumstances at any time dictate.
- A combination of both distribution methods may be used.
- Emergency Services hold sufficient SITS supplies to cater for their own personnel.
- Consideration will be given to issue SITS directly to Schools (during school hours), GHA facilities, visiting cruise ships and hotels. SITS should also be provided at points of entry / exit (Land Border / Airport / Port)
- Additional SITS supplies are available by MOD if required.

7.2 List of Distribution Centres is as :-

- Distribution Centres location will be advised by the SCG by television, radio, public address systems and social media.

7.3 Incident with no Prior Warning

Consider:-

- SITS distribution (dispensing SITS even after exposure is considered worthwhile for up to 24 hours post-event).
- Decontamination of persons in plume deposition zone.
- Respiratory protection where appropriate.

7.4 Incident with Prior Warning Received

The most appropriate protection that can be advised is for people to *go in, stay in* and *tune in* until advised they can leave.

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7.5 Evacuation Centres/Shelters

- Evacuation Centres are defined in the Major Incident Response Plan.
- Evacuation Centres will provide temporary shelter to visitors and tourists that may be stranded in Gibraltar.
- MOD will provide monitoring equipment and will assist with its use if this is requested by the SCG.
- Shower facilities to decontaminate persons with external radioactive contamination. Consider installing mobile decontamination facility if deemed necessary.
- Consular Offices should be contacted to provide assistance to their nationals if deemed necessary.

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8. INFORMING AND WARNING THE PUBLIC

If an emergency within HM Naval Base is likely to escalate and cause a danger to people outside the boundary fence, the Government will issue public emergency instructions by radio, television, social media and public broadcast vehicles.

8.1 EMERGENCY INSTRUCTIONS

The following emergency instruction will be issued.

EMERGENCY INSTRUCTIONS

Go in, stay in and tune in

- Go or stay indoors.
- Close external doors and all windows, including ventilators.
- Switch off air conditioning, fans and systems providing ventilation from external air.
- It is advisable not to collect children from school unless told to do so. They will be properly cared for.
- Tune in to GBC radio / TV for emergency instructions. Follow HM GoG and RGP twitter accounts.
- Do not use the telephone until the ALL CLEAR is given – ensure telephone lines are free for the emergency services and if you have an emergency that is life threatening. This is particularly important for mobile phones, which may fail if the network is overloaded.
- Keep pets indoors.
- Remain indoors until the ALL CLEAR is given or until you receive instructions from the Police.
- Follow instructions from the Police or other officials for returning to your home or usual place of work or activity.

8.2 INFORMATION

An essential part of protecting the public is the provision of practical information for the public to help themselves.

Note: Public information messages that would be issued by the Government Media Officer are found in the News Media Arrangements Section 10, Pages 31 - 36.

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9. NEWS MEDIA ARRANGEMENTS

9.1 THE MEDIA RESPONSE

When any major incident occurs, the response by the media will be immediate. In addition, an incident involving a nuclear reactor and especially that of a warship will attract overwhelming international attention. Gathering information will be the singular focus of their attention and it is, therefore, imperative that HM GoG, emergency services and Ministry of Defence manage jointly and are adequately prepared to meet the demands of the media.

9.2 MEDIA ROLE

The media should not be underestimated and have an important role in assisting the emergency services and Government by disseminating information to the public during a major incident. The media response at a major incident usually occurs in three stages. However, in Gibraltar there are likely to be only two stages:

- **Local media** made up of local press, radio and television. These will be on scene within minutes in such a community as Gibraltar.
- **International media** of over 100 people, are likely to arrive in Gibraltar within four hours of the incident where they can gain access. The Ministry of Defence will restrict access to the waters surrounding the scene and Naval Base but the designated Operational Berths are easily overseen from the Gibraltar heights, especially around the Cable Car Lift and all points to the summit of the Rock.

9.3 NEEDS OF MEDIA

The needs and requirements of the media have to be addressed in both manpower and equipment terms at the earliest opportunity. Accompanying the ever increasing number of media reporting personnel will be their support services and transport comprising of cars, communication vehicles and mobile satellite equipment and indeed, from the sea by boat. Border restrictions with the Spanish authorities may only delay slightly access by the press who will seek other means. Consideration should be given to coastal patrols to prevent shore landing where feasible. Press should not be permitted in evacuation centres unless evacuees give their unanimous permission.

9.4 MEDIA BRIEFING CENTRE

It is vital that a Media Briefing Centre be established as soon as possible. This establishes a focal point for the media where they can receive initial press statements and regular briefings. The need for adequate vehicle parking may need to be taken into account depending on accessibility to Gibraltar.

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9.5 INITIAL MEDIA BRIEFING

During the initial stages of an incident, HM GoG Media Officer may establish a designated Media Briefing Point at No.6 Convent Place where all accredited members of the media must be directed.

9.6 ARRANGEMENTS FOR DEALING WITH THE MEDIA / PUBLIC

Whilst each individual agency retains the ability to issue media/public information bulletins regarding their own duties, it is advisable to superimpose over this a co-ordinating structure. Co-ordination will be conducted by HM GoG Media Officer. Individual services Public Relation Officers (PROs) are advised that this team is informed of any information bulletins, preferably prior to their release. The team will be located in the identified Media Briefing Centre.

HM GoG Media Team and the MoD Media Officer will issue information in liaison with each other.

9.7 ARRANGEMENTS FOR DEALING WITH ENQUIRIES FROM FRIENDS AND RELATIVES OF CASUALTIES

The Police, if necessary, will establish a Casualty Bureau and publicise the public enquiry telephone numbers through the media. An incident involving large numbers of casualties should not arise directly from the radiation hazard itself. However, persons potentially radioactively contaminated who are under care will need to be registered through the Police Casualty Bureau system. The Bureau records must be kept cross-referenced with those of the hospitals and medical centres to enable proper enquiries from relatives and friends to be managed sympathetically and efficiently.

9.8 INFORMATION TO THE PUBLIC

Pre-prepared advice is issued by Ministry of Defence to persons within the Naval Base. Any additional advice given to the public must be agreed by all appropriate organisations prior to its release via the media or other appropriate means. Advice to the public will vary according to the circumstances prevailing at the time.

If specific messages regarding the incident are to be released they will be jointly compiled by relevant members of the response agencies and will be issued by the HM GoG Media Officer.

It is vital that Situation Reports are provided to the public so as to maintain confidence, trust and co-operation of the public. This applies equally to personnel engaged in the emergency at all levels and in particular their families.

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10. INITIAL PUBLIC INFORMATION STATEMENTS

The following statements suitably modified to suit the occasion are for use in the event of an incident, which is, or may develop into, an off-site radiological incident. Prior consultation/approval of the HM GoG Media Officer is essential before making any announcement along the following lines.

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OFF-SITE NUCLEAR EMERGENCY

1. A problem has occurred on board the nuclear-powered submarine..... which is berthed at.....berth in Gibraltar.

2. Although THERE IS NO RADIATION HAZARD we (*are advising/have advised*) people in the immediate area surrounding the submarine (*define area*) to leave/take shelter) as a precautionary measure while the problem is being dealt with. There is no danger whatsoever of a nuclear bomb type of explosion.

3. There is no need for people outside the above named area to take any special action. However, to assist specialist teams and emergency services responding to the problem, it is requested that individuals in the vicinity (*define, by reference to local boundaries, e.g. roads, district names*) stay indoors, unless advised to otherwise by the police.

4. Further statements will be made when there are any more developments. Please listen for announcements on GBC radio, TV, BFBS and through the internet and social media.

Shelter Advice

- Go indoors and STAY THERE.
- You are advised NOT to collect children at school unless told to do so. The school authorities will look after them.
- Close all doors, windows and ventilators. Switch off any ventilation or air conditioning systems drawing air from outside the building.
- DO NOT leave the shelter or a building unless requested to do so by the Police or other emergency service.
- Keep tuned to GBC radio, TV, BFBS and follow updates on social media.
- Keep pets indoors.
- Emergency Services and Military forces are responding to the accident. You will be informed when these precautions are no longer necessary.

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OFF-SITE NUCLEAR EMERGENCY – RADIATION HAZARD CONFIRMED

1. A problem has occurred on board the nuclear-powered submarine..... which is berthed at..... berth in Gibraltar.

2. (INSERT REPORT ON CURRENT SITUATION)

3. A full investigation will be carried out into the cause of the problem.

4. There is no danger whatsoever of a nuclear bomb type explosion, nor has there been a release of radioactive material from the submarine. There is, however, a radiation hazard in the immediate vicinity of the submarine's hull. In accordance with the prearranged local public safety plan, and after consulting local civil emergency authorities, we:

are evacuating/have evacuated a zone within.....metres of the submarine.

in accordance with HM GoG's policy, are advising/have advised the public to remain indoors and close all external windows and doors.

AND

are issuing/have issued Stable Iodine Tablets to personnel throughout Gibraltar starting in the downwind sector as a precaution against the absorption of radioactive Iodine. These are to be taken immediately on the advice of the Environmental Agency.

5. These are precautionary measures taken while naval and civilian specialists are dealing with the problem.

6. There is no need for people outside the above named area to take any special action. However to assist specialist teams and emergency services responding to the problem it is requested that individuals in the vicinity (*define by reference to local boundaries, e.g. roads, district names*) stay indoors, unless advised to do otherwise by the police).

7. Further statements will be made when there are any more developments. Please listen for announcement on GBC radio, TV, BFBS and follow updates on the internet and social media.

Shelter Advice

- Go indoors and STAY THERE.
- You are advised not to collect children at school unless told to do so. The school authorities will look after them.

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- Close all doors, windows and ventilators. Switch off any ventilation or air conditioning systems drawing air from outside the building.
- DO NOT leave the shelter or a building unless requested to do so by the Police or other emergency service.
- Keep tuned to GBC radio, TV, BFBS and follow updates on social media.
- Keep pets indoors.
- Emergency Services and Military forces are responding to the accident. You will be informed when these precautions are no longer necessary.

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OFF-SITE NUCLEAR EMERGENCY – RELEASE OF RADIOACTIVE MATERIAL CONFIRMED

1. A problem has occurred on board the nuclear-powered submarine..... which is berthed at..... berth in Gibraltar.

2. (INSERT REPORT ON CURRENT SITUATION)

3. A full investigation will be carried out into the cause of the problem.

4. There is no danger whatsoever of a nuclear bomb type of explosion. Some radioactive material has, however been released from the submarine. There is also a radiation hazard in the immediate vicinity of the submarine. In accordance with the prearranged local public safety plan, and after consulting local civil emergency authorities, we:

are evacuating/have evacuated a zone with.....metres of the submarine,

AND

in accordance with HM GoG's policy, are advising/have advised the public to remain indoors and close all external windows and doors.

AND

have started/completed issue of Stable Iodine Tablets to personnel throughout Gibraltar as a precaution against the absorption of radioactive Iodine.

5. These are precautionary measures taken while naval and civilian specialists are dealing with the problem.

6. There is no need for people outside the above named area to take any special action. However to assist specialist teams and emergency services responding to the problem it is requested that individuals in the vicinity (*define by reference to local boundaries, e.g. roads, district names*) stay indoors, unless advised to do otherwise by the police).

7. Further statements will be made when there are any more developments. Please listen for announcement on GBC radio, TV, BFBS and follow updates on the internet and social media.

Shelter Advice

- Go indoors and STAY THERE.

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- You are advised NOT to collect children at school unless told to do so. The school authorities will look after them.
- Close all doors, windows and ventilators. Switch off any ventilation or air conditioning systems drawing air from outside the building.
- DO NOT leave the shelter or a building unless requested to do so by the Police or other emergency service.
- Keep tuned to GBC radio, TV, internet, BFBS and follow updates on social media.
- Keep pets indoors.
- Emergency Services and Military forces are responding to the accident. You will be informed when these precautions are no longer necessary.

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11. IMMEDIATE PUBLIC HEALTH ASPECTS OF A RADIOLOGICAL ACCIDENT

The Director of Public Health is responsible for co-ordinating the Public Health aspects of the response to any nuclear emergency that impinges on the health of the population.

A long term strategy on the management of the long term public health aspects is contained in Appendix 2.

The immediate public health aspects of a radiological emergency to be considered are as follows:-

11.1 Public Health Response

- Management of any on-site or off-site casualties. Any casualties that are either actually or suspected of being contaminated may be de-contaminated in the Exclusion Zone Reception Centre (EZRC) or mobile de-contamination facility before being treated by the GHA.
- Support to MOD from GHA where this is practicable, feasible and safe to do so.

11.2 Response to Radiation Deposition Off-Site

- Monitoring of areas outside HM Naval Base where deposition of radioactive material has been confirmed by the MOD Health Physics team. Competent Authority to ensure that this monitoring is carried out.
- Monitoring of people for contamination if considered necessary.
- Immediate decontamination of persons exposed to radioactive material deposition outside HM Naval Base.
- Keeping records of persons monitored and decontaminated.
- Monitoring of ambient air to estimate end of deposition. This will be managed by the Competent Authority with the support of the MOD.

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12. ROLES AND RESPONSIBILITIES

In this section the roles and responsibilities of all key responders, both first and second tier, are described.

12.1 Royal Gibraltar Police

12.2 Gibraltar Fire & Rescue Service

12.3 Airport Fire & Rescue Service

12.4 Gibraltar Ambulance Service

12.5 Gibraltar Contingency Council

12.6 Gibraltar Health Authority

12.7 Environmental Agency Gibraltar

12.8 HM Government of Gibraltar (including ministry departments)

12.9 Ministry of Defence, including MACP / MACA

12.10 Gibraltar Port Authority

12.11 Electricity, Gibraltar Electricity Authority

12.12 Water, AquaGib Ltd

12.13 Technical Services Department

12.14 Telecommunications, Gibtelecom

12.15 Health and Safety (Factories Inspector)

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12.1 ROYAL GIBRALTAR POLICE

Introduction

In an emergency situation, the police have clearly defined objectives and, in association with those objectives, undertake specific functions within the framework of their normal statutory obligations and the overall police role. The Police's role in a major incident is to coordinate and facilitate the emergency response.

Objectives

- Protection of life and property
- Maintenance of public order
- Detection of crime and preservation of evidence
- Management of the threat zone, radiation or contaminated areas.

Functions

- a) Co-ordination of operations. The senior police officer present will identify any Forward Control Point (FCP) and Rendezvous Points (RVP) for vehicles, where appropriate, in liaison with the other Emergency Services and co-ordinate the operations of participating organisations. In addition, the police will be responsible for the setting up of a cordon to secure the threatened or affected area. Monitoring of radiation levels by MOD monitors to be undertaken during this process.
- b) Establishment of a major incident control room. The major incident control room will normally be established at Police HQ in the first instance until the SCG is activated.
- c) Traffic control. This will present a severe problem if the majority of the populated area is likely to be affected. If a rendezvous point or points are to be set up for emergency vehicles and resources, the Police HQ Operations Room will arrange for personnel and vehicles to be despatched to control the point or points. They will nominate routes for access to and from the rendezvous point or points and will ensure that such routes are kept clear and suitably sign posted. They will notify external agencies and the general public of the effects of traffic regulation around Gibraltar.
- d) Establishment of a casualty bureau. The casualty bureau will be established by the officer in charge of the casualty bureau after notification from the Emergency Control Centre Co-ordinator. It is located at New Mole House Police Station.
- e) Information to the public. This will be managed by HM GoG Media Officer who will arrange as necessary for information to be released to the public via the media.
- f) Mortuary duties. The Police as Coroner's Officers have primary responsibility for the recovery of the dead, identification of victims and furnishing of

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necessary information to the Coroner. It is not anticipated that there will be any fatalities directly as a result of a radiation incident.

- g) Security of Property. The Police or any other duly authorised body will be responsible for all aspects of recording and storage of property recovered from casualties sustained outside of HM Naval base. This duty will also include premises and vehicles.
- h) Press Liaison. Initial public advice will be made by the Police Media Spokesperson or nominated police officer in consultation with the Government Media Officer. As soon as practicable after an incident the Government Media Officer will be responsible for issuing and coordinating all news media information, and will establish a media briefing point and, if necessary, make arrangements to provide media facilities at a nearby Media Centre. It is essential for other organisations to liaise closely to ensure that information for press releases is co-ordinated. See Section 8, Informing and Warning the Public and Section 9, News Media arrangements.
- i) Record of incident. The Police will maintain an operational log as a record of the incident.

Mobilisation and Deployment

The Police, as an initial action, if it considered necessary and on instructions of the SCG will deploy sufficient resources to isolate the contaminated or threat zone and the surrounding area, where it is practical to do so. The area will be defined by the SCG in consultation with MOD.

Police HQ Operations Room

- a) When alerted by the MoD Incident Control that an Off-Site Emergency has been declared, the Police HQ Operations Room will immediately open a log of events and ascertain the following:
 - Confirm the location of the incident
 - A description of the incident and the current situation
 - The radioactive material released, and any other hazardous substances
 - The wind direction and speed
 - The likely threatened area
 - Safe access routes and Rendezvous Point(s)
 - Any special contact numbers in use
 - Who else has been informed
- b) Contact the Civil Contingencies Coordinator and alert him/her of the incident.

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- c) Contact other organisations as are appropriate to the incident (see Figure 2, Section 4).
- d) Despatch Police Unit(s) to the pre-identified traffic control points via a safe route. The first Senior Police Officer at the Command Centre should consult with the Senior GFRS Officer to identify the threatened areas, which should have been notified by the MoD.
- e) Establish an Incident Control Command at New Mole House Police Station or an agreeable alternative location as advised by the SCG.
- f) Deploy other responders to Strategic, Tactical and Operational, as necessary.

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12.2 GIBRALTAR FIRE AND RESCUE SERVICE (GFRS)

Introduction

The GFRS has clearly defined objectives and therefore undertakes specific functions within the framework of their normal duties and statutory obligations. The GFRS is the responsible service with operational jurisdiction for fires and any other incidents within Gibraltar that includes the MoD estate, with the exception of aircraft incidents (airfield) and any Radiation Emergency on board nuclear powered warships (NPW) that would involve the reactor. This responsibility lies on the Airport Fire and Rescue Service, (formerly known as the Defence Fire & Rescue Service (DFRS)).

Objectives

To save life and property, render humanitarian services and restore of normality.

Functions

The role of the GFRS is derived from its long experience in fire-fighting and rescue operations of all types and includes:

- a) Deploy responders to Strategic, Tactical and Operational, as necessary.
- b) Contact Ambulance Service and Gibraltar Health Authority and alert them to the incident.
- c) Lifesaving operations¹.
- d) Assist in information gathering and hazard assessment to give advice to the Police to enable them to advise the public.
- e) Liaison with the Police regarding the provision of a cordon around the threat zone or contaminated area outside the HM Naval Base to enable the GFRS to exercise control (except at terrorist related incidents).
- f) Liaison with the Ambulance Service Incident Officer and the Medical Incident Officer (if there is one present) with regard to providing assistance at casualty handling at Ambulance Loading Points and the priority evacuation of injured persons.
- g) The management of health and safety of all personnel within exclusion / threat zone, where protected persons are permitted.
- h) Consideration of the effect the incident may have on the environment and the action to be taken to minimise this.

¹ GFRS has identified the possible need for some of its employees to be subject to emergency exposures. Normal operational procedures will apply which allow for fire fighters to be exposed to a limit of 20mSv total dose absorbed per incident.

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- i) Assisting the Police with recovery of the dead, if required to do so, as in the Gibraltar Major Incident Response Plan.
- j) Participating in investigations as appropriate and preparing reports and evidence for inquiries.
- k) Standby during non-emergency recovery phase to ensure continued safety at, and surrounding, the contaminated area if necessary.

Mobilisation

On initiation of the Plan, GFRS Control will mobilise the GFRS's predetermined response and if appropriate deploy to advised rendezvous points.

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12.3 AIRPORT FIRE AND RESCUE SERVICE (AFRS)

Introduction

The Airport Fire and Rescue Service (formerly known as the Defence Fire & Rescue Service) was formed in October 2015 on being officially transferred from the Ministry of Defence to HM Government of Gibraltar.

AFRS is tasked to provide fire cover at Gibraltar Airport during its operational hours as its primary role. AFRS has also retained one of its previous Defence tasks as part of the GIBNUSAFE which includes closing up in the MoD's IHQ and deploying the response forces as required by the Incident Commander.

Objectives

To save life and property, render humanitarian services and assist in the restoration of normality.

Functions

In addition to its core tasks, AFRS acts in support of the Gibraltar Fire & Rescue Service. Below are some of the likely functions:

- a) Deploy responders to Strategic, Tactical and Operational Commands, as necessary.
- b) Rescue of trapped casualties and respond with resources as may be required to safely and effectively deal with the circumstances of the given situation.
- c) Assist in information gathering and hazard assessment to give advice to the Police to enable them to advise the public.
- d) Liaison with the Police regarding the provision of a cordon around the threat zone or contaminated area outside the HM Naval Base to enable the GFRS to exercise control (except at terrorist related incidents).
- e) Liaison with the Ambulance Service Incident Officer and the Medical Incident Officer (if there is one present) with regard to providing assistance at casualty handling at Ambulance Loading Points and the priority evacuation of injured persons.
- f) The management of health and safety of all personnel within exclusion / threat zone, where protected persons are permitted.
- g) Consideration of the effect the incident may have on the environment and the action to be taken to minimise this.

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- h) Assisting the Police with recovery of the casualties, if required to do so, as in the Gibraltar Major Incident Response Plan.
- i) Participating in investigations as appropriate and preparing reports and evidence for inquiries.
- j) Standby and assist as required during non-emergency recovery phase to ensure continued safety at, and surrounding, the contaminated area if necessary.

Mobilisation

As a core responding agency of the NERO, AFRS will initially have been mobilised on site as required by the GIBNUSAFE plan but will remain prepared to mobilise additional assets in support of GFRS on initiation of the GRERP.

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12.4 GIBRALTAR AMBULANCE SERVICE

Introduction

In an emergency the Gibraltar Ambulance Service has specific functions to achieve their objectives which are an extension of their normal statutory obligations and role. The ambulance service in Gibraltar is operated by the Gibraltar Health Authority.

Objectives

The saving of life and mitigation of injury.

Functions

- a) Triage, treatment of life-threatening injuries and stabilisation of casualties. The MOD or HM GoG trained personnel, on notification of a suspected or real radiation incident, will check casualties for radioactive contamination. Any casualties found to be contaminated will be de-contaminated and handed over to the GHA for treatment. The Ambulance Incident Officer will assess and triage casualties outside the threat zone.
- b) Conveyance to hospital. The Ambulance Service will be totally responsible for all matters relating to the collection and conveyance of casualties or sick persons which are not affected by radioactive contamination or de-contaminated personnel from outside the radioactive contaminated area. Where there is no radiological deposition but a threat zone has been identified, the Senior Ambulance Officer will make a judgement as to whether to commit ambulance personnel to collect casualties or sick persons.
- c) Alerting of hospital services. The GFRS control will be responsible for alerting the Ambulance Service. The Ambulance Incident Officer (AIO) and a Medical Officer from GHA will make the Health Service initial reconnaissance, where this is necessary. Casualties with life threatening conditions are most likely to occur from incidents, such as road traffic accidents, rather than from the direct effects from the radiological events of the HM Naval Base. It is the responsibility of the AIO to co-ordinate the assessment, stabilisation and despatch of patients to hospital. If patients are known or suspected to be contaminated with radioactive material then they will transported by GHA (dirty ambulance) to the mobile de-contamination facility.

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12.5 GIBRALTAR CONTINGENCY COUNCIL

The Gibraltar Contingency Council (GCC) is co-chaired by HE The Governor and the Chief Minister and sits at the highest level (Tier 1) of Gibraltar's security and civil contingencies policy and strategy architecture. GCC is responsible for setting overarching direction to the Executive Committee of the Gibraltar Contingency Council (ExCoGCC) (Tier 2) who are in turn responsible for the development of the tactical menu for the GCC's strategy, policy, provision of SME advice and the effective implementation of plans.

GCC is charged with drawing up response plans in relation to different threats that could be foreseen to occur in Gibraltar and with rehearsing these plans and overseeing the implementation of these in the event of need.

To assist the GCC to carry out their obligations for civil contingencies, emergency planning and support to SCG, HM GoG has appointed a Civil Contingencies Coordinator. The Civil Contingencies Coordinator provides all technical advice on civil contingencies matters and specific emergency plans, which includes the periodic review of all such plans, training of Government personnel in emergency response, exercising of plans and liaison with organisations outside of Government, such as Ministry of Defence and private commercial businesses. In addition, the Civil Contingencies Coordinator is responsible for the maintaining of the Government's command and control centres, certain emergency stores and the Emergency Contacts Directory.

In times of an emergency the Civil Contingencies Coordinator and his staff undertake an advisory role and ensure that the SCG have all necessary resources at their disposal to permit the efficient management of the emergency. The Civil Contingencies Coordinator is part of the SCG working at all levels of command and control but principally at the strategic level, depending on the nature of the incident. The Civil Contingencies Coordinator and his staff are available on-call 24 hours per day when NERO is stood up.

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12.6 GIBRALTAR HEALTH AUTHORITY

Introduction

In an emergency the Gibraltar Health Authority (GHA) has specific functions to achieve their objectives which are an extension of their normal statutory obligations and role. In the case of a release of radioactive and toxic substances, the Health Authority has the additional objective of long-term health surveillance of the affected population. In situations that involve long-term health implications on the population the SCG will set up a Joint Health Advisory Group (JHAG), which will be chaired by the Director of Public Health. The composition of JHAG will be determined at the time of an incident by the SCG.

It has been agreed with the MoD that any casualty that is either actually or suspected of being contaminated will be de-contaminated in the EZRC or mobile de-contamination facility before onwards transportation to the GHA. This will also include all casualties arising from within the affected area outside the HM Naval Base.

Objectives

The key objectives are: Saving life, mitigation of injury, the promotion of recovery, and the long-term health surveillance of the population from effects of exposure to any radioactive release. It is considered most unlikely that there will be any immediate loss of life directly attributable to a radiation incident from the Naval Base.

Functions

- a) The assembly of all information relating to the nature, size and likely effects of an incident.
- b) The design and implementation of an action plan for investigation and control of the effects of a radiological release. Consideration should be given to the psychological trauma that may have been inflicted on the population, whether or not a radiological release has taken place.
- c) The maintenance of records of exposed public and remediation workers to assist in both short term and long term planning for monitoring and care. Such records may be used for epidemiological studies where appropriate.
- d) Provide liaison with, and advice to, appropriate agencies involved in an incident, particularly with respect of exposure of workers to any radioactive material.

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Procedures

- a) Alerting Procedure. Once a report of a release or potential release of radioactive material is received the Gibraltar Health Authority will institute their Standard Operating Procedures for the emergency.
- b) Monitoring will be necessary at the entrances of the Accident and Emergency Unit of St Bernard's Hospital to avoid inadvertent contamination spread from self-referral casualties.
- c) If a casualty is found to be contaminated the person responsible for triage will decide whether the casualty should be sent to EZRC or mobile de-contamination facility. Casualties are likely to present as general accident trauma and not conditions due to the effects of radiation. General trauma accidents are possible due to accidents from rapid evacuation, e.g. road traffic accidents.

Co-ordination

Co-ordination with other organisations will be through the SCG.

Mobilisation

The Medical Director (MD), or Deputy MD, acting on advice and in consultation with the Director of Public Health (DPH), will be responsible for the mobilising of all health services as they determine. This will also include the reduction in response as the impact diminishes or incident ends. St Bernard's Hospital is a critical resource for Gibraltar and the MD will consider what measures will be necessary to protect the facility, staff and patients. The mobilisation will need to take this into account when considering deploying staff.

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12.7 ENVIRONMENTAL AGENCY GIBRALTAR

Introduction

The Environmental Agency Gibraltar is a separate organisation to HM GoG to which it is wholly contracted to undertake the tasks of Environmental Health. These duties include:

- the monitoring of the safety of water supplies,
- the inspection and sampling of food,
- the inspection of food premises,
- waste management.

Objectives

- ensuring the safety of water supplies,
- ensuring that food is free from radioactive fission products and safe to eat, (with MOD assistance)
- ensuring that contaminated waste is shipped and disposed of properly.

Functions

- a) advising AquaGib on any preventative and any remedial action required concerning water supplies and the operation of desalination plants,
- b) organising as required for the sampling of water supplies,
- c) organising for the distribution of Stable Iodine Tablets (SITs) by the Royal Gibraltar Regiment once an Off-Site Nuclear Emergency has been declared.
- d) the monitoring of the distribution of Stable Iodine Tablets,
- e) advising proprietors of food premises and the general public on food safety and how to protect food from risk of contamination from radioactive fission products,
- f) ensuring the safe disposal by the MOD/HQBF of contaminated waste arising from remediation works,
- g) to prepare and maintain off-site emergency plans as defined under the REPPIR 2004 Regulations ².

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- h) all samples of water, food or waste to be transported by the MOD to the UK for analysis.

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12.8 HER MAJESTY'S GOVERNMENT OF GIBRALTAR

Introduction

The different departments of the HM GoG have an important role to play in a wide range of emergency situations. This role will vary with the nature and phase of the emergency. Potentially any Government service could be required, either for front line delivery to the public or in a supporting role to the Emergency Services or other agencies. It is essential that all of HM GoG services be prepared to meet their potential requirements.

The nominated lead Departmental Minister, and the SCG has the responsibility of co-ordinating HM GoG's response at strategic level in accordance with the Gibraltar Major Incident Response Plan. Their activities will be supported by Departmental Support Teams as appropriate. Each Minister involved in the incident will also have an administrative support team who will co-ordinate the activities of that particular service delivery in accordance with Ministry or Departmental Procedures.

Objectives

- The support of the emergency services and others engaged in the response.
- The provision of a wide range of support services for the community.
- The recovery and return to normality of the community including areas that may have suffered from radioactive material deposition.
- Maintain the Government's normal service at an appropriate level.

Functions

The nature of any emergency invariably requires the involvement of a number of Government department services in partnership with other agencies. Their integration is essential to the effectiveness of the overall response and crucial to the care of those involved.

- a) The provision of services covering the following functional areas will provide the basis for a co-ordinated Government response to any emergency situation:
- Information to the Public
 - Transport
 - Care and Welfare
 - Emergency Accommodation
 - Emergency Feeding
 - Schools and Public Places
 - Construction and Technical Support
 - Support to Businesses and Industry, including Tourism

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- b) There are also two important elements common to all of the functional areas:
 - i. Financial support and record keeping.
 - ii. Legal advice and administrative support.
- c) Every Department of HM GoG will have a contribution to make towards the overall response to an emergency. The roles and responsibilities of the departments are set out below.
- d) Information to the public and media. The HM GoG Media Officer will be responsible for providing information to the public and establishing a media briefing point in Gibraltar, including information to the Gibraltar Tourist Board. If necessary, arrangements will be made to provide media facilities at a nearby Media Centre. See Section 8, Informing and Warning the Public and Section 9, News Media arrangements. Section 10 contains the public information messages which could form the basis of information releases to both the public and the media.
- e) Ensure that the SCG has independent technical advice available on matters of health physics and radiation monitoring.
- f) Ensure that sufficient expertise and resources are available for monitoring and remediation under this plan.

Chief Minister or nominated lead Minister

The Chief Minister, or nominated lead Minister, is responsible for the overall co-ordination of the personnel and resources of HM GoG, which would be used when dealing with major disruptions caused by peacetime disasters. The Chief Minister will also be responsible for liaising with the Governor for any assistance required from HM Government.

Welfare, Social Services and Housing

The appropriate departments of HM GoG will need to work closely together on matters of public welfare. This will involve social services for the support of families and those with special needs. In addition matters of housing may arise especially where re-housing or temporary accommodation may be required until the emergency situation and recovery stage is fully resolved.

Public Transport

A Government company owns buses that operate the normal daily bus routes and private tour operators own buses that cover additional routes, notably those serving the tourist trade. In an emergency these services may be commandeered by HM

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GoG to provide an integrated managed public transport system for the controlled movement of the population.

Education

The initial alert should be provided by the Civil Contingencies Coordinator. The Department of Education will be responsible, when advised to do so by the SCG, for alerting all schools and other educational establishments during term time to ensure that all pupils and students are sheltered in doors and that all external doors and windows are closed. The same arrangements for informing private householders will be applied, except initial calls will be made by telephone as a matter of priority. See Section 8, Informing and Warning the Public.

In addition it will be necessary to ensure that each school / educational establishment has adequate means of communication. Normal daily school drinking water should be adequate but alternative stocks of bottled water will be provided if necessary.

Building and Technical Services

Normal operations of the Building and Technical Services sections may need to be temporarily suspended in support the immediate emergency phase. This may require the deployment of resources to safe locations.

During the recovery stage (see Appendix 5) remedial works may be required, either using direct Government of Gibraltar personnel or hiring and supervising contractors. Technical advisers to the SCG will advise on permissible radiation doses where this appropriate. The DEFRA CBRN Emergencies (formerly the UK Government Decontamination Service) will provide guidance on the decontamination processes available and suitable consultants / advisors. DEFRA CBRN Emergencies contact details are:

DEFRA CBRN Emergencies
MoD Stafford
Beaconside
Stafford ST18 0AQ

Tel: +44 (0) 300 1000315
Email: CBRNRecovery@defra.gov.uk

Finance

This is an important issue for any major emergency, and particularly for a radiation emergency emanating from the HM Naval Base, whether or not an actual release of radioactive material has taken place. The Financial Secretary will have overall control of all financial matters. This is outlined Appendix 3, Financial Arrangements.

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Legal Services

The Attorney General will be responsible for all legal matters relating to the Government.

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12.9 MINISTRY OF DEFENCE

Introduction

The HM Naval Base is able to accept up to two Nuclear Powered Warships (NPW) at the designated Operational Berths. The Ministry of Defence (MoD) is responsible for the operations at the HM Naval Base. An emergency involving a release of radioactive material (real or potential) requires emergency arrangements to be in place, including an alert procedure to the civil power and civil emergency services.

In Feb 2008 (reviewed Oct 2013) the Ministry of Defence undertook a *Hazard Identification and Risk Evaluation*¹ as part of their compliance with *The Radiation (Emergency Preparedness and Public Information) Regulations 2004* (REPPIR 2004)². The supporting analysis for the NPW accident conditions was provided by Rolls Royce Naval Marine (RRNM), Derby, who is also the delegated nuclear plant design authority. The assessment report concluded that the operator continued to need an Operator's Emergency Plan. This plan is termed the "On-site" plan.

In the event of an accident leading to a nuclear emergency, both the HM Naval Base and Ministry of Defence have emergency arrangements in place to effectively manage the subsequent accident situation. These arrangements provide maximum protection for all key groups of individuals within the Gibraltar Naval Base.

A continual cycle of exercises and audits has demonstrated that these emergency arrangements work well. In the unlikely event of a reactor emergency, decisions on actions such as evacuation, sheltering and the taking of Stable Iodine Tablets (SITs) by persons within the Naval Base are based on information and data supplied from the NPW and supporting Nuclear Emergency Response Organisation (NERO).

Specialist technical cells aid the interpretation of the accident scenario and the appropriate accident mitigation measures. In addition, a Reactor Emergency Monitoring System and mobile monitoring units will supply further information.

Objectives

To carry out operations on the HM Naval Base in an efficient and safe manner.

Functions

- a) To immediately alert the Royal Gibraltar Police and the Gibraltar Fire & Rescue Service of any incident, which is, or may develop into, an off-site radiological incident.
- b) To provide immediate technical advice and support to the Royal Gibraltar Police, the Gibraltar Fire & Rescue Service and Gibraltar Health Authority on off-site effects.

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- c) To provide a technical liaison person to attend the Strategic Coordinating Group.
- d) To prepare and maintain on-site emergency plans as defined under the REPPIR 2004 Regulations².
- e) To provide manpower to distribute SITS as directed by the Environmental Agency, refer to Section 7.
- f) To provide and service appropriate vehicles for the conveyance of any contaminated, both confirmed or suspected, civilian casualties to the EZRC or mobile de-contamination facility for decontamination and onwards transportation for treatment.

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12.10 GIBRALTAR PORT AUTHORITY

Introduction

The Port of Gibraltar has special duties to be carried out in the event of an emergency arising at HM Naval Base berths and seaways. These functions are an extension of their normal operations and are consistent with maintaining safety at sea of vessels traversing the Port seaway, berthed and operations on shore associated with the Port.

There are special considerations for a radiation emergency associated with the Royal Naval Operational Berths 49 and 50 on the South Mole.

Note: Any radioactive incident involving Operational Berths 49 and 50 on the South Mole is unlikely to have any significant impact on the Port area with respect to radioactive contamination given that the prevailing winds are mostly West to South-Westerly. However a Southerly wind would have an effect. Wind direction is quoted from where the wind blows from and not to. Therefore, a South-West wind will come from 225° and blow towards the North-East at 45°.

Objectives

- preserve health, safety and welfare of all persons employed or using the Port,
- provide advice to users of the Port on hazards that may arise within the Port area or external hazards that could impinge on port activities.

Functions

- a) maintain Port activities and business as reasonably achievable during an emergency involving HM Naval Base unless access is restricted,
- b) restrict access and egress to the Port facilities as advised by the SCG or Ministry of Defence,
- c) provide a Port representative to the SCG, as required, and advise on the status of Port throughout the emergency,
- d) assist in the decontamination of Port facilities and vessels caught up in the incident where deposition of radioactive material may have occurred,
- e) provide a certificate of clearance for vessels to leave the Port and for cargo landed to be shipped onward by land, in consultation with the SCG.

Initial Response

In the event of an Off-Site Nuclear Emergency being declared, the Captain of the Port will close the Port to entry of all vessels. This may also include restricting

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access by road. If the alert is of an Off-Site Nuclear Emergency – Radiation hazard confirmed or worse, then the Captain of the Port will, in addition to closing the Port for entry, may decide to advise vessels to leave if no radioactive material has escaped from HM Naval Base.

Visiting passenger cruise liners

This may cause a problem for passengers ashore who may not be able to return to the ship due to road access restrictions or the ship sailing. The Captain of the Port may order a ship to sail to protect it from becoming contaminated should the risk be advised by the SCG or MoD.

Vessels embarking

Ships that are berthed and could possibly be subject to radioactive contamination, however remote, should be monitored before they leave the Port. Consideration should be given to providing the master of an embarking vessel a certificate indicating that the vessel has been monitored and cleared to leave in consultation with the SCG. See Appendix 5, Extended Response and Recovery.

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12.11 GIBRALTAR ELECTRICITY AUTHORITY

In any emergency the maintenance of supply of electricity is vital. In an emergency involving the release of radioactive material into the atmosphere the electrical supply can be interfered with where supply lines cannot be maintained effectively. Areas where radioactive contamination has occurred and there are also failures in electrical supply, for whatever reason, will be particularly vulnerable to lengthy interruptions due to restrictions of entry of maintenance personnel. In addition if the generation plant is in the affected area, operational generation staff will be advised to remain under cover unless it is considered that they should be evacuated for personal safety reasons.

The Gibraltar Electricity Authority will initiate their own contingency plans to maintain appropriate electrical supplies to critical areas of Gibraltar. It is unlikely that any radioactive release incident will cause the generation plant to be out of operation for more than a few days.

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12.12 WATER, AQUAGIB Ltd

Water supplies to Gibraltar are the responsibility of AquaGib Ltd. Apart from the normal use, water will also be required for decontamination of people and structures. The underground reservoirs of Gibraltar hold on average 6 weeks supply which might be less during summer peak tourist months. Water is obtained from Reverse Osmosis plants. Plant shutdown is ordered by the SCG and reserves used until agreed by SCG.

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12.13 SEWERAGE, Technical Services Department

Sewerage is not currently treated on Gibraltar but is discharged directly out to sea. Any radioactive deposition will almost certainly enter the sewerage system. It will be vital that the sewerage system is flushed through with water until monitoring confirms that acceptable levels of radioactivity are achieved. Acceptable levels of discharge of radioactive substances into the environment change from time to time and the latest discharge limits will be advised by the Environmental Agency. The discharge of sewerage containing radioactive material from a radiological release is considered acceptable as the level of dilution will be considerable and therefore will not cause any harm to the marine environment. Any rain fall will significantly assist the cleansing of impervious surfaces and sewers.

The monitoring of the sewerage system and marine outfalls will be undertaken by the Technical Services Department to a predefined sampling and monitoring scheme. Assistance from external contractors and Ministry of Defence may be enlisted for this task.

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12.14 COMMUNICATIONS, Gibtelecom

Introduction

Gibtelecom are the main provider of landline and mobile telephone systems in Gibraltar. The Spanish mobile telephone companies also have coverage in many parts of Gibraltar but this should not be relied on in an emergency. It should be noted that mobile telephone systems are not secure unless encrypted transmission through TETRA or a similar system is used.

It is likely that the telephone system will become overloaded in the initial phases of a radiation emergency (see escalation and control below).

Emergency Services

The Emergency Services rely on their own radio communication facilities for general communication during an incident. The Government Emergency Services use Gibtelecom's TETRA radio network.

Other responders

HM GoG, and other organisations, also have mobile telephones through Gibtelecom and access to landlines.

Escalation and Control

If the situation escalates and necessitates control of the telephone network then HM GoG will implement the Essential Users Telephone System. This will restrict the use of all landline telephones except to registered users. It may only be initiated by the SCG. An operational Director of Gibtelecom will authorise the implementation of the plan by the company. It should be noted that this restriction cannot be applied to the mobile network.

Emergency Contacts Directory

A directory of essential and useful telephone numbers and emergency contacts is provided as an annex to the Appendix of this plan but as a separate document. These contact details should be guarded and treated as OFFICIAL, particularly those pertaining to the Ministry of Defence, Government Ministers and ex-directory numbers. The responsibility for maintaining the Emergency Contacts Directory rests with the Office of Civil Contingencies.

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12.15 HEALTH AND SAFETY

HM GoG has its own Health and Safety Inspectorate, known as the Factories Inspectors and is part of the Department of Employment. They are responsible for all health, safety and welfare matters relating to the Government labour force and legislation covering industrial and commercial businesses in Gibraltar.

After consultation with MOD they will be responsible for providing advice to Government emergency operations managers and ministers for the deployment of their personnel into both radiation deposition zones and unaffected areas where other risks may be present.

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13. STAND-DOWN

A prescriptive stand down procedure is just as important as the activation. HM GoG (SCG) will make the decision to stand down, acting on advice from the Royal Gibraltar Police, from an emergency by either authorising a staged reduction in response resources or a complete incident end. The decision will be taken in consultation with other key responding organisations. The timely reduction or end will have a profound effect on the population, businesses and the financial status for Gibraltar, where an Off-Site Nuclear Emergency – (release of radioactive material) confirmed has been declared.

Where a release of radioactive substances has resulted in deposition of radioactive substances outside the HM Naval Base, an area may be cordoned and controlled access established until remediation of the contaminated area can be completed.

Under these circumstances the emergency stand down may be issued by the Royal Gibraltar Police after consultation with SCG with the affected area remaining under the control of HM GoG's Recovery Coordinating Group for long term recovery where severe contamination has occurred.

13.1 ALL OTHER RESPONDERS, STAND-DOWN

The decision to stand down the initial response will be taken by the SCG. Arrangements will be put in place to co-ordinate any on-going activities such as investigations, recovery operations, health surveillance, repairs and reinstatements. Each organisation will be responsible for notifying their own staff of the stand down arrangements.

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14. DEBRIEFS

It is essential that all staff involved in an incident be debriefed if lessons are to be learnt and improvements to future incident response be achieved. These should be conducted at all levels from front line staff up to senior management. Internally, each agency will conduct its own debriefs using local line management.

On an inter agency level, the SCG may request the Police to co-ordinate a multi-agency debrief, if it considers it appropriate. Similarly, departmental and corporate debriefings can also be convened following any scale of emergency.

An important benefit of debriefing personnel involved is that it can assist in the psychological recovery of individuals who may have been traumatised by the event.

This may go a long way to reducing post traumatic stress disorder (PTSD).

14.1 ORGANISATION

In order to maximise the benefits, a number of points should be observed to enable debrief meetings to proceed effectively.

Convened at the appropriate time

Local Team debriefings	in the first "shift" immediately following the stand-down of the incident.
Departmental debriefings	not later than 5 working days after the emergency services have stood down.
Corporate debriefings	not later than 7 working days after the emergency services have stood down.
Inter-Agency debriefings	not later than 14 working days after the emergency services have stood down. (Can be extended to 28 working days if necessary for a major protracted event).

The time periods shown above are a guide; the longer the time after the event or particular episode the less value the debriefing will be.

- **Held at an appropriate venue** - The venue must be able to accommodate all those who are likely to attend. It must also be able to provide for any special needs such as the use of audio-visual equipment which could be used as an aid to the debriefing.
- **Chaired by an appropriate authority** - In the event of a radiological emergency or major incident, it has been agreed that HM GoG will appoint a suitable Government person or organisation to convene and chair inter-agency debriefings.

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- **Organisation specific team debriefs** should be conducted by the local line management of the organisation and include contractors where appropriate. For example, involvement of voluntary organisations, business and tourism may be incorporated with the appropriate Government ministry or department.
- **Chaired by an appropriate person** - Multi-agency debriefings should be chaired by a Police Officer of rank not less than that of a superintendent in the event of a major disaster or that of a Senior Officer for debriefings. Such a person should be skilled and experienced in conducting meetings and must be able to call on the support of officers from their legal departments to advise as appropriate. The chairperson should also ensure that a record of proceedings is taken by a suitably experienced officer.
- **Constructive** - The aim of every debriefing session should be to evaluate what has occurred and if necessary to introduce positive changes which will ensure a continued effective response to emergencies in the future. It is acknowledged that emergency preparedness is a dynamic and ongoing process and debriefings are an essential element of effective planning. It should not be seen as an opportunity to apportion blame or to single out a “scapegoat” which can only be counter-productive.
- **A forum to exchange information** - It may not always be clear how different authorities and agencies responded to an emergency. Debriefings can provide an excellent opportunity for all concerned to gain an appreciation of the difficulties and responses of each organisation. Such enhanced understanding should foster a more informed response for future emergencies.
- **Conclusions / recommendations** - Managers and officers of organisations attending debriefs will decide whether they should produce minutes or a report of the proceedings. It should be borne in mind that all information, conclusions and recommendations will be public information. Matters involving UK national security would be advised by the Ministry of Defence and should be excluded from debriefs. The release of radioactive material from HM Naval Base Gibraltar in an incident and the subsequent alert to the civil authority should not involve any security classified aspects. Those organising the debrief will also determine who should receive copies of such documents.

14.2 INQUIRIES / INVESTIGATIONS

It should always be borne in mind that the discussions, minutes or reports of debriefings could be used in inquiries or investigations by or against HM GoG, as the civil authority, including the emergency services. Representatives from legal departments will be able to advise on this issue during the debriefing.

An incident investigation conducted by the UK Government or Ministry of Defence, may also request records for their own enquiries.

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It follows, therefore, that all records in whatever form must be preserved and controlled. In addition, such records will be available to the public under the Freedom of Information Act (UK 2005) and Gibraltar equivalent, except those documents that are exempt under security considerations, pertaining to criminal proceedings, or commercial activities not covered by the Act. The exemption sections that could apply are Sections 23, 24 and 26. The Gibraltar Law Offices of HM GoG can advise on all aspects of the Freedom of Access to Information on the Environment Regulations 2005 which is the Gibraltar equivalent.

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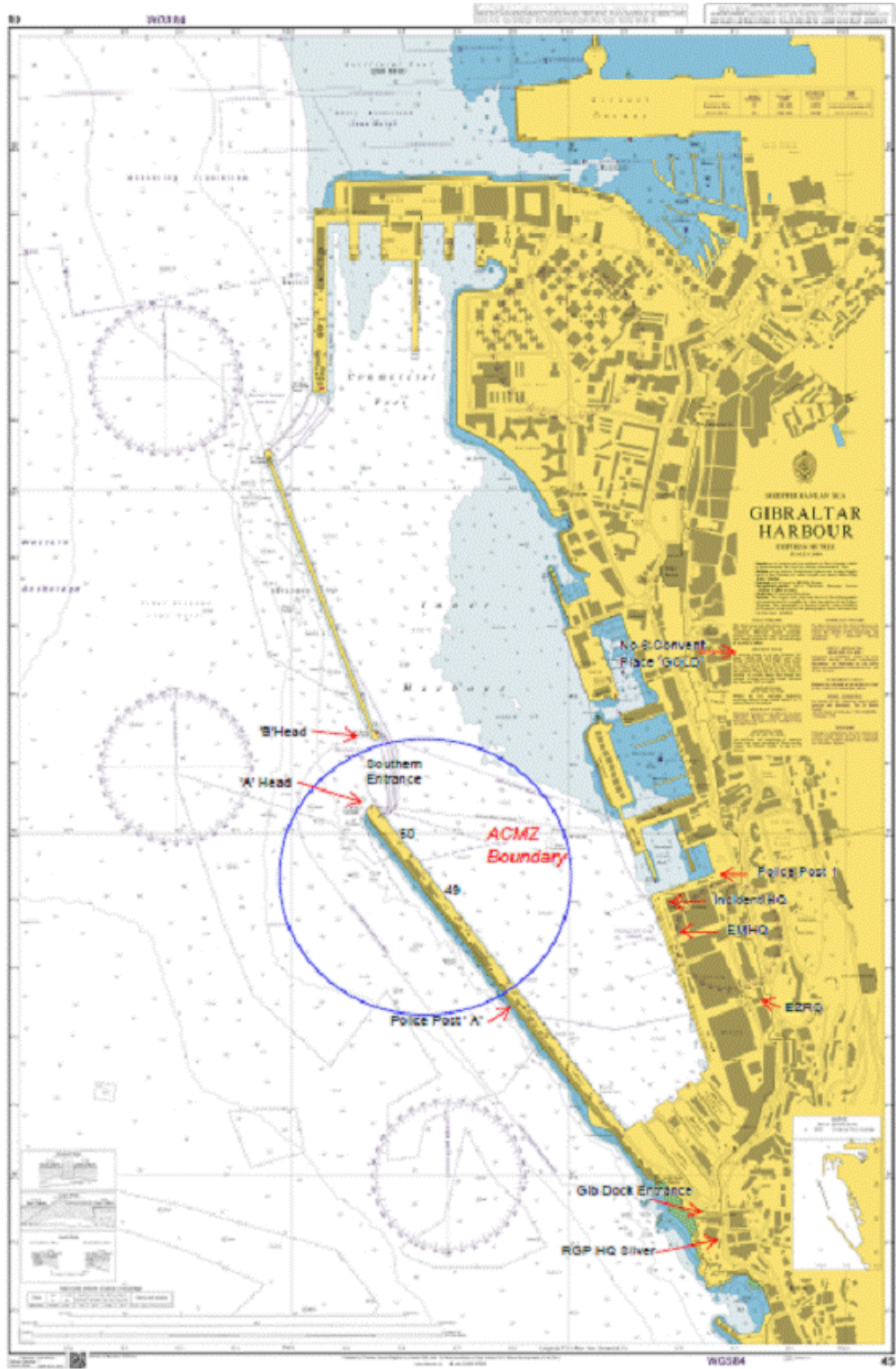
APPENDICES

1. Location of Site
2. Public Health Aspects of a Radiological Accident
3. Financial Arrangements
4. Environmental considerations
5. Extended Response and Recovery
6. Training and Testing
7. Review and Evaluation
8. Terminology
9. Plume Dispersion and Deposition Diagrams
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11. Technical Data
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APPENDIX 1 - LOCATION OF SITE - HM NAVAL BASE GIBRALTAR



Directorate General Military Survey, Ministry of Defence, London, 1971.

Source:

Operational Berths located on South Mole between Easting 874-876 and Northing 014-016
Scale 1:5000 Grid 100m

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APPENDIX 2

PUBLIC HEALTH ASPECTS OF A RADIOLOGICAL ACCIDENT

PUBLIC HEALTH RESPONSE

The Director of Public Health is responsible for co-ordinating the public health aspects of the response to any emergency that impinges on the health of the population. He has a key role in maintaining the health of the public and emergency responders. In this context, visitors and tourists are also included. The health of all HM Naval Base personnel is the responsibility of the Ministry of Defence, although arrangements exist between the Ministry of Defence and the Gibraltar Health Authority to support each other where feasible and practicable to do so. The responsibility for managing all casualties, whether known to be contaminated or suspected, will be undertaken by the MoD.

RESPONSE TO RADIATION DEPOSITION OFF-SITE

Where deposition of radioactive material has been confirmed outside of the HM Naval Base by the MoD Health Physics teams, the Competent Authority appointed under the REPIR 2004 regulations² will ensure routine monitoring is undertaken in conjunction with the MoD when it is considered safe to do so.

Areas which are shown to contain significant hazardous levels of radioactive contamination will be identified by the MoD, Competent Authority and other expert sources contracted to assist HM GoG. The length of time that an area may be hazardous to health will be a function of the radionuclide half-lives involved and concentration of deposition.

MONITORING

Monitoring shall include the measurement of radioactive material in the environment and monitoring of people for contamination. In the latter case this would be at the time of a release or in the next few days post-event. In all cases records must be made of each person monitored and results passed to the Director of Public Health for assessment and surveillance management.

Once the immediate release event has subsided it will be necessary to monitor the environment to establish the severity and extent of contamination. Again records will need to be maintained and the changing effects to be reported as determined by HM GoG.

Monitoring will include direct radiological monitoring of surfaces and the taking of samples for laboratory analysis (most likely carried out in UK through MoD).

Samples may include sources from earth, vegetation, animals, water (especially rain run-off), and swabs from surfaces such as roofs, roads and building entrances.

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The method of taking samples and the subsequent management will be the responsibility of the Competent Authority appointed under the REPPiR 2004 regulations² in keeping with their normal surveillance programmes.

DECONTAMINATION

If anyone is exposed to radioactive material from deposition outside HM Naval Base they must be decontaminated without delay. The first priority will be to protect individuals' airways to prevent or at least minimise the inhalation of radioactive material. This will be particularly important before clothing is to be removed prior to decontamination washing. Generally radioactive particles are easily removed by washing with warm water and detergent, showering being the most effective means. Wherever possible families should be kept together and young children and infants allowed to be decontaminated by their parents with assistance as required. Personal modesty should be maintained at all times. There is usually no major urgency to decontaminate people from radioactive materials as compared to hazardous reactive chemicals. An exception to this will be persons with open wounds. Advice on the means of decontaminating should be verified at the time with the Ministry of Defence and Public Health England (PHE) in the UK as this is under continual development and review.

AIR MONITORING

Air monitoring will be an important tool for estimating the end of deposition and continued assessment during the recovery phase where remobilisation of contaminated dusts might occur. These results will be supplied to the Health Authority on the same regular basis of monitoring or if additional monitoring is requested. Air quality monitoring will be managed by the Competent Authority appointed under the REPPiR 2004 regulations².

LONG TERM SURVEILLANCE

Perhaps this will be the singular most important function of the Health Authority. It will take place for a long period of time and determined by the Director of Public Health in conjunction with advice from the UK Health Protection Agency and International Atomic Energy Agency as required. The surveillance will continue for individuals known to have been exposed, for several years post-exposure, dependant on the individual's wishes. In addition, people who are known not to have been exposed but are resident in Gibraltar may be approached to volunteer to be monitored as a control.

During the recovery phase, all workers operating in a known contaminated area will also be placed under continual health surveillance as an extension to the surveillance of the emergency responders working in the area.

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APPENDIX 3

FINANCIAL ARRANGEMENTS

A major emergency incident involving a release or potential release of radioactivity from HM Naval Base will necessarily incur expenditure by HM GoG and the emergency services above that normally encountered in their daily operations. Under these circumstances the Ministry of Defence will be liable for reimbursing all necessary expenditure. This will require adequate control of finance and the establishment of procedures that can be brought into effect quickly to assist the emergency management team. In the case of a radiological incident such financial arrangements must be robust as the effects of any radioactive contamination and the subsequent recovery would most likely continue for a considerable length of time.

The financial arrangements that would be applied in a major incident would be implemented. In addition, consideration would need to be given by the SCG to the location of Government services and in particular the finance section. Apart from the financial arrangements for managing an incident and the subsequent recovery, the daily financial service would need to be maintained.

The Recovery Management Team would require finance personnel dedicated to the recovery operation unless it was considered that the additional burden could be sustained within the existing Finance section. The normal arrangements for obtaining receipts and control of invoices would apply but consideration would need to be given to obtaining additional copies for the MoD.

It should be recognised that time to engage a suitable contractor for a particular operation may over-ride the necessity to obtain competitive quotations.

Where assistance is required that is not directly applicable to an incident emanating from HM Naval Base, then the normal guidance applied in the UK to requesting and engaging assistance from the MoD will apply under the Military Aid to the Civil Authority (MACA). This is described in the MoD Joint Doctrine Publication (JDP-02).

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APPENDIX 4

ENVIRONMENTAL CONSIDERATIONS

IDENTIFYING MAJOR EMERGENCY HAZARDS

Major radiation emergency hazards to the environment will be those where events have the potential to:

- to affect normal day-to-day activities;
- pose knock-on threats to human health by contamination of food or drinking water;
- affect large areas of land designated for conservation, amenity or planning purposes;
- be long term or persistent and / or inhibit natural processes of regeneration;
- be severe by causing significant permanent or long-term damage to the ecosystem (direct, indirect or knock-on), such as reduced breeding success of protected species, or reduced biodiversity of protected habitats, or destruction / reduction in quality of a significant proportion of the area of a rare habitat.

EMERGENCY SCENARIOS

A nuclear emergency at the HM Naval Base will be a unique event due to several variables, i.e. the range of radionuclides, the concentrations and quantities involved, the receiving environment, available pathways for dispersion, prevailing meteorological conditions, etc. This individuality of incidents may mean that it is generally not possible to predict precisely the impact, or duration of effects, suffered by the local environment. To this end, the following accident scenarios are offered for consideration.

- **Fire in primary containment.** This can pose a substantial threat to the environment because this may release radionuclides into the air that may disperse over a wide area more easily than any other radiological event. However, a fire in the primary containment can only present a radiological hazard if both the primary and secondary containments are breached. Fires tend to cause products of combustion, vaporous material and fine dust debris to be carried high into the atmosphere that will then redeposit over a wide area. This would pose a significant hazard to the environment except perhaps the sea water and harbour sea bed muds.
- **Explosion breaching containment.** This will also pose a substantial threat to the environment because an explosion may release material from the confines of the warship. Again, both the primary and secondary containments will need to be breached for a radiological hazard to occur. An explosion not accompanied by a fire may release toxic material but is unlikely to be expelled to any significant height when compared to a fire. The release of radioactive material could pose a particular threat under stable air conditions.

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ENVIRONMENTALLY SENSITIVE AREAS

The Upper Rock and the southern waters of Gibraltar are designated as nature reserves.

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APPENDIX 5

EXTENDED RESPONSE AND RECOVERY

The release of radioactive material that may deposit in the environment of Gibraltar is likely to cause a restriction on the access of the land and facilities depending on the amount and severity of radionuclides released. Short-lived radionuclides will not present a long term problem. An incident may result in an extended response period especially where there is significant contamination to facilities that have a direct affect on public services and business. The recovery from a severe release will also require significant long term management.

EXTENDED RESPONSE

The majority of the radionuclides have half-lives that will extend into several years, except radioactive iodine (^{131}I) which will have decayed completely within 3 months. Iodine is the most volatile and easily absorbed element.

The quantity of radioactive material contaminating the deposition area, depending on the conditions of release and deposition, is likely to be small and dispersed homogenously, and although measurable, could well be below international limits of exposure for most of the initially affected area.

An estimate of when an affected area can be re-entered and made liveable could be as short as 3 months or perhaps up to a year or so depending on weather conditions. Rain will cause particle material to be either washed away into the sea or absorbed deeper into the ground. Some of the material may be soluble and therefore made further safe by increased dilution due to rain.

RECOVERY

The Recovery Coordinating Group would need to consider the following when devising a recovery programme. The remediation and recovery would need to be set against the overall benefits obtained.

Advantages	Disadvantages
Improved public perception	remediation workers receive radiation doses
Return to normality (need to be defined)	waste generation and associated issue of volumes, activities, transport, storage, disposal
Public reassurance	Social disruption
Public dose savings	Environmental damage
Consideration of and protection for wildlife	Loss of earnings / livelihood
Limiting damage to people's livelihood	Monetary costs / claims for compensation
	Reduction in flexibility to apply subsequent remediation options

Source: Nuclear Emergency Planning Liaison Group: *Civil Nuclear Emergency Planning - Consolidated Guidance*, Handbook Chapter 17, DTI, UK, 2003.

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Advice on methods of decontamination and removal of contaminated material can be obtained from the DEFRA CBRN Emergencies, MoD and Department for Business, Energy and Industrial Strategy (BEIS). They will also advise which contractors may be suitable. Contact details of the DEFRA CBRN Emergencies can be found on Page 45 of this document.

REMEDIATION

Following an accident involving a release of radioactive material, the residual hazard would come from the long-lived contamination which may remain on the ground for many years. A number of techniques, including washing, chemical cleaning, vegetation removal, turning of land and building demolition could be used to decontaminate areas after the accident. There are no UK national criteria, at present (2006), for decontamination after an accident and any decisions would be taken in light of the particular circumstances of the accident. Timescales would allow all necessary local and national authorities to be included in these considerations.

The UK PHE has issued guidance in this area in their document *Intervention for Recovery After Accident* (NRPB 1998) and this guidance is summarised here for information. It is based on separating potential recovery countermeasures into three categories as shown in the table below.

Recovery Countermeasures: Categories

Category	Description	Examples
A	Moderately dose effective, relatively low resource / disruption, prompt implementation, completed within about one month.	Ploughing of large areas of grass. Extended evacuation / short-term relocation (short-lived radionuclides). Vacuum sweeping / fire hosing all metallised surfaces. Grass cutting.
B	Dose effective, relatively high resource / disruption, long duration / lasting impact.	Turf / soil removal and replacement. Double digging all soil / grass areas. Road planning. Prolonged or permanent relocation.
C	Either poorly dose effective or: moderately dose effective, high resource / disruption etc.	Fire hosing buildings. Sandblasting walls. Roof replacement. Cleaning indoor surfaces.

Measures in Category A could generally be completed within the first month following the emergency and, once completed, would incur no further disruption.

Combinations of such measures can also be highly dose effective. They therefore

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clearly meet the aim of facilitating prompt return to normal living. Since the costs of these countermeasures (in the widest sense of the word) are relatively small, it is proposed that consideration should always be given to whether it is appropriate to implement remediation countermeasures in this Category even for very low levels of exposure. Prompt implementation of appropriate measures in this Category should ensure that doses are reduced to low levels (at most a few mSv in the year following the emergency) following all but the most severe emergencies.

More disruptive countermeasures (i.e. those in Category B) are difficult to complete within the first month, or continue to cause disruption after they are completed, or require substantial resources. They are less effective therefore in facilitating a prompt return to normal living. Also potential costs are likely to be high, and it is proposed that measures in this Category are unlikely to be justified in circumstances where the annual projected dose is less than 10 mSv. At projected doses of around 10 mSv in the first year it is likely that only the least disruptive of these measures would be justified.

Measures in Category C would not in general be justified on radiological grounds. However, they might be included in a recovery strategy, either because the circumstances of the accident prevent other, more effective countermeasures being implemented, or for reasons other than dose reduction. For example, the cleaning of indoor surfaces would not normally be expected to avert significant dose, but may well provide a high degree of reassurance for people in their homes and workplaces. This guidance is summarised in table below.

Summary of Guidance of Intervention for Recovery

Circumstances	Countermeasures	
	To consider	Unlikely to be justified
Any off-site contamination	Category A	Category B, Category C [note 1]
Dose >10 mSv y ⁻¹	Category A, Category B [note 2]	Category C [note 3]
Lifetime dose >1 Sv	All	None

Note 1: May be justified in support of other measures

Note 2: Need to offset increasing resource / disruption with increasing dose averted

Note 3: May be justified in support of other measures, or if Category B measures impractical

RELEASE OF CONTAMINATED GOODS, PROPERTY AND VEHICLES

The Recovery Coordinating Group, set up by the SCG or Competent Authority, will advise on the clearance and certification process for releasing property, cargo, sea-going vessels, aircraft and motor vehicles. No movable goods, property or vehicles should be allowed to leave Gibraltar until the levels of radioactive contamination, real or suspected, are at or below the limits set by the IAEA; such limits are continually under review. Expert advice should be obtained at the time as to what would be the acceptable levels.

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The clearance certification should include the actual results of the monitoring and, if appropriate, the background levels of natural radiation. It is important to differentiate between the presence of natural radiation and that which might have resulted from an incident.

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APPENDIX 6

TRAINING AND TESTING

The objective of testing the radiation emergency plan is to give confidence in the following constituents of the plan:

- the completeness, consistency and accuracy of the emergency plan and other documentation used by organisations responding to an emergency
- the adequacy of the equipment and facilities
- the competence of staff to carry out the duties identified for them in the plan and their use of the equipment and facilities

ASPECTS OF PLAN TO BE TESTED

The overall testing regime for the off-site emergency plan will be similar to the Gibraltar Major Incident Response Plan but will have a greater emphasis on activation, alerting the emergency services, public warnings, and mobilising HM Naval Base personnel who may assist HM GoG and civil emergency services in the event of an emergency.

All other aspects are common to the Gibraltar Major Incident Response Plan.

Regular liaison with the MoD, HM Naval Base, to programme exercises to fit in with their onsite exercises would be of benefit to both the civil emergency responders, MoD and Government of Gibraltar.

METHODS OF TRAINING AND TESTING

Exercises to test the on-site and off-site emergency plans should be viewed as part of the on-going training of key personnel in preparation for dealing with an emergency. There are a number of forms that such exercises can take and these include: drills, seminar exercises, walk-through exercises, table-top exercises, control post exercises, and live exercises.

All of these are common to the Gibraltar Major Incident Response Plan and other emergency response plans. Seminar and table-top exercises would be appropriate and cost-effective means of exercising the plan.

TIMETABLE FOR TESTING

Emergency plans have to be reviewed, revised and tested periodically and not exceeding three years. The testing of emergency plans should be based on an emergency scenarios identified in the safety report as being reasonably foreseeable.

Aspects of this plan may be tested in combination with other plans such as the Gibraltar Major Incident Response Plan, and in particular the activation of command and control.

The timetable for testing all emergency response plans is vested with the Civil Contingencies Coordinator.

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APPENDIX 7

REVIEW AND EVALUATION

All emergency plans require periodic review and evaluation to ensure that they remain valid. The review process should take into account changes in legislative requirements, changes of infrastructure of key responding organisations, including roles and responsibilities. In addition, improvements in communication and technological advances should also be incorporated to ensure that plan users are in a position to respond more effectively. This may include the means of disseminating plans and their ease of accessibility.

Emergency plans are usually evaluated against a schedule of exercises designed to test particular plan aspects or procedures. Multi-agency exercises have the added advantage of also enabling plans to be reviewed with respect to the involvement of individual responding organisations which otherwise could be over-looked during internal organisation changes.

Formal plan and procedures review should include an examination of training requirements both for existing personnel and in particular new staff. All organisations that may be called on to respond to a radiological emergency should include in their staff induction programmes the basic aspects of emergency planning and response.

The periodic review of this plan should be carried in conjunction with a review of other emergency plans and operational procedures so as ensure that there is no conflict or omissions between plans.

The custodian of this plan will undertake the periodic review, which shall not exceed three years as required under Section 10(1) of the REPPIR 2004 regulations².

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APPENDIX 8

TERMINOLOGY

Note: Wherever possible SI units have been used and their equivalent common usage units provided for clarity. Names of chemical substances are shown to the standards of the International Union of Pure and Applied Chemistry (IUPAC) with common or colloquial names included for ease of understanding.

Alpha Particle	Fast moving helium nucleus ${}^4\text{He}$. Stopped by few millimetres of air or surface of skin but harmful if taken inside the human body.
Atom	Smallest unit of an element, having all the characteristics of that element and consisting of a dense, central, positively charged nucleus surrounded by a system of electrons. Cannot be divided in a chemical reaction except for limited removal, transfer, or exchange of certain electrons.
Atomic Mass	Atomic weight including protons and neutrons.
Atomic Number	Number of protons in an atom.
Becquerel (Bq)	The SI derived unit of radioactivity. "Radioactivity" is caused when atoms disintegrate, ejecting energetic particles or electromagnetic radiation. One becquerel is the radiation caused by one disintegration per second.
Beta Particle	Electron, negatively charged particle but can be positively charged (positron). Wide range of energy levels. Stopped by a few metres of air. Depending on energy can be stopped by thick fabric, thin metal sheet, concrete and water. Harmful if taken inside the human body but less harm than alpha particles.
Danger Areas	Area having been contaminated from radioactive fall-out.
Fission Products	Stable and unstable nuclides from atomic fission process.
Gamma Radiation	Electromagnetic radiation emitted from the nucleus of an atom; sometimes called gamma rays. Absorbed by thick metal and concrete but may travel several metres in air. Risk is from external irradiation of human body.
Gray (Gy)	The SI unit of radiation dose. Radiation carries energy, and when it is absorbed by matter the matter receives this energy. The dose is the amount of energy deposited per unit of mass. One gray is defined to be the dose of one joule of energy absorbed per kilogram of matter.
Ionising Radiation	Radiation that causes ionisation in recipient living cells.
Isotope	Nuclides of same element, same atomic number but different atomic mass.

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Nuclide	Distinct nuclear species (synonymous with isotope).
Radiation Dose	Energy imparted from radioactive substances to living and inanimate matter from energetic particles or electromagnetic radiation.
Radioactive Contamination	Radioactive material deposited in the environment potentially causing a hazard to health especially when taken inside the human body.
Radioactive Decay	Gradual decrease in radioactivity of a radioactive substance.
Radioactive Deposition	Radioactive particles deposited into the environment from atmospheric dispersed radioactive material, including irradiated debris and radioactive particles bound to debris.
Radioactive Half-Life	Time taken for the radioactivity to be reduced to half.
Radioisotope	Radioactive isotope.
Radionuclide	Radioactive nuclides.
Risk	A function of the probability (or likelihood) of harm actually occurring and the severity of its consequences.
Risk Assessment	The identification of the hazards present and an estimate of the extent of the risks involved, taking into account any precautions that may have been taken or other mitigation measures. Sometimes known as Hazard Analysis.
Sievert (Sv)	An SI unit used for measuring the effective (or equivalent) dose of radiation received by a human or some other living organism. Different forms of radiation have different effects on living tissue, therefore a simple measurement of dose as energy received, stated in grays, does not give a clear indication of the possible effects of the radiation. The equivalent dose, in sieverts, is equal to the actual dose, in grays, multiplied by a "quality factor" which is larger for more hazardous forms of radiation. An effective dose of one sievert requires 1 gray of beta or gamma radiation but only 0.05 gray of alpha radiation or 0.1 gray of neutron radiation. The sievert is a large unit, therefore radiation doses are usually measured in millisieverts (mSv).
Stable isotope	Element (nuclide) not exhibiting radioactive decay.
Threat Zone	Area potentially at risk from radioactive deposition.
Unstable	Element (nuclide) undergoing radioactive decay.
X-Ray Radiation	Electromagnetic radiation from an atom due to loss of charged particles, e.g. loss of electrons. Longer wavelength than gamma but shorter than ultra-violet. Effects are similar to but less than gamma radiation.

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APPENDIX 9

PLUME DISPERSION / DEPOSITION DIAGRAMS

The three plume dispersion and deposition diagrams included in this Appendix are for general information only and should not be used for real emergency response, although may be used for exercise and training purposes. In a real emergency the MoD will supply a plume dispersion with anticipated doses and deposition.

The example plume dispersion and deposition diagrams have been calculated against a general weather condition where the prevailing wind is from the South-West, under Pasquill stability weather category D3, using the PUMA dispersion model. Pasquill category D3 represents neutral weather conditions with average wind speeds at about 5 m s⁻¹. The main isotope plotted is Iodine-131.

Scientific number notation has been used on the diagrams. The following examples are provided for a better understanding.

Unit	Scientific notation	SI units			
Sievert (Sv)	5.00E-02	5.00 x 10 ⁻²	0.050 Sv	50 mSv	50,000 µSv
Sievert (Sv)	3.50E-02	3.50 x 10 ⁻²	0.035 Sv	35 mSv	35,000 µSv
Sievert (Sv)	1.00E-02	1.0 x 10 ⁻²	0.01 Sv	10 mSv	
Becquerel (Bq)	1.00E+07	1.0 x 10 ⁷	10,000,000 Bq	10 MBq	

Sievert is the unit of absorbed dose of radiation. (See Appendix 9)

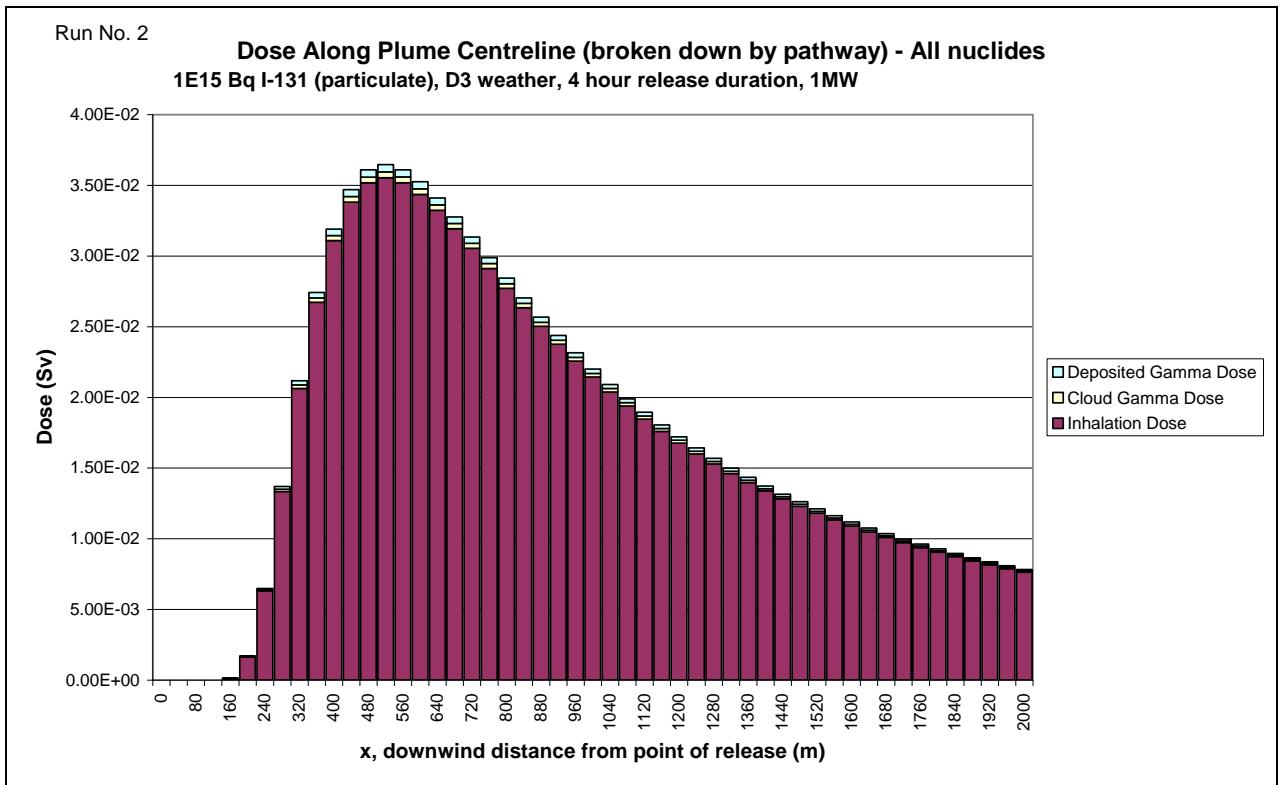
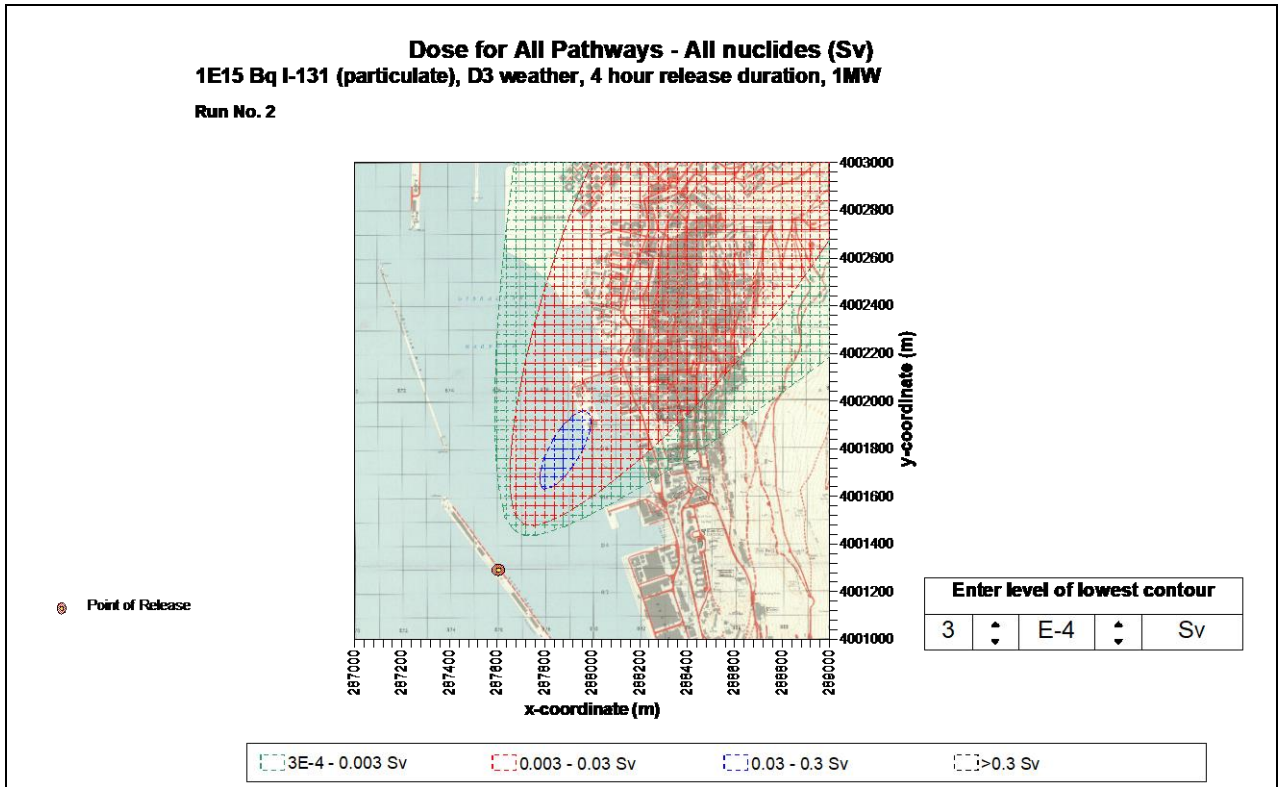
Becquerel is the SI unit of radioactivity. (See Appendix 9)

The radiation doses and activity deposition are based on a worst case where most of the contents of a 1 MegaWatt (MW) nuclear reactor on board a ship is released to atmosphere over a period of 4 hours.

PUMA Run no.2 Dose for all pathways, all nuclides
PUMA Run no.3 Deposited Gamma Dose, all nuclides
PUMA Run no.4 Deposited activity, all nuclides

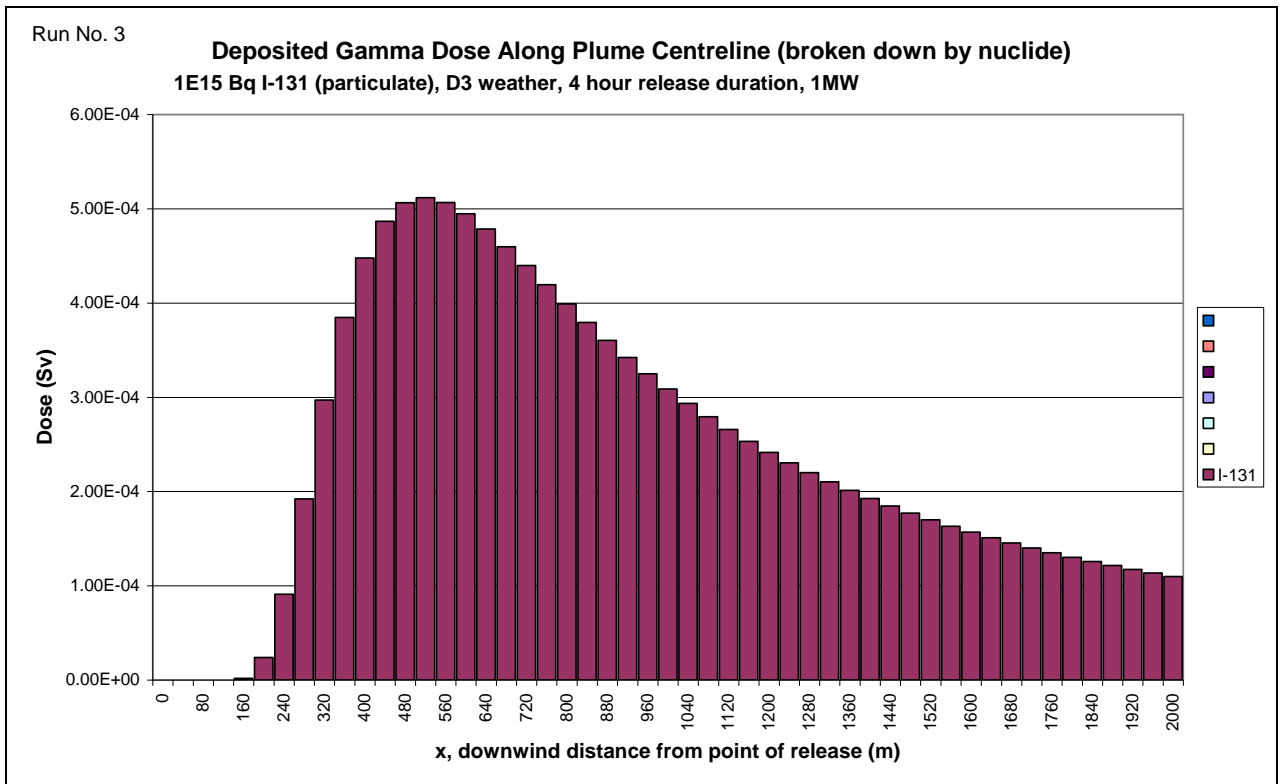
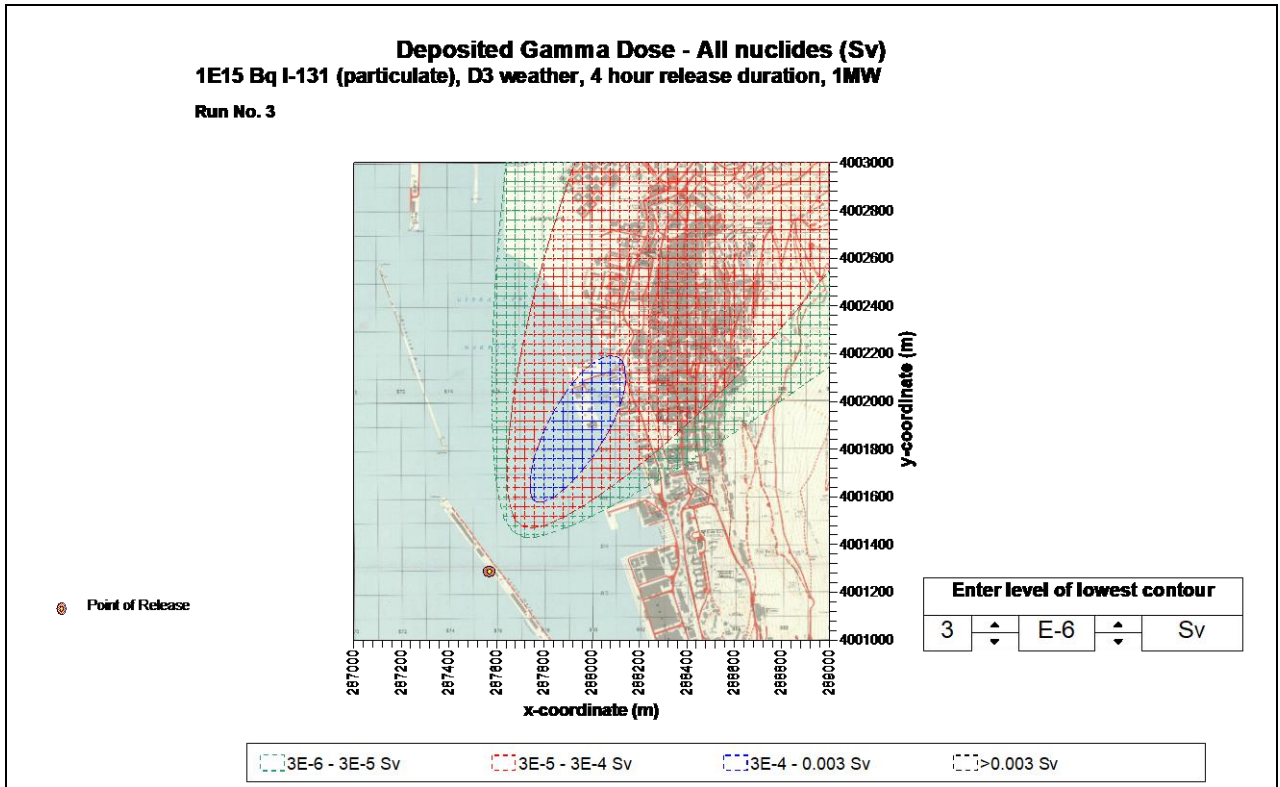
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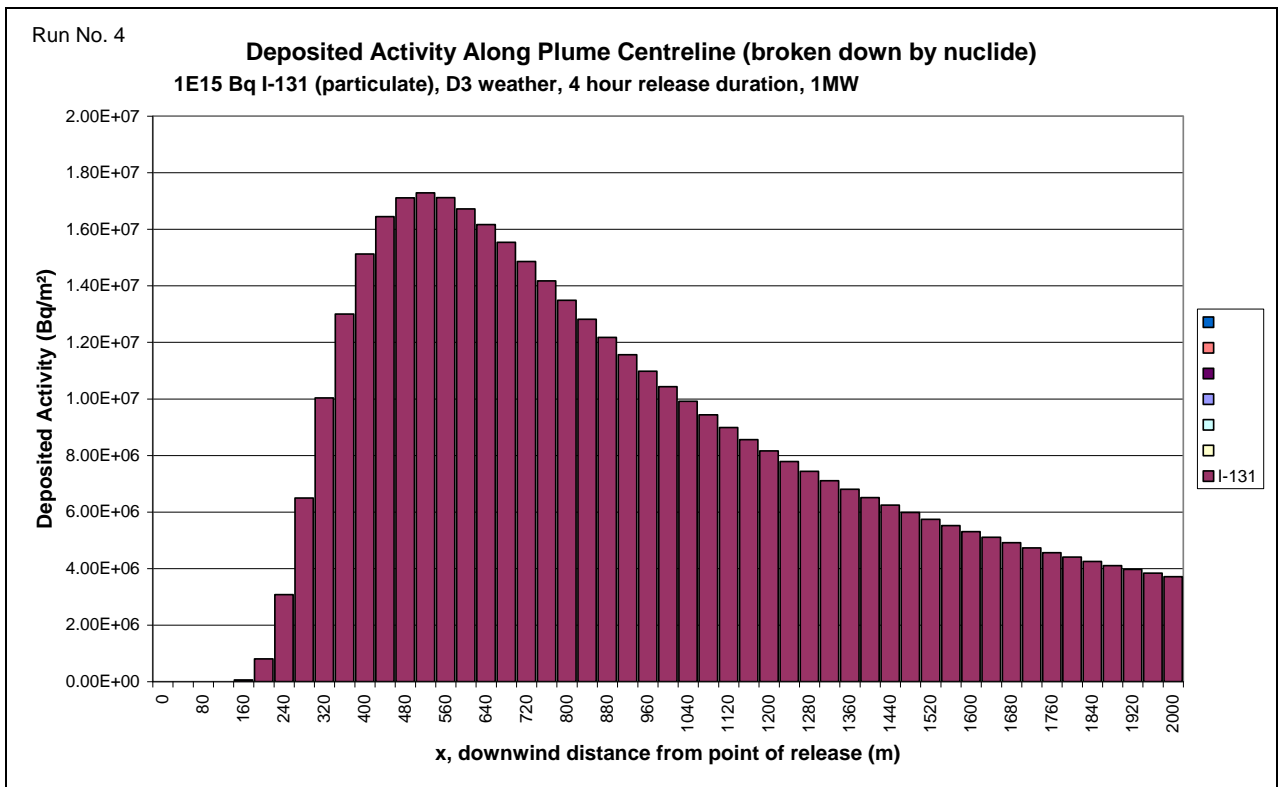
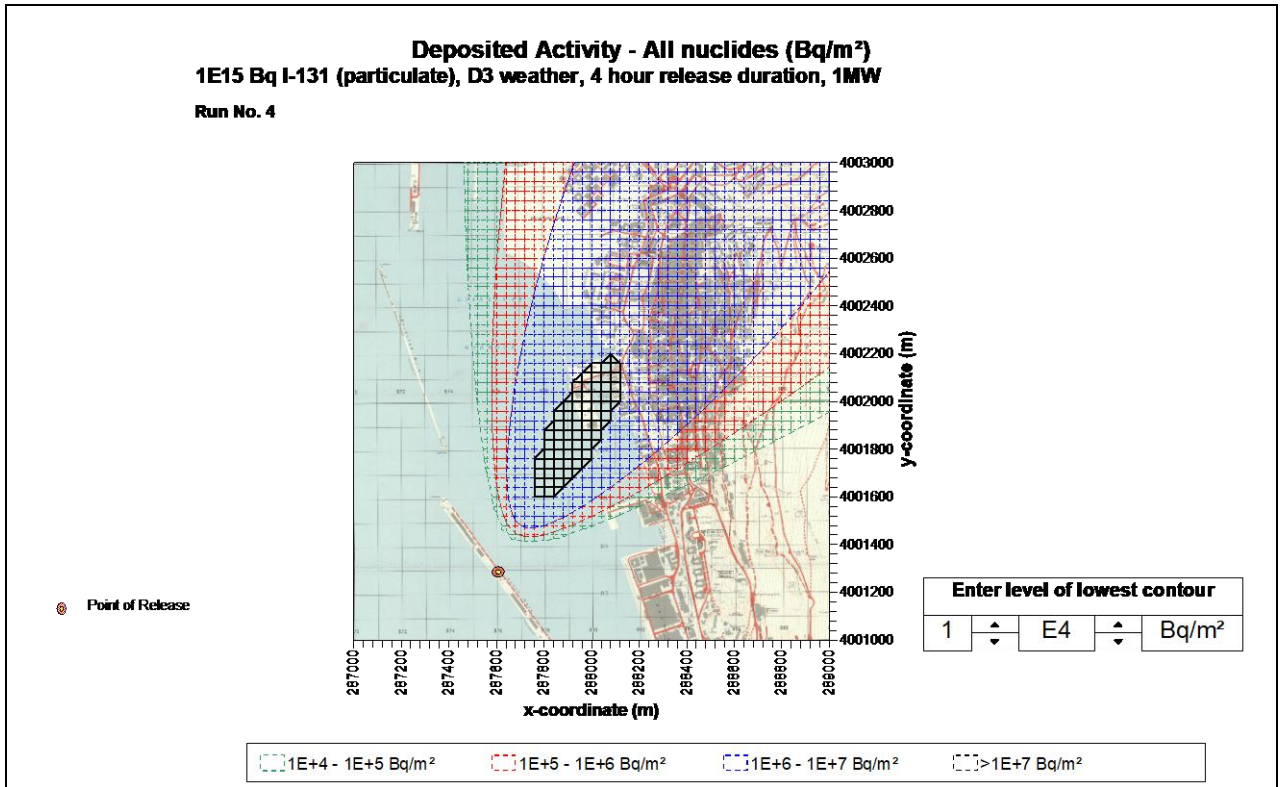
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APPENDIX 10

RADIATION AND RADIATION PROTECTION

BASIC AWARENESS

Note: The notes contained in this appendix are not intended to give an in depth knowledge about radiation and radiation protection but a basic awareness and introduction to those persons who may be called on to use this Radiation Emergency Response Plan.

We are exposed to radiation, in its various forms, every day of our lives; it is a natural part of our environment and has been since the Earth and cosmos were born. Common sources of naturally occurring radiation include radon gas, which occurs naturally in granite bearing rocks, and the increased exposure to cosmic rays when flying at high altitudes. However, there are also sources of manmade radiation, including nuclear power plants and radioactive sources used in medical diagnostics and radiotherapy treatment.

First we will describe the different types of radiation, including its effects and how it arises, and then move on to basic radiation protection. Certain terms and abbreviations will be encountered, which are either explained where first used or are contained in Appendix 9, Terminology and Abbreviations.

The different types of ionising radiation have their own symbols as follows:

type	symbol	nature
alpha	α	particle
beta	β	particle
gamma	γ	electromagnetic wave
X-ray	X	electromagnetic wave
neutron	n	particle

Radiation is found in two fundamental forms: as electromagnetic waves (rays) or as atomic particles. Here we are concerned with ionising radiation and its potential harmful effects.

The Electromagnetic Spectrum

Electromagnetic radiation is energy travelling through space in packets (photons) with specific wavelengths and associated energies. The electromagnetic spectrum describes the whole range of electromagnetic radiation with different wavelengths. Visible light is a form of electromagnetic radiation with a wavelength of $\sim 10^{-9}\text{m}$, but the full spectrum ranges from gamma radiation with very short wavelengths of $< 10^{-11}\text{m}$ to long wave radio with wavelengths $> 10^3\text{m}$. Figure 1 shows the

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electromagnetic spectrum.

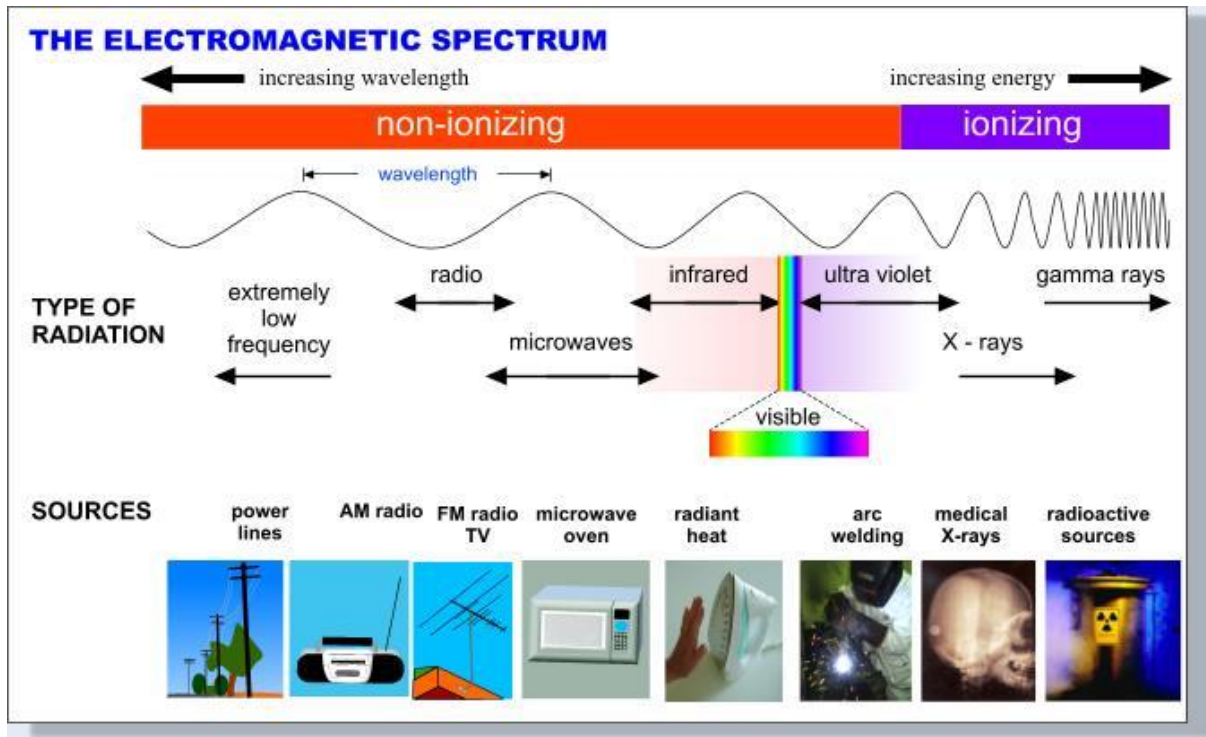


Figure 1: Electromagnetic spectrum

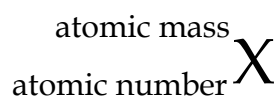
The Atom and Atomic Particles

An atom is the smallest unit of matter that cannot be divided further by chemical means. A simple model of an atom is of a central solid nucleus, with orbiting particles of energy known as electrons which travel in different orbital levels. The main constituents of the nucleus are protons and neutrons. There are other particles in an atomic nucleus but are beyond the scope of these notes.

Elements are atoms with varying numbers of protons. The number of protons characteristic of an element is its atomic number. Protons have positive charges; so to balance these, atoms have an equal number of electrons, which are negatively charged. Some electrons can be positively charged and are known as positrons, but this is beyond the scope of these notes.

How are the elements written – symbols?

The symbolic presentation of the elements including isotopes is as follows.



where X is the element symbol.

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Figure 2 shows a symbolic representation of a helium atom.



Figure 2: Helium atom

A short-hand form of writing radio-isotopes is to use the chemical symbol suffixed with the mass number, for example Na-24 indicates sodium with atomic mass 24.

Isotopes

Although an element is defined by its atomic number, i.e. how many protons it has, it can have variants with differing numbers of neutrons, known as isotopes or nuclides. The words isotope and nuclide are effectively synonymous. The total number of protons and neutrons in an atom is known as the atomic mass, as shown above. Therefore, isotopes of an element are variants with different atomic masses. Interestingly, the chemistry of an element is governed by the atomic number.

Hydrogen is the simplest element, with only one proton. However, it has three isotopes, with 0, 1 and 2 neutrons, as shown in Figure 3 below.

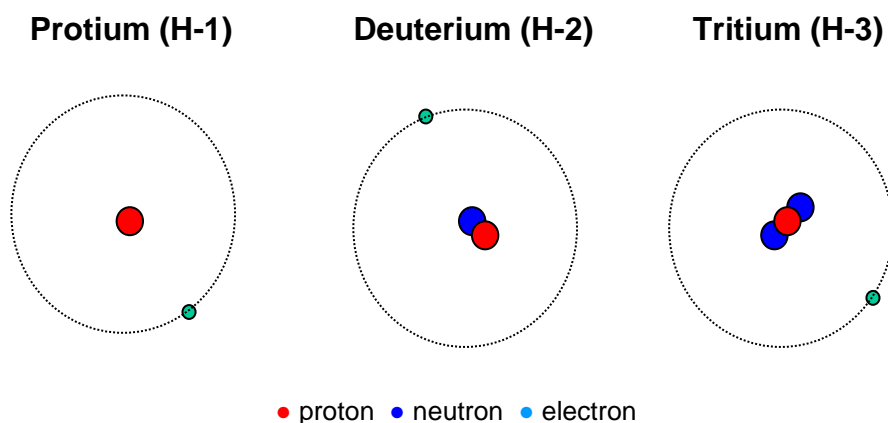


Figure 3: Hydrogen and its isotopes.

Protium is an alternative name for hydrogen isotope 1. Hydrogen Oxide (H₂O) is better known as water and Deuterium Oxide is commonly known as 'Heavy Water'.

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Radioactivity

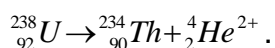
An isotope is stable if the forces within the nucleus are balanced. Most elements have at least one stable isotope, and in some cases more. For example, both Beryllium and Phosphorus only have one stable isotope, whereas Tin has ten stable isotopes.

In an unstable isotope, the forces within the nucleus are unbalanced, leading to an excess of energy. The unstable nucleus attempts to reach stability by releasing this energy in the form of neutrons, protons, or other particles or energy forms. Such unstable isotopes are described as being radioactive. The energy or particles thrown off as the isotope seeks to reach stability are known as radiation.

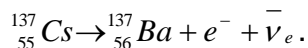
The nuclei of very unstable isotopes sometimes release energy as gamma rays (γ -rays), which can be seen in Figure 1 to be very low wavelength electromagnetic radiation.

When an unstable isotope seeks to become stable by emitting particles, this is known as disintegration. The process of isotopes releasing particles whilst changing from one element to another is known as radioactive decay.

The two key forms of radioactive decay that we are interested in here are alpha (α) and beta (β) decay. In alpha decay the nucleus of an unstable isotope of a heavy atom seeks to become stable by emitting a new nucleus made up of two protons and two neutrons (a positively charged helium nucleus - no electrons). Since the nucleus has lost two protons, the atomic number of the isotope is reduced by 2 and the atomic mass by 4, resulting in a nucleus of a new element. For example, a uranium nuclide that undergoes alpha decay results in a helium nucleus (alpha particle) and a thorium nuclide:



In the case of beta decay a neutron in the nucleus decays into proton, releasing an electron and a neutrino. The neutrino is an uncharged particle which does not interact with its surroundings, so we will not consider it further. This decay therefore results in no change in the atomic mass of the nuclide, but an increase of one in the atomic number, so forming a nuclide of a different element. For example, a Caesium nuclide that undergoes beta decay results in a barium nuclide:



Radioactive half-lives and decay chains

Different unstable isotopes undergo decay at different rates. The time period over which half of the nuclei in a material have undergone decay is known as the radioactive half-life. Half-lives range from a few microseconds to thousands of years.

In some cases a nucleus must undergo a series of decays before becoming stable, which is known as a decay chain. Each decay stage in the chain has its own half-life. For example, a ${}^{232}\text{Th}$ undergoes a decay chain with 10 stages before ending as the

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stable nuclide ^{208}Pb .

Ionizing and non-ionizing radiation

Non-ionizing radiation causes molecules to vibrate but does not alter their overall composition. Ionizing radiation can cause electrons to be displaced from a molecule, forming a positively charged molecule, known as an ion. Ionizing radiation may be in the form of either particles or electromagnetic energy, which behave in different ways.

Alpha (α) particles, beta (β) particles and gamma (γ) rays are all forms of ionizing radiation. The next section describes their characteristics.

Another form of ionizing radiation is X-rays, which are released when electrons surrounding a nucleus change from one orbital level to another.

Characteristics of individual types of ionizing radiation

Alpha particles are heavy particles, and are relatively easily stopped, such as by human skin or a few millimetres of air. However, if ingested or inhaled alpha particles can severely damage health.

Beta particles are essentially electrons. They can be stopped by a few centimetres thickness of a dense material, although they can travel significant distances through air. Similarly, to alpha particles, ingestion or inhalation is dangerous but not to as great an extent.

Gamma (γ) rays are very difficult to stop. It takes several metres of a dense material such as lead to stop them. They can travel several metres in air and are able to pass through the human body, potentially exposing the internal organs to radiation. Although gamma rays do not directly ionise human tissue, they can excite electrons which then go on to ionize tissue.

X-rays have similar but lesser effects to Gamma (γ) rays.

Neutrons are produced by some radioactive materials by spontaneous nucleus decay but are more often produced under artificial conditions where an alpha emitting radioactive source is brought into intimate contact with the element beryllium. They can also be produced by accelerating atoms of deuterium or tritium in a vacuum into other atoms of deuterium or tritium absorbed in into a metal such as zirconium. The penetrating power of neutrons is high in some materials (higher than gamma) but can also be absorbed by materials containing light elements such as hydrogen; hence neutron shielding usually comprises water, wax, concrete or light polymers. The presence of neutron radioactive substances may indicate fissionable material.

Detecting radiation

Part of the danger of radiation lies in the fact that it cannot be detected by the human senses, so someone can be completely unaware that they are being exposed to radiation. In all cases it must be detected using some form of specialist equipment, such as a "Geiger counter", which relies on the ionisation effects, and "scintillation

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counters” where the radiation produces small bursts of light in photosensitive crystalline material that can be amplified electronically and measured.

Measuring radiation

The key factor to evaluate the risk associated with exposure to radiation is the measurement of the energy imparted from the radiation to the person’s tissue, or other inanimate material. This is known as the radiation dose.

There are a number of units used for quantifying radiation and radiation protection. One Becquerel (Bq) is equivalent to a quantity of material undergoing one atom disintegration per second. This unit is extremely small and often laboratory amounts are as MBq and in the environment as kBq. Since it is the energy deposited by the radiation that is of interest; one Gray (Gy) is the dose associated with the deposition of one Joule of energy per kilogram of matter. Absorbed dose rates are measured in Grays per hour (Gyh^{-1}).

However, different forms of radiation have different effects on biological tissue. For example 1 Gy of alpha radiation is far more hazardous than 1 Gy of beta radiation. A unit which takes this into account is the Sievert (Sv). The Sievert is the product of the dose in Grays multiplied by a “quality factor” (or radiation weighting factor), which is larger for more hazardous forms of radiation. For example, an effective dose of 1 Sv requires 1 Gy of beta radiation but only 0.05 Gy of alpha radiation; hence alpha particles have a radiation weighting factor of 20. The Sievert is a large unit so radiation doses are usually measured in milliSieverts (mSv).

Radiation Effects

Ionizing radiation deposits energy in body tissue, which may cause no long-term ill effects to the cell structures. Large amounts of ionizing radiation can cause significant damage to cells, which results in the condition commonly known as “radiation sickness” or in severe cases death. Alternatively cells can remain fundamentally undamaged but may mutate, increasing the risk of the cells becoming cancerous.

There are two categories of effects of radiation exposure, stochastic and deterministic.

Stochastic effects are where the probability of the effect occurring is a function of the dose which causes the effect. The severity of effect is not related to the magnitude of initiating dose. An example is radiation induced cancers.

Deterministic effects (non-stochastic) are based on a threshold of ionising radiation exposure being achieved in a recipient before any effect is observed / detected. Such effects may be erythema (reddening of skin), where high levels of radiation dose are required over a short period of time (>3.0 Gy).

Practical Radiation Protection Principles

Radiation protection is based around three basic principles: time, distance and shielding. Where a radioactive source is unsealed, such as in the case of dispersed

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contamination, containment is also considered. These principles are explained as follows. The health risk increases with increasing amounts of radiation received.

Time

The amount of radiation received is directly proportional to the exposure time. In the case of external exposure this is very easily calculated, as it is the time the person is in near the source. For internal exposure, from ingestion or inhalation, the radiation source is trapped within the body. The biological half-life is then used to measure radiation exposure time, which is defined as the time the body takes to either expel or chemically break down half of the radioactive substance. Clearly, reducing exposure time is a good way of decreasing risks, although this is not easily achievable in the case of ingested or inhaled sources.

Distance

The radiation energy level from a radioactive source decreases relatively quickly with distance. In simple terms, if you move twice as far away from a source, the radiation is four times less. Conversely, if you move to be half as far away from a source, the radiation levels are four times higher. Increasing the distance from a source is therefore a useful method of reducing the risk of exposure.

Shielding

Shielding is the third key factor of radiation protection. This involves placing some material between the radioactive source and a person. In the case of alpha and beta particles we can see from above that this can be relatively easily achieved. For gamma rays several centimetres of a very dense material is required to give significant levels of shielding. Commonly thick lead blocks or plates are used to give protection from gamma rays, and lesser thicknesses of lead sheet for X-rays.

Examples of Radiation Protection

The Chernobyl accident in 1986 resulted in radioactive particles settling over large areas of Europe. These areas are monitored, and in some regions food production from the land is restricted for human consumption, albeit the limits were originally arbitrarily set and not based on any proven scientific evidence.

Following a release of radioactivity, the public may be advised to shelter in their homes or place of work with the doors and windows closed. This provides protection both in that the building itself provides shielding protection and that keeping the building reasonably sealed prevents inhalation of radioactive particles. In addition, occupying the centre ground floor area of a building applies increased distance. An alternative countermeasure is evacuation, which takes advantage of increasing the distance from the source / area of contamination; however, this can only be achieved before the radioactive material has been deposited. Evacuation after deposition should be considered once the radioactivity has decayed sufficiently to permit controlled exposure.

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Hazards from Ionising Radiation put into Perspective

The hazards from being exposed to ionising radiation need to be put into perspective with our everyday normal lives. Indeed, recent studies (2006) show that the effects of radiation exposure in the population of Ukraine, as a result of the 1986 Chernobyl disaster, is much less than anticipated.

The table below provides an indication of risk of death from several causes.

Hazard	Radiation Dose (mSv)	Risk of Death
Average annual dose to people in the UK as part of normal life	2.6	1 in 10,000
Dose from a return flight from London to New York	0.14	1 in 230,000
Dose from eating a bag of brazil nuts	0.01	1 in 2.5 million
Expected dose from using a training source	<0.001	1 in 2.5 Million
Heart Disease		1 in 200
Cancer (all)		1 in 387
Burn or Scald at Home		1 in 610
Maternal Death in Pregnancy		1 in 8,200
Road Accident		1 in 16,800
Surgical Anaesthesia		1 in 185,000
Lightning		1 in 18.7M
Rail Travel Accident		1 in 43M
Aircraft Accident		1 in 125M

Source: UK Health & Safety Executive, 2006

The information contained in these notes has been taken from several sources; a useful guide is *Living with Radiation*, UK Health Protection Agency.

The science of radiation and properties of radioactive substances unavoidably contains technical words, terms and abbreviations which can be intimidating to non-scientific persons. To assist the user of this plan Appendix 9, Terminology and Abbreviations, provides explanations and descriptions

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POSSIBLE RADIATION HAZARDS

The table below lists the main radionuclides (radioactive substances) that could be released from a nuclear power plant in a warship. There are 22 other radionuclides that would also be released but they are insignificant compared to those shown in the list. All of the radionuclides listed present a hazard by inhalation or entering the body through an injury to the skin, for example, an open wound. The primary radiation hazard is shown which may be different where the external gamma radiation hazard is not significant. See Appendix 12, Technical Details, and Appendix 13, Contamination and Radiation Dose Intervention Levels.

Radionuclide (isotope)	Symbol	Radioactive Half-Life	Primary Radiation Hazard	State
Iodine 131	¹³¹ I	8.04 d	G	vapour / particle
Strontium 90	⁹⁰ Sr	29.12 y	B	particle
Caesium 137	¹³⁷ Cs	30 y	G	particle
Plutonium 239	²³⁹ Pu	2.41 x 10 ⁴ y	A	particle
Plutonium 241	²⁴¹ Pu	13.2 y	B	particle
Cobalt 60	⁶⁰ Co	5.27 y	G	particle
Zirconium 95	⁹⁵ Zr	63.98 d	G	particle
Niobium 95	⁹⁵ Nb	35.15 d	G	particle
Ruthenium 106	¹⁰⁶ Ru	368.2 d	B (s)	particle
Cerium 144	¹⁴⁴ Ce	284.3 d	B (s)	particle
Americium 241	²⁴¹ Am	432.2 y	A, G	particle
Tritium	³ H	12.26 y	B	water vapour

Half-Life: d = days, y = years

Radiation: A = alpha, B = beta, B (s) = beta (skin), G = gamma

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APPENDIX 11

TECHNICAL DATA

NUCLEAR REACTOR FISSION PRODUCTS

The science of radiation and properties of radioactive substances unavoidably contains technical words, terms and abbreviations which can be intimidating to non-scientific persons. To assist the user of this plan Appendix 9, Terminology and Abbreviations, provides explanations and descriptions. Appendix 11 comprises a basic awareness of radiation and radiation protection

The table below lists the main radionuclides (radioactive substances) that could be released from a nuclear power plant. There are 22 other radionuclides that would also be released but they are insignificant compared to those shown in the list. All of the radionuclides listed present a hazard by inhalation or entering the body through an injury to the skin, for example, an open wound.

Radionuclide (isotope)	Symbol	Radioactive Half-Life	Primary Radiation Hazard	State
Iodine 131	¹³¹ I	8.04 d	G	vapour / particle
Strontium 90	⁹⁰ Sr	29.12 y	B	particle
Caesium 137	¹³⁷ Cs	30 y	G	particle
Plutonium 239	²³⁹ Pu	2.41 x 10 ⁴ y	A	particle
Plutonium 241	²⁴¹ Pu	13.2 y	B	particle
Cobalt 60	⁶⁰ Co	5.27 y	G	particle
Zirconium 95	⁹⁵ Zr	63.98 d	G	particle
Niobium 95	⁹⁵ Nb	35.15 d	G	particle
Ruthenium 106	¹⁰⁶ Ru	368.2 d	B (s)	particle
Cerium 144	¹⁴⁴ Ce	284.3 d	B (s)	particle
Americium 241	²⁴¹ Am	432.2 y	A, G	particle
Tritium	³ H	12.26 y	B	water vapour

Half-Life: d = days, y = years

Radiation: A = alpha, B = beta, B (s) = beta (skin), G = gamma

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APPENDIX 12

CONTAMINATION AND RADIATION DOSE INTERVENTION LEVELS

A “radiation emergency” is defined, for the purposes of the Radiation Emergency Response Plan, as being an incident involving the release of radioactive substances that will potentially give a member of the public a dose above 5 mSv. This is set by the International Atomic Energy Agency (IAEA) and the Gibraltar *Radiation (Emergency Preparedness and Public Information) Regulations, 2004*. This potential dose disregards any health protection measures to be taken during the 24 hours immediately following the first release of radioactive material.

Emergency Reference Levels

Emergency Reference Levels (ERLs) for sheltering and evacuation as recommended by the PHE (Radiological Protection Division) are summarised in the table below. The ERLs are levels of ‘dose saved’ at which it is justifiable to introduce countermeasures. It should be noted that these values are levels at which the countermeasure should be considered for implementation, they do not necessarily represent the optimum levels for a release of radioactive fission products from an incident within the HM Naval Base. Other factors such as the reduction in anxiety of the public resulting from the implementation of a countermeasure, the disruption to individuals, the number of people involved and financial will also need to be considered.

Countermeasure	Dose Equivalent (mSv)			
	ERL			
	Whole Body		Whole Body	
Sheltering	3	Sheltering	3	Sheltering
Evacuation	30	Evacuation	30	Evacuation

Below these levels of dose saved the radiological risk may be assessed as less than the conventional risks and social disruption resulting from implementing the countermeasures, i.e. the risks of implementation are likely to outweigh the benefits. However, it has been decided by the Government that the countermeasure of issuing Stable Iodine Tablets (SITs) will be carried out when an Off-Site Nuclear Emergency is declared.

The dose levels for personnel engaged on remediation works will be advised by experts contracted to the Competent Authority when necessary. Levels of ground contamination, below which remedial action is deemed not necessary, will be similarly advised by experts when necessary.

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