Office for Nuclear Regulation

ONR GUIDE			
LC 11 – Emergency Arrangements			
Document Type:	Nuclear Safety Technical Inspection Guide		
Unique Document ID and Revision No:	NS-INSP-GD-011 Revision 5		
Date Issued:	July 2017	**Review Date:**	July 2020
Approved by:	Kulvinder McDonald	Superintending Inspector – Nuclear Safety & Professional Lead - Operational Inspection	
Record Reference:	TRIM Folder 1.1.3.793. 2017/263535		
Revision commentary:	This document has been updated as part of the implementation of the Nuclear Safety Directive 2014/87/EURATOM. Text added (s 2.4) to reflect role of the TIG.		

TABLE OF CONTENTS

1. INTRODUCTION

1.1. Many of the licence conditions attached to the standard nuclear site licence require, or imply, that licensees should make arrangements to comply with regulatory obligations under the conditions. ONR inspects compliance with licence conditions, and also with the arrangements made under them, to judge the suitability of the arrangements made and the adequacy of their implementation. Most of the standard licence conditions are goal-setting, and do not prescribe in detail what the licensees' arrangements should contain; this is the responsibility of the duty-holder who remains responsible for safety. To support inspectors undertaking compliance inspection, ONR produces a suite of guides to assist inspectors to make regulatory judgements and decisions in relation to the adequacy of compliance, and the safety of activities on the site. This inspection guide is one of the suite of documents provided by ONR for this purpose.

2. PURPOSE AND SCOPE

2.1. The purpose of this document is to provide guidance on compliance inspection of the site licence arrangements, including demonstration emergency exercises, for Licence Condition 11 (LC 11). It is intended to promote a consistent approach to the inspection of emergency arrangements and the evaluation of exercises. This guidance is not intended to be mandatory, but provides a framework for inspectors, on which to base their judgment and discretion during such inspections.

2.2. This guidance does not indicate the frequency or depth of the compliance inspections — these will be determined by the integrated intervention strategy and the specific ONR programme.

2.3. This guidance considers each sub-condition (section 3) and identifies its purpose (section 4), and then indicates the key considerations that should be reflected in the licensee's arrangements (section 5). Guidance on the inspection of the implementation of these arrangements is provided in section 6.

2.4. This document assists in implementing Council Directive 2014/87/Euratom of 8 July 2014 amending Directive 2009/71/Euratom, by highlighting ONR's regulatory expectations underpinning the relevant licence conditions and or legislation. The following Directive Articles are addressed in this document:

6(e) licence holders provide for appropriate on-site emergency procedures and arrangements, including severe accident management guidelines or equivalent arrangements, for responding effectively to accidents in order to prevent or mitigate their consequences. Those shall in particular:

6e(i) be consistent with other operational procedures (See paragraphs 6.2, 6.3 & 6.4) and periodically exercised to verify their practicability; (See paragraphs 5.21 and 6.5.

6e(iii) provide arrangements to receive external assistance; (See paragraphs 4.3,5.18 and Annex 1, section 2.4).

6e(iv) be periodically reviewed and regularly updated, taking account of experience from exercises and lessons learned from accidents; (see paragraphs 5.11 5.21, 5.25 and 6.10).

3. LICENCE CONDITION 11: EMERGENCY ARRANGEMENTS

LC 11(1): Without prejudice to any other requirements of the conditions attached to this licence the licensee shall make and implement adequate arrangements for dealing with any accident or emergency arising on the site and their effects.

LC 11(2): The licensee shall submit to ONR for approval such part or parts of the aforesaid arrangements as ONR may specify.

LC 11(3): The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless ONR has approved such alteration or amendment.

LC 11(4): Where any such arrangements require the assistance or co-operation of, or render it necessary or expedient to make use of the services of any person, local authority or other body the licensee shall ensure that each person, local authority or other body is consulted in the making of such arrangements.

LC 11(5): The licensee shall ensure that such arrangements are rehearsed at such intervals and at such times and to such extent as ONR may specify or, where ONR has not so specified, as the licensee considers necessary.

LC 11(6): The licensee shall ensure that such arrangements include procedures to ensure that all persons in his employ who have duties in connection with such arrangements are properly instructed in the performance of the same, in the use of the equipment required and the precautions to be observed in connection therewith.

4. PURPOSE OF LICENCE CONDITION 11

LC 11(1): Without prejudice to any other requirements of the conditions attached to this licence the licensee shall make and implement adequate arrangements for dealing with any accident or emergency arising on the site and their effects.

4.1. This is the key sub-condition which is aimed at ensuring a licensee has adequate arrangements in place to be able to respond effectively to any incident in order to ensure the protection of both site personnel and the public so far as is reasonably practicable, thereby ensuring that the licensee, while responding to such an incident, fulfils the general duties imposed upon them by sections 2 and 3 of the Health and Safety at Work etc. Act 1974 (HSW Act).

LC11(2): The licensee shall submit to ONR for approval such part or parts of the aforesaid arrangements as ONR may specify; and

LC11(3): The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless ONR has approved such alteration of amendment.

4.2. These are standard sub-conditions allowing ONR, having identified key document(s), to specify and freeze (by approval) part or parts of the document(s). An approval is normally issued once a document has undergone technical assessment, and ONR is satisfied with the contents. Once a document is approved the licensee can no longer alter or amend it without the permission of ONR.

LC 11(4): Where any such arrangements require the assistance or co-operation of, or render it necessary or expedient to make use of the services of any

person, local authority or other body the licensee shall ensure that each person, local authority or other body is consulted in the making of such arrangements.

4.3. Sub-condition (4) is aimed at ensuring that when the on-site emergency plan is drawn up, the licensee consults those agencies that may be required to provide support for the licensee's emergency response. This will ensure that they are aware of the duties that the licensee may request them to undertake on its behalf.

LC 11(5): The licensee shall ensure that such arrangements are rehearsed at such intervals and at such times and to such extent as ONR may specify or, where ONR has not so specified, as the licensee considers necessary.

4.4. The aim of sub-condition (5) is to ensure that arrangements contain provisions to ensure that the roles and duties required to respond to an emergency are rehearsed on a regular basis. In part, this requirement is to confirm that those responding to an emergency on the site are trained and experienced, so that the emergency organisation on site functions effectively and efficiently, under what may include adverse conditions.

***LC 11(6): The licensee shall ensure that such arrangements include procedures to ensure that all persons in his employ who have duties in connection with such arrangements are properly instructed in the performance of the same, in the use of the equipment required and the precautions to be observed in connection therewith*.**

4.5. The aim of sub-condition (6) is to ensure that the licensee has adequate arrangements in place to instruct its staff, including providing appropriate training, to ensure that persons responding to an emergency on the site are aware of the roles and duties they are expected to perform. The licensee's compliance with this sub-condition should also provide the means for them to meet the requirements of regulation 7 of the Radiation (Emergency Preparedness and Public Information) Regulations 2001 (REPPIR) relating to the training of, and provision of equipment to, employees who may be involved in the response to a radiation emergency. This should help ensure that persons responding to an emergency on the site are suitably qualified and experienced (SQEP) to perform their roles and to use the relevant equipment provided to them.

5. GUIDANCE ON ARRANGEMENTS FOR LC11

General

5.1. Licensees are required to comply with the Health and Safety at Work etc. Act 1974 (HSW Act) and its relevant statutory provisions. The HSW Act places a fundamental duty on employers to ensure, so far as is reasonably practicable, the health, safety and welfare at work of all their employees. It also imposes a duty on employers to ensure, so far as is reasonably practicable, that persons not in their employment are not exposed to risks to their health or safety as a result of the activities undertaken. This is taken to include risks arising from the nature of the activities, and the plant and equipment necessary to undertake the activity.

5.2. Sections of the Nuclear Installations Act 1965 (NI Act) relating to the licensing and inspection of nuclear installations are relevant statutory provisions of the Energy Act 2013. These sections of the NI Act apply to all licensees. Section 4 of the NI Act requires ONR to attach conditions to a licence in the interests of safety, and ONR may attach licence conditions with respect to the handling, treatment and disposal of nuclear matter. Failure to comply with licence conditions is an offence under section 4 of the NI Act. Furthermore licence conditions are also applicable provisions of the

Energy Act 2013, which provides for the serving of an improvement notice. Licence Condition 11 “Emergency Arrangements” is one licence condition of particular importance in relation to ensuring that adequate arrangements are made for responding to any accident or emergency arising on the site.

5.3. REPPIR are regulations made under the HSW Act, whose main aim is to: establish a framework for the protection of the public through emergency preparedness for radiation emergencies, with the potential to affect members of the public, from premises and specified transport operations; ensure the provision of information to the public in advance, in situations where a (REPPIR) radiation emergency might arise; and ensure that identified measures are put into practice in the event of any kind of radiation emergency (however it may arise).

5.4. Often, many licensees display in control centres a convenient reminder of the responsibility placed on duty-holders to protect: the public; personnel; plant; environment — and to ensure the security of the site (PPPES).

LC 11(1)

5.5. The Nuclear Installations Act 1965 (NI Act), Licence Condition 11 and REPPIR, each place specific duties on the licensee with regard to emergency planning and response, and for the licensee’s arrangements to be judged adequate it is necessary for the licensee’s arrangements to facilitate compliance with these requirements. The legislative requirements particularly relevant to sub-condition (1) are described in paragraphs 5.6 – 5.15 below and these should be addressed by the licensee’s arrangements.

5.6. The duty on the licensee to restrict so far as is reasonably practicable the extent to which their employees and other persons are exposed to ionising radiation, imposed by regulation 8 of the Ionising Radiations Regulations 1999 (IRR99), applies to emergency exposure situations as well as to normal operations.

5.7. REPPIR requires that, where it is reasonably foreseeable that a radiation emergency may arise, the licensee prepares (regulation 7) and periodically reviews (regulation 10) an emergency plan, in consultation with their employees, any person carrying out work on behalf of the operator, ONR, the relevant local authority in whose area the premises of the operator are situated, the emergency services, the relevant health authority and the Environment Agency or Scottish Environment Protection Agency or Natural Resources Wales. REPPIR regulation 7 also requires that all employees who may be involved in or affected by such a radiation emergency are provided with suitable and sufficient information, instruction and training; and the equipment necessary to restrict that employee’s exposure to ionising radiation.

5.8. At the time of introducing REPPIR, ONR (then the Nuclear Installations Inspectorate), provided assurance to licensees that the extant arrangements in place to address LC11, should also ensure that many of the REPPIR requirements would also be addressed. Where specific additional measures were deemed necessary to comply with REPPIR, these could be accommodated in limited cases by amendments to an emergency plan approved under LC11, and/or by extending the applicability of lower tier emergency procedures.

5.9. REPPIR regulation 7 requires that the emergency plan is ‘designed to secure, so far as is reasonably practicable, the restriction of exposure to ionising radiation and the health and safety of persons who may be affected by such reasonably foreseeable emergencies as are identified in the said assessment.’

5.10. REPPIR schedule 7 lists the information that must be included in the emergency plan:

- the names or positions of persons authorised to set emergency procedures in motion and the person in charge of and co-ordinating the on-site mitigatory action;
- the name or position of the person with responsibility for liaison with the local authority responsible for preparing the off-site emergency plan;
- for reasonably foreseeable conditions or events which could be significant in bringing about a radiation emergency, a description of the action which should be taken to control the conditions or events and to limit their consequences, including a description of the safety equipment and the resources available;
- the arrangements for limiting the risks to persons on the premises including how warnings are to be given and the actions persons are expected to take on receipt of a warning;
- the arrangements for providing early warning of the incident to the local authority responsible for setting the off-site emergency plan in motion, the type of information which should be contained in an initial warning and the arrangements for the provision of more detailed information as it becomes available;
- the arrangements for providing assistance with off-site mitigatory action; and
- the arrangements for emergency exposures including the dose levels which have been determined as appropriate for the purposes of putting into effect the emergency plan.

5.11. The licensee's arrangements for dealing with any accident or emergency arising on the site usually include the preparation of a high-level document (usually titled the "Emergency Plan"), and an accompanying suite of low-level documents detailing how it should be implemented (frequently titled "Emergency Handbook"). Reviews should be carried out periodically after a specified time interval, and in response to any significant change in the site status, risk levels, hazard assessment or OPEX. The resources required to implement the emergency plan will require (usually dedicated) facilities on-site for its implementation and appropriately trained staff who are SQEP for their duties. REPPIR schedule 7 states the essential content of the emergency plan (see para. 5.11. above) ; the following paragraphs provide guidance on what should be considered for inclusion.

5.12. The on-site emergency plan should identify the types of possible incidents on the site and define a strategy, system and response structure for dealing with them. It would be expected to be based on a range of potential accidents - from those which are considered reasonably foreseeable, to those which the safety case suggests are severe accidents for the site in question. It should also consider the requirements of 'extendibility', indicating how this would be addressed if a much larger (unforeseen or limiting) event was to occur.

5.13. The emergency plan should define the licensee's strategy for dealing with these incidents, describe the site's emergency response organisation and its deployment, identify locations, facilities and equipment available for handling the emergency, and define the arrangements for instruction, training and rehearsals. It would be expected that the plan will provide a classification system for the different levels of severity of emergency, providing criteria for the declaration of severity level. Depending on the severity it should identify the key roles within the emergency organisation and their associated levels of responsibility and authority. It should also state the minimum number of staff deemed necessary to implement the emergency plan at all times,

including periods which are outside normal working hours. The plan should also describe the roles of, and interfaces with, the organisations with whom the licensee has collaborated in drawing up the plan (e.g. emergency services, local authorities and enforcement agencies). The detailed information underpinning the emergency plan should be given in supporting documentation.

5.14. When it is possible to foresee that an accident may affect the public off-site, the plan should describe the provisions for an off-site response and interventions to protect members of the public. It should also define the notification process by which relevant off-site organisations, e.g. Local Authorities, police, fire, ambulance, regulators, etc., are made aware of the potential for an off-site impact.

5.15. With regard to a nuclear licensed site, ONR determines the area of the detailed emergency planning zone (DEPZ) under REPPIR regulation 9(1) and the area of the public information zone under REPPIR regulation 16(1). The licensee's arrangements should ensure that persons living or working within these zones are provided with relevant information about the plan and about any accident that may affect them. Schedule 9 of REPPIR specifies the required minimum content of the information provided.

5.16. The licensee's arrangements may not be limited solely to nuclear aspects. They may integrate responses to emergencies arising from non-nuclear hazards on nuclear sites (especially on those sites where the Control of Major Accident Hazards (COMAH) Regulations apply), and the handling of environmental events.

LC 11(2) and LC 11(3)

5.17. The licensee's high-level Emergency Plan is usually approved by ONR and their arrangements for controlling this document should recognise the consequences of such approval. The Licensee should have in place procedures for identifying when a change to the approved plan is required, and the need to seek approval of any proposed amendments from ONR prior to implementation of the change. Low-level documentation supporting implementation of the Emergency Plan, not being approved, may be amended without ONR permission, but the licensee's arrangements should ensure that incremental changes to supporting documentation do not affect the validity of the approved plan. Modifications to emergency arrangement documentation should follow the processes in place for modifications under LC 22.

LC 11(4)

5.18. The arrangements should identify all likely on-site or off-site organisations from whom the licensee may require support in order to be able to handle an on-site emergency. The emergency services will clearly be required and, for an event with off-site impact, the Local Authority (LA) will be required to mobilise its resources to implement the off-site emergency plan for advising affected persons locally, handling any evacuees and supporting an off-site strategic co-ordination centre, to coordinate the off-site emergency response at local and national levels as necessary. The licensee's arrangements should recognise duties placed by REPPIR on the LA to generate this off-site plan, and should describe how the licensee's role and organisation interfaces with the off-site emergency organisation. The arrangements should also recognise the interactions with the other organisations (including regulatory bodies, government departments, hospital trusts, etc.) who might be involved in responding to a major off-site incident. The interactions, functions and roles of all these organisations should be outlined in the supporting documentation.

5.19. The arrangements should address the situation where there is more than one commercial enterprise (and possibility more than one licensee) embedded on the site. The interactions between the on-site enclaves, the duties that each places on the other, and an agreed command and control structure integrating the whole site emergency response should also be defined in the arrangements. Similarly, where there are industrial sites nearby that are subject to COMAH or could otherwise represent an external hazard to the nuclear site, the arrangements should include provision for the (periodic) exchange of information between the sites, so that the external hazards presented by those industrial sites can be assessed and any necessary amendments to the safety case can be made.

5.20. The arrangements should require routine consultation across a wide range of organisations and the general public. It would be expected that the arrangements detail formal forums for the appropriate initial and continuing consultation with the local community, emergency services and other persons with roles under the approved plan. Examples of such forums are Local Liaison Committees (LLC), Emergency Planning Consultative Committees (EPCC), and the Local Resilience Forums (LRF) that were established following the enactment of the Civil Contingencies Act 2004. While the LRF provides an overarching forum at which the full range of potential problems are discussed, the LLC and (especially) the EPCC provide forums that can address specifically nuclear issues. It should be noted that ONR participates in the LRF and has observer status on the other committees.

LC 11(5)

5.21. As part of the licensee's training programme, their arrangements should ensure that a programme of rehearsals is implemented that covers all the key elements of the emergency response. The effectiveness of the emergency arrangements should be demonstrated periodically, and currently this is undertaken by licensees at least annually on operational sites. Response to actual on-site events may contribute to operational experience and learning, and may lead to improvements in the emergency organisation.

5.22. The emergency response may be broken down into subtasks which may be rehearsed in isolation, but which should be brought together in a coordinated response requiring a full site response. Licensees may choose to conduct a series of site training exercises (which should be spread over the different shifts), to allow emergency responders on the site to practise and improve their emergency role.

5.23. A key objective of the programme of rehearsals should be to establish that each emergency response team is competent to respond effectively, at any time, to an emergency that may arise on the site, including those with significant off-site implications. Usually, one of the site rehearsals will be chosen as a demonstration to be observed by ONR as part of a compliance inspection of the LC11 arrangements and their implementation. Guidance on the inspection and evaluation of this Level 1 demonstration emergency exercise is given in paras 6.5 – 6.12.

5.24. The licensee's arrangements should recognise and have procedures for the possibility that ONR may specify rehearsal intervals, or may accept the measures that the licensee considers necessary. The licensee's arrangements should reflect the mandatory nature of a specification if it is issued, and anticipate the steps to be taken to comply with the specification.

5.25. The arrangements should include the use of feedback from both demonstration rehearsals and training exercises. Lessons learned should inform the future rehearsal programme, and prompt review of the adequacy of the arrangements as demonstrated. Where improvement opportunities are identified, the arrangements should ensure that these changes are made in a timely fashion, and if reasonably practicable prior to the next emergency demonstration. The arrangements should also address the routine maintenance of the facilities and equipment. Facilities and equipment must always be in a suitable condition for use – either for test, rehearsal or response to a real event.

LC 11(6)

5.26. The arrangements under this sub-condition interface closely with those produced for other licence conditions (e.g. LC 10, LC 12 & LC 26). The arrangements should ensure that induction and refresher training programmes cover the full range of necessary skills and competencies, takes into consideration learning points generated from rehearsals, and are designed to ensure that emergency personnel are SQEP at all times.

5.27. The arrangements would be expected to include: criteria against which the competence of staff can be judged; appropriate frequencies for refresher training; and processes to keep track of the emergency training received by each individual, and identify the dates by which any refresher training will need to be provided. This will enable the licensee to demonstrate that relevant personnel are currently SQEP for the roles they are identified to perform. The arrangements should also require the production and delivery of suitable training packages to provide staff with the necessary initial competencies, and to provide periodic refresher training (and familiarisation training, when required by the introduction of new equipment or facilities) to maintain the competencies. The arrangements should also ensure that, when any changes are made to the licensee's emergency response arrangements, all relevant staff receive suitable and sufficient instruction and training prior to the implementation of the changes.

5.28. The arrangements should ensure that the requirement for staff to participate in demonstration exercises, rotates such that over a period of time, ONR has the opportunity to inspect the range of emergency teams in operation.

6. GUIDANCE ON INSPECTION OF ARRANGEMENTS AND THEIR IMPLEMENTATION

Arrangements

6.1. When undertaking inspection of the licensee's arrangements it is usual to undertake a broad overview ("broad shallow" inspection) and then sample in more detail selected areas ("deep slice" inspection). Over a series of inspections, all key elements may be inspected by rotating the areas covered by the deep slice inspections.

6.2. As well as the overall documentation structure and content, examples of broad shallow inspection topics include: the integration of nuclear, conventional and environmental response; the commitment of the senior management to the emergency organisation, financial provisions for emergency response, delivery of the licensee's continuous improvement programme; the interface and interaction between on and off-site responses/ responding organisations; and the ability to learn from/ respond to issues arising in the emergency training programme both on- and off-site.

6.3. Examples of deep slice inspection topics include: thorough review of the emergency plan and the overall strategy that has been adopted (assistance from the Emergency Arrangements team would allow a wider perspective to be included); looking at the integration of personnel, procedures and facilities within the emergency response organisation; checking the equipment and facilities provided (including maintenance schedules and records); reviewing the training of individuals and teams, the quality of courses, and the state of the training programme; and the nature and frequency of interactive training with off-site emergency services.

6.4. The above examples are just some of the topics that might be inspected. Examination of previous intervention records may be useful to identify what aspects of the arrangements have been recently examined and what corrective actions were required. The inspection should be aimed at establishing previous corrective actions have been effectively implemented and also looking at aspects that have not been recently examined. Emergency arrangements should be consistent with the licensee's other operational procedures and plans; emergency plans and procedures should be managed within the site's management systems to ensure that interdependencies with other operational practices and procedures are actively managed. The totality of the licensee's emergency arrangements should be reviewed over an appropriate timescale, which should be determined by the Inspector, based on the licensee's performance during demonstration exercises and the results of previous LC 11 inspections. Where an inspector considers that it is appropriate, they may request the advice or assistance of a specialist inspector in Emergency Preparedness and Response (EP&R).

Level 1 Demonstration Emergency Exercises

6.5. The evaluation of the L1 emergency exercise is normally undertaken by a team of ONR inspectors. One of the full site exercises, undertaken as part of the licensee's emergency response training programme, is chosen by ONR as the demonstration exercise. The purpose is to seek assurance that the licensee's emergency arrangements and its emergency response personnel have the capability to deal effectively with emergencies with on-site or off-site consequences. Such demonstration exercises are normally carried out annually on operational sites.

6.6. The scenario – which is usually agreed between ONR and the licensee – is the key to setting the aims and objectives for the exercise. Prior to agreeing the scenario, the site inspector should consider: the previous exercise history both in terms of the types of technical scenario chosen and the learning points arising from the exercises.

6.7. Over time, all technical aspects of the emergency response need to be demonstrated. The licensee's arrangements should include a means to track the technical aspects tested in L1 emergency exercises to ensure this requirement is met.

6.8. The technical scenario needs to be a challenge to the demonstration team and therefore should normally be based on lower probability high hazard events that could possibly occur on site.

6.9. The key requirement is that the scenario ensures that sufficient elements of the emergency response plan are exercised together, so that the ability to demonstrate integrated control and management of multiple multi-element tasks is tested. It should require the demonstration team to think – not just run through a routine set of actions. The defence in depth available on nuclear sites is such that any real emergency is likely to be something unusual – not something that can be dealt with by turning the handle.

6.10. The scenario should also take into consideration the learning points from previous exercises – particularly those points which come up more than once. It should be chosen to demonstrate that the corrective actions taken have solved the problem(s) and have been implemented effectively. References 7.1 – 7.3 provide further information on the selection of appropriate exercise scenarios.

6.11. The licensee team chosen to make the demonstration should be rotated through those available. ONR should be able to evaluate, over time, all those available who could be called upon in a real emergency. Continual demonstration by the perceived strongest team is not acceptable.

6.12. The demonstration exercise is inspected by a team of nuclear inspectors. It is always useful to have someone with Health Physics expertise in the team and, if possible, inspectors who have hands on experience of operation of similar facilities. Ideally it should include inspectors who are familiar with the safety case and expected actions as well as those who have experience of emergency exercise performance across a number of sites and licensees.

6.13. Additional guidance on the inspection of L1 Exercises is given in reference 7.1.

7. FURTHER READING

7.1. T/INS/011 Appendix 1: Introduction To Exercises

7.2. T/INS/011 Appendix 2: Aide Memoire For Inspectors For Level 1 Emergency Exercise Evaluation

7.3. T/INS/011 Annex 1: Detailed Supporting Guidance

8. DEFINITIONS

Approval / approved: Refers to the power exercisable by ONR, under certain nuclear site licence conditions (including LC 11), which prohibits any change to an (approved) document produced by a licensee except with the consent of ONR.

Arrangements: Refers to the totality of the LC11 arrangements and includes the responses of other organisations where these are required to secure the adequacy of the LC11 arrangements.

BA: Breathing Apparatus

COMAH: Control of Major Accident Hazards Regulations 1999.

DEPZ : Detailed Emergency Planning Zone.

DRT: Damage Repair Team

EPCC: Emergency Planning Consultative Committee(s)

HSW Act: The Health and Safety at Work etc. Act 1974 (as amended)

HIRE : Hazard Identification and Risk Evaluation (report).

IRR99 : The Ionising Radiations Regulations 1999.

LA : Local Authority.

Level 1 Demonstration Emergency Exercise: An exercise selected from an operator's emergency arrangements training programme that aims to convince ONR

that the operator's arrangements produce teams that can manage emergencies on the site.

LLC: Local Liaison Committee(s)

LRF: Local Resilience Forum(s)

NI Act: The Nuclear Installations Act 1965 (as amended)

ONR: The Office for Nuclear Regulation.

OPEX: Operating Experience

PPPES: Public, Personnel, Plant, Environment, Security

REPPIR: The Radiation (Emergency Preparedness and Public Information) Regulations 2001 (as amended)

Specification / specify: Refers to the power exercisable by ONR, under certain nuclear site licence conditions (including LC 11), to require the licensee to carry out a specific action.

SQEP: Suitably Qualified and Experienced Person(s)

APPENDIX 1: INTRODUCTION TO EXERCISES

A1.1 Why Inspect a Demonstration Exercise?

A1.1.1 A Level 1 demonstration exercise is a single snapshot of the performance of one of the (usually several) emergency response teams that a licensee has on site. The exercise will deal with a single scenario, possibly in only one of several facilities, on one particular day. It is important to form a view in the context of continued readiness and the ability of the licensee to respond to a real event at any time. An intense training period prior to a demonstration exercise is not the preferred approach.

A1.1.2 To answer the question it is necessary to recognise that the site inspector will, as a matter of routine, be keeping a watching brief on the licensee's annual emergency preparedness training programme. This will generate a programme of internal exercises/ rehearsals/ demonstrations that the licensee undertakes to allow it to assess its overall state of competence and capability. Taking an ONR team – with wide ranging experience – to site enables ONR to subject the demonstration to an in depth inspection; this team can, simultaneously, cover a wide variety of facets of the response and the interactions between them. However, the size of the team does need to be proportionate in respect of the priority attached to the intervention, i.e. informed based upon a prioritised programme.

A1.1.3 The team enables ONR to evaluate the management and integration of the response by being in more than one place at the same time. Thus for any particular exercise an in depth review of some key areas, together with an overview of others, enables the exercise evaluation team to make a judgement on the ability of the licensee's staff to cope with a real emergency.

A1.2 What do you have to do?

A1.2.1 The site inspector ensures that the scenario tests a significant proportion of the emergency response capability; he/ she will also have reviewed the scenario and will require the licensee to demonstrate that learning points identified from previous exercises have been successfully addressed. To avoid last minute changes, it is important to agree the scenario with the licensee well in advance of the date of the demonstration exercise.

A1.2.2 To carry out an adequate assessment of the licensee's arrangements, members of the ONR team should be suitably qualified and experienced. Team members should have completed the Command and Control "Foundation" and "Exercise Evaluation" training courses provided by the Emergency Arrangements team.

A1.2.3 Agreeing the scenario

- The key requirement is that the scenario ensures that sufficient elements of the emergency response plan are exercised together, so that the ability to demonstrate integrated control and management of multiple multi-element tasks is tested.
- The scenario should be rooted in the current safety case for the site/ facility. It should involve an element of loss of radiological control or nuclear safety. The technical scenario can range from REPPIR's reasonably foreseeable event to the more extreme possibilities in the safety case and should involve casualty recovery and contamination and radiation dose control appropriate to the site in question.
- It need not require an off-site radiological release in situations where this is not credible. However to ensure that public protection is actively considered as well as on-site actions, it is possible to have an on-site incident that is coupled to an 'unrelated' off-site release. **Umpiring** can make the **ECC** Director aware he/ she has two 'unrelated' problems to face.
- The scenario should contain the unexpected - making the emergency team think rather than just running through a standard set of responses.

- Before agreeing to the scenario it will be necessary to be aware of the recent history of scenarios set, the lessons to be learned from the last exercise (and any recurrent actions from previous exercises), any areas/ aspects that have not been demonstrated to the regulator for some years, any recent changes to the emergency arrangements, and any ongoing policy issues being followed up by the Emergency Preparedness section.
- When the off-site emergency services are involved, the scenario should provide a sufficient challenge (e.g. casualties for recovery/ a large fire in the controlled area/ an on-site Road Traffic Accident [with trapped personnel] in the plume, contaminated casualties to be taken to hospital, etc.) to ensure they have work to do. This will require the demonstration of an integrated approach from the licensee and emergency services.
- Levels of radiation and contamination should be such that active control is necessary, with sufficient back up information e.g. contamination data to be used if the demonstration of control is inadequate.
- It will add to the realism if the simulated 'repair' can actually be carried out by the damage repair team (DRT). Likewise the use of actors to simulate casualties adds an element of realism. Note that casualties should have 'real' names – not something that is obviously made up (e.g. Andrew N. Other) and not the same names used year after year.
- The scenario should be aimed at being completed in about 3 hours with the licensee making provision for domestic arrangements as appropriate. There should be a clearly expected decision sequence which can be used to judge the actual actions against those expected.
- It is not possible to prevent those involved in the exercise having some prior knowledge of the event. Since exercises develop a life of their own (i.e. the same scenario never plays the same way twice) prior knowledge is more likely to be a hindrance than a help.
- The scenario should be passed out to the inspection team at least 2 weeks in advance to allow it to be studied and any questions raised. However, if the site inspector is to play his/ her expected role in the exercise another inspector (perhaps from a twin site) should organise the scenario and handle the administration.

A1.2.4 At the same time that the scenario is agreed, it is good practice to define the exercise objectives. Inspectors may wish to use the bullet point headings from the Appendix 2 aide mémoire to agree detailed measurement criteria.

A1.2.5 Before going to site the inspection team should be familiar with the scenario. They will need to know what is expected to happen, when it is expected to happen, who the casualties will be and where they will be, who is expected to take which decisions, and what the licensee success criteria are. Quite often it will only be possible to hear one side of any communication e.g. a telephone call so that it will be necessary to deduce what is happening from what can be heard and the actions that result from the call. Knowing the scenario in detail facilitates such deduction.

A1.2.6 Before any exercise it is usual to have a meeting on-site to handle the admin for the day, to clarify any last minute issues, to sort out access to active areas, to distribute identifying tabards, to identify minders, etc. After this meeting it is usual for the ONR team to be taken round the areas of action during the exercise to familiarise themselves with the layout and facilities that are to be used. Having read the scenario, a new inspector should raise any queries with the site inspector prior to departure. However, if there are any remaining uncertainties these can be raised at this meeting with the licensee.

A1.2.7 It is best if a new inspector knows before going to site what parts of the exercise he/ she is expected to cover. If this involves entry to the active area and the inspector is a radiation worker, it is essential that the inspector's radiation pass book is passed to the licensee at the meeting to ensure both inspector and licensee comply with the law.

A1.2.8 At the pre-meeting inspectors should establish if, when, and where they are required to muster, and pick up an observer tabard. If the inspector is unfamiliar with the site and the

licensee offers a ‘minder’ it is recommended that the offer be accepted. These individuals look after the details of routine protection, getting inspectors around on the site, into the areas they want to visit, etc. They can be very useful since they see what the inspector sees and should be made aware of what the inspector thinks, limiting surprises when the site and ONR get together in the ‘hot’ exercise debrief. Usually familiar with the site emergency procedures, they can be useful in allowing an inspector to check whether what is being observed is a valid part of the site’s arrangements or a ‘construct’ of the particular exercise.

A1.3 Observing the Exercise

A1.3.1 To gain an overall picture of what has happened it is necessary for all inspectors to keep a timed log of all key events and decisions at their location(s). It is usually best to note the time that the site alarm sounds at the start of the exercise and time everything relative to this. Putting individual information together enables an overall picture of what the various licensee teams knew (when), what decisions they took (when), what they did (when), what information they exchanged (when), etc.

A1.3.2 If inspectors are not satisfied with the exercise play, any required intervention should be through the umpires/ exercise controllers via the ONR team leader; usually the Superintending Inspector. Inspectors should only intervene directly if they see something that is sufficiently unsafe to require an instant response. In general non-urgent issues identified on site are usually fed back to the site inspector to carry forward.

A1.3.3 Umpires

- Umpires should wear tabards that identify them clearly. They should be competent to provide the information they have to transfer so that they can improvise realistically if questions are raised that the scenario has not considered in detail.
- Umpires should not normally volunteer information e.g. radiation/ contamination readings unless asked for them. NB the licensee’s measurement instrument should be switched on when asking the umpire for exercise radiation/ contamination readings.
- Umpires can point out things that would be obvious in real life but may not be so in the simulation e.g. seeing a large pool of water, the sound of escaping gas/ high pressure steam, the sound and sight of a large fire, hearing of loud noises, etc.
- Umpires should not steer, comment to, or prompt teams undertaking exercise tasks – even if the team are obviously getting it wrong.

A1.3.4 Safety

- On the familiarisation visit to the site before the exercise, inspectors should be looking at what is proposed for the exercise. Nothing introduced should undermine the usual safe practices on site.
- Inspectors looking at team deployment should be familiar with the symptoms of fatigue and heat exhaustion. They should continually review the performance of the teams to identify anyone suffering from it. Individuals believed to be so suffering should be pulled out of the exercise before an accident happens.
- **Breathing Apparatus (BA)** teams tend to be young and fit. Inspectors should consider their own capabilities when following them to ensure they do not overstrain themselves.
- Safety should always supersede any form of exercise play. Exercises should be stopped if unsafe acts happen (or are about to happen) or if a real incident/ injury occurs.

A1.3.5 Exercise Termination

- Exercises should normally be run until the licensee’s exercise objectives (usually stated in the scenario) have been met, and the ONR team is satisfied they have seen enough.

- Exercises should normally be allowed to run until the DRTs have demonstrated their capability and have returned safely to the exit barrier.
- If an exercise has gone awry, e.g. the casualties have not been rescued after several hours, the exercise should be terminated after a given period of time. Bearing in mind the fatigue load on those taking part (and the fact that if a real event occurs as the exercise is finishing and they will have to respond), 4 hours is about the maximum that they should be asked to perform.
- The ONR team should agree beforehand who will decide/ tell the licensee that the exercise is considered finished; this is usually the ONR Team Leader. If a consensus is required, inspectors who are deployed round the site should pick up an ECC phone number and phone in to the ECC observer to give their view on whether it should finish or not. Alternatively, the exercise control team will have radios that can be borrowed to get the message in.

A1.4 Making the Judgement

A1.4.1 When observing the exercise play it should be borne in mind that at the end of the exercise the inspector will be asked to provide a judgement on the standard of those sections which he/ she has observed. Comparison of the detailed measurement criteria from A1.2.4 with what was actually done is one criterion for making a judgment on the success of the demonstration. During the ONR hot debrief the team discusses what has been seen and, sometimes most important, when the different centres became aware of various issues.

A1.4.2 Comparing his/ her event time line with that of other inspectors it is possible to derive a picture of what actually happened overall. Once the picture is clear the inspector will need to make an individual judgement on what they have seen so that an overall team judgment of the whole exercise can be derived. There are various ways in which this overall judgement is derived within the ONR team during its hot debrief. As an example each team member is asked (based on what they have observed) to rank the licensee performance on a scale of 0 – 10 where 5 is not permitted. 0 – 4 represents degrees of unacceptability, 6 – 10 degrees of acceptability.

A1.4.3 To make such a judgement it is necessary to allow for the unreality of the scenario - and the level of role playing that is incorporated to get the scenario to work. A licensee team may have to be told the temperature is increasing, or that they can see a fire or flood – the reality is that their senses would tell them that. It should be remembered that the key consideration is whether you think the licensee's team would cope in a real emergency.

A1.4.4 Once an overall team view is established it is then usual to generate a list of good points that you observed and a list of learning points i.e. those points where you consider that some change is required. It is a good idea to know what you think should be done as this will assist the site inspector when he comes to check how they have responded to your learning point. It will be necessary to provide evidence to support any criticisms. They will be discussed with the licensee team at the joint debrief which follows the ONR hot debrief. This is when detailed notes come in useful – unless the fault has already been noted by the licensee or is so self evident that it could not be overlooked e.g. it took 2 hours to rescue the first casualty.

A1.4.5 Following the ONR hot debrief, a joint ONR/ licensee meeting takes place; other participating stakeholder organizations also attend. The debrief follows a structured protocol with a single spokesperson delivering the feedback. The licensee first reports back from its own hot debrief and then the ONR comments are fed back to the licensee, including the team's judgement on the adequacy of the demonstration.

A1.4.6 Most licensees are self-critical. They will also have a more complete picture of what occurred since they know what they were thinking (and why) at particular times. It is no

disgrace in the joint debrief to listen to the licensee's explanation of a problem, which you have identified, and to decide that you will give them the benefit of the doubt and withdraw your criticism. Indeed, it is to your advantage if you accept their explanation since in areas where you do not they will be more inclined to listen to your point of view.

A1.4.7 When making the judgement not only what has been achieved but how it has been achieved will be considered. However, if a good overall performance has been achieved by methods which do not correspond to the generality of good performance – say a very personal command and control style is used – this should not require an aspect to be repeated. It is the ability to cope, (safely in a well-controlled managed way), that in reality matters – not the method by which individuals choose to cope.

A1.5 If the judgement is adverse

A1.5.1 In making the judgement on specific exercises the key question is whether the regulatory team considers the licensee team would cope with a real emergency. The result of the exercise will be either a satisfactory demonstration of the arrangements or that a further rehearsal is required. If the demonstration was unsatisfactory, a decision is required on whether the extent of problems revealed will necessitate a partial or a full repeat exercise (once the problems have been addressed by the licensee).

A1.5.2 This decision should be based on the performance as demonstrated on the day. For example if the problem is assessed as being associated with general communication on site, improved communication is only likely to be demonstrated by running all the on-site facilities. On the other hand, if the problem is communication between the off-site survey vehicles and the site, then this could be demonstrated by a repeat of that part of the exercise.

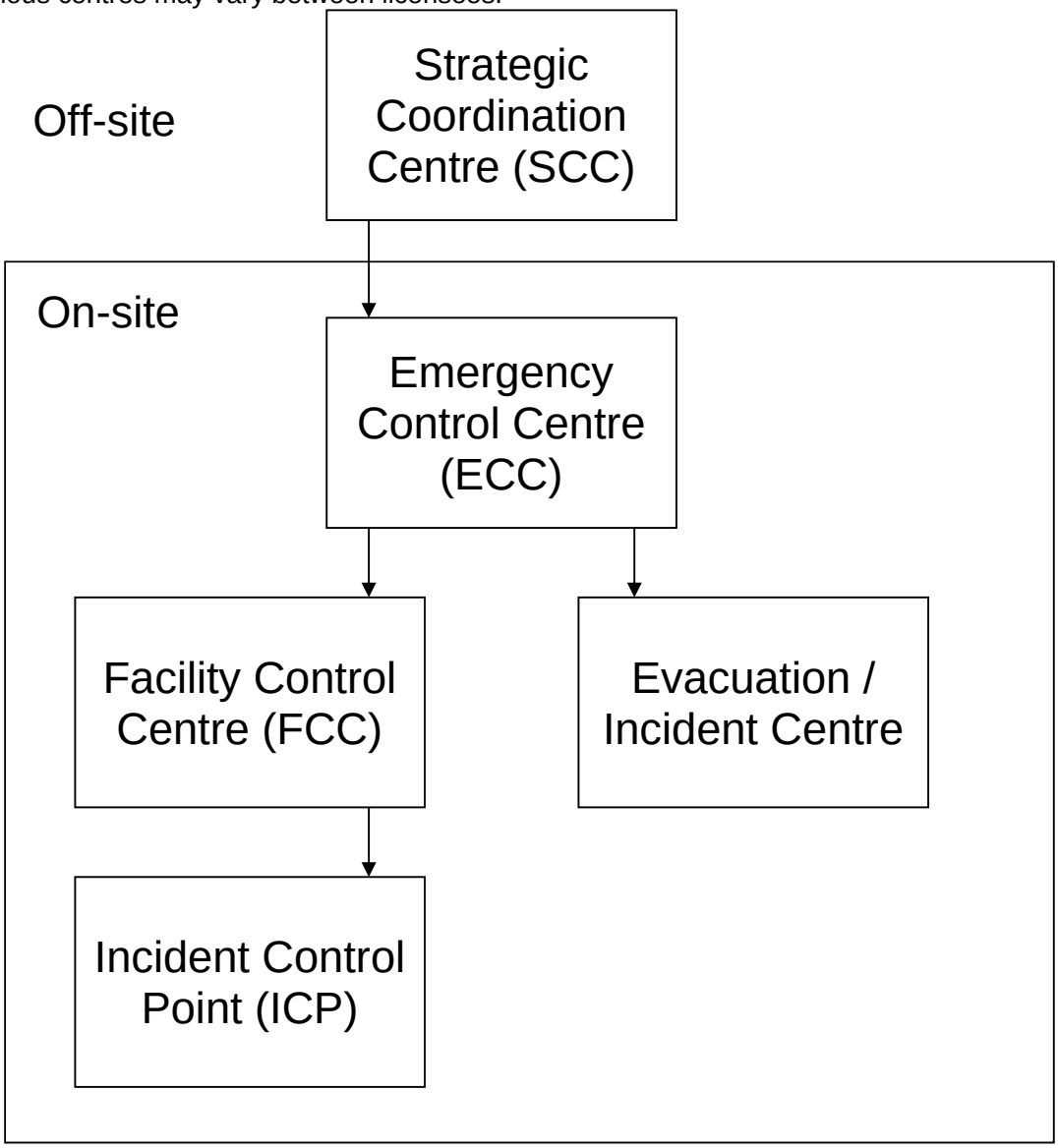
A1.5.3 If a repeat is judged necessary, the question of continued operation of the site arises while the shortfalls are addressed. The decision will be dependent on the number and significance of the shortfalls on the particular day, and a judgement on whether they represent fundamental weaknesses in the licensee's arrangements, or are associated with the particular licensee's team getting it wrong. This judgement will draw on the work that the site inspector has undertaken as part of his/ her routine inspection of emergency arrangements and their implementation on the site.

A1.5.4 It should be borne in mind that, if the licensee does not provide a satisfactory demonstration of the arrangements this does not usually require a site or facility to be shut down (or be brought to a safe state) while the emergency response capability is recovered.

APPENDIX 2: AIDE MEMOIRE FOR INSPECTORS FOR LEVEL 1 EMERGENCY EXERCISE EVALUATION

A2.1 Emergency Arrangements - Control Centres

A2.1.1 The following figure and paragraphs describe the typical command and control centre arrangements for a site. The exact arrangements including names and locations of the various centres may vary between licensees.



A2.1.2 The site Emergency Control Centre (ECC) is usually located on the affected site and is where the site emergency controller manages the overall Licensee's activities to minimise off-site releases and restore the site to a safe condition. For the reactor sites a further centre, (Central Emergency Support Centre (CESC)), is set up to provide technical support to the ECC and manage the off-site interface and monitoring aspects.

A2.1.3 The Strategic Co-ordination Centre (SCC) is sited sufficiently far from the affected site not to be directly affected by the site emergency. Its purpose is to decide upon the actions to be taken off-site to protect the public, to ensure that those actions are implemented effectively and to ensure that authoritative advice is passed to the public.

A2.1.4 The Facility Control Centre (FCC) is located in the facility affected by the emergency. Its purpose is to provide management control over activities to recover casualties, make an initial assessment of the impact of the incident and plan and initiate tactical measures to return the plant to a safe state.

A2.1.5 On sites where potential incidents may require a facility to be evacuated, the activities of the FCC may be carried out at a remote Evacuation / Incident Centre. This centre also serves as a muster point to identify missing persons, perform an initial assessment of the radiological exposure of facility workers and to manage the interim health and welfare requirement of evacuees.

A2.1.6 The Incident Control Point (ICP), also called Access or Forward, provides the front line control at the incident scene. The key objectives managed from the ICP are to search for and recover casualties, assess plant damage and to terminate the incident and effect damage repair.

A2.2 Emergency Arrangements Control Structure

This section is intended as aide mémoire guidance for inspectors identifying the significant attributes for each emergency response activity with some general key words as indicators of what to look for. New inspectors may also wish to refer to the supporting guidance that provides further clarification and detailed information on each control centre or process activity.

List of Sections

Control Centres / Points

- A2.2.1. Emergency Control Centre (ECC)
- A2.2.2. Facility Control Centre / Room (FCC)
- A2.2.3. Evacuation / Muster Centre
- A2.2.4. Incident Control Point (ICP)

Process Activities

- A2.2.5. Command and Control
- A2.2.6. Teams
- A2.2.7. Breathing Apparatus Control
- A2.2.8. Dose Control
- A2.2.9. Contamination Control
- A2.2.10. On- and Off-Site Survey Control

Non Reactor sites

- A2.2.11. Plant with Chemical / Dispersible Radioactive Source Terms

A2.2.1 Emergency Control Centre

Attributes	Indicators
Management	• Centre managed using Command and Control principles A2.2.5
Strategic Thinking	• Big picture, realistic/ worse case scenarios • Actions based on realistic/ resources in place for worst case • Forward thinking, timely decisions based on best available information • Strategic action tracking/ response to actions not being met • Public/ personnel/ plant/ environment/ security
Public/ Personnel Protection	• Early/ continuing conservative off-site countermeasure advice • Muster points/ plume position • Keeping staff informed • Moving non-essential personnel out of danger/ off-site • Decision making on individual dose commitment • Tenability (refer to annex 1)
Muster co-ordination	• Site closed up • Casualty/ missing person identification (golden hour) • Early incident area/ site wide reconciliation • Release of individuals to support emergency response
Communication	• Sharing focus/ status information, (refer to annex 1 - Information management, action management & record keeping and FCC Interface with ICP/ECC) • Emergency services (refer to annex 1 - Emergency Services Liaison) • Information to SCC/ clarity of control handover • Requests to/ from other external centres, e.g. CESC • Refer to annex 1 - On and off-site communication

A2.2.2 Facility Control Centre / Room

Attributes	Indicators
Management	• Centre managed using Command and Control principles A2.2.5
Strategic/ tactical thinking	• Early stages (until ECC operational) strategic thinking/ issues as ECC • Once ECC has taken over, forward thinking about tactical overview/ guidance/ assistance to ICP on incident assessment, casualty recovery, incident control and termination • Generation/ evaluation of practical aspects of repair proposals
Declaration	• Evaluation of all available information, e.g. plant status/ symptoms, CCTV, maintenance jobs, fence post monitors • Realistic/ possible worst case assessment • Early conservative decision based on best available information, (refer to annex 1 – Declaration)

Public/ Personnel Protection	• Early ECC stand-in role • Alarm/ tannoy/ site close up & muster (refer to annex 1 - Roll call) • Tannoy incident outline/ safe muster routes • Early conservative countermeasure advice to Police (refer to annex 1 – Off- and On-site countermeasure advice) • Tenability (refer to annex 1)
Plant Control	• Evaluation of incident/ prognosis based on realistic/ worst case assumptions • Steps to alleviate incident impact/ terminate incident • Short and long term stable end point position • 'Beyond Design Basis' instructions/ operations • Refer to supporting guidance - Plant Control
Interfaces/ communications	• Handover to ECC • Sharing focus/ status with ECC/ ACP (refer to annex 1 – On- and off-site communication and FCC Interface with ICP/ ECC) • Use of on-site resources e.g. damage repair

A2.2.3 Evacuation Centre / Muster Point (refer to annex 1)

Attributes	Indicators
Management	• Centre / Point managed using Command and Control principles A2.2.5
Roll Call	• Co-ordinated central system identifying those involved • Seriously injured need to be identified and recovered within the 'golden hour' • Any system – be it paper or electronic – is acceptable if it can deliver in the timescale • Seriously injured casualties only 'accounted for' when they receive medical treatment

Muster points	• Venue large enough to handle those mustering/ having sufficient respirators to allow evacuation through plume
	• Single individual in control
	• Application of automatic countermeasures
	  - KIO3 simulated realistically – water available
	  - Doors/ windows shut; ventilation off (unless plenum appropriately filtered)
	• Contamination Control A.2.2.9
	• Radiation/ contamination monitoring instrumentation being used
	• Audible tannoy / Effective communication
	• Release of individuals to support emergency response

Plant muster	• Rapid screening system for and segregation of contaminated individuals • Decontamination facilities, e.g. shower

point	• EPD/ dose checking • Routine monitoring/ air samples for contamination spread with fixing or removal • Debriefing of those involved & feed forward of information • Release of individuals to support emergency response
Criticality Issues	• Checking for symptoms of high radiation dose • Immediate dose assessment • Those suspected of having high dose to medical facilities • Debrief of those 'close' to the event & feed forward of information • Release of individuals to support emergency response

A2.2.4 Incident Control Point, (also termed Access or Forward Control Point)

Attributes	Indicators
Management	• Control point managed using Command and Control principles A2.2.5
Tactical thinking	• Incident assessment/ Casualty recovery/ incident alleviation & termination • What has to be done, in what order, how, requiring what resources/ equipment/ material • Continuous assessment of risks, consideration of existing and forward resource requirements • Contamination Control A.2.2.9 • Changes of direction based on what has been achieved, what needs to be achieved, and what can be achieved
Team Control	• Clear objectives set – for re-entry team and for teams deployed, (refer to annex 1 - Entry Team co-ordination and control) • Series/ parallel working as situation allows • Coordination/ co-operation with emergency services • Plans/ objectives changed/ updated as teams gather information/ achieve objectives • Tenability (refer to annex 1) • Entry Team Communications (refer to annex 1)
Emergency services liaison/ co-operation/ coordination	• Sharing of information • Agreed command structure in ICP and for individual teams • Recognition of possible areas of contribution and specialist skills • Effective use of specialist skilled resources
Information Handling	• Single radio contact point in quiet area • Flow of info from deployed/ debriefing teams to boards and controller • Use of all information sources, e.g. fixed cameras, installed monitoring equipment, etc. • Interaction with other centres, e.g. sharing of focus points/ action outcomes • Record keeping

A2.2.5 Command and Control (refer to annex 1)

Attributes	Indicators
Leadership	• Direction (short and long term)/ focus • Priorities (short and long term/ regular review) for public, Personnel, plant, environment and security • Calm operating environment • Team roles defined
Decision making/ action tracking	• Forward thinking/ resourcing for worst case/ acting on most likely • Anticipating events • Using available information / not waiting too long to decide • Monitoring action completion/ responding to answers
Information Handling	• Briefing team/ emergency services • Use of boards • Co-ordination with other centres • Record keeping

A2.2.6 Teams (refer to annex 1 - Teams)

Attributes	Indicators
Composition	• Initial teams' site personnel switching to mixed/ emergency services when position on access and egress known • Initial teams to include HP carrying/ using instruments • Initial team to include first aiders for casualty handling
PPE/ RPE	• Full change/ impervious suit with gloves/ boots/ suit hoods taped • Initially BA until hazard understood • Electronic Personal Dosemeters (EPDs) carried with rate and accumulated dose. • Dose reference levels / EPD alarms set based on entry task
Briefing	• Before entry on task, known and potential hazards, safe routes/ fall back areas, communications requirements, dose constraints/ action levels, expected actions if casualties encountered/ team has problems/ unexpected conditions encountered plus any specialist requirements, e.g. position of fire risers/ stretchers, etc.
Back up Rescue Team	• During any entry a BA back up rescue team should always be available for instant deployment
Task Definition	• Tasks thought through to minimise team dose • Complex tasks rehearsed before entry • Equipment tried and tested before entry

A2.2.7 Breathing Apparatus Control (refer to annex 1 - BA Control)

Attributes	Indicators
Tally board	• Single tally board – or two teams (fire/ licensee) situated close together - with a single individual staffing the board(s) at all times • Tallies and BA pressures entered and removed as team members enter and exit • Controller should know who is in/ out at all times

A2.2.8 Dose Control (refer to annex 1 - Dose Control)

Attributes	Indicators
ALARP	• While IRR dose limits are disapplied (provided a Radiation Emergency declared) during emergency, ALARP still has to be applied • Tasks involving dose commitment should be planned to minimise dose • Continuous risk assessment should be undertaken (could be done in the head of the ICP controller / other ICP specialists)
Systems	• For monitoring and recording individuals' doses received during entries for comparison with previously agreed emergency dose limits and controlling dose commitment to individual team members • To go to higher authority, e.g. Emergency Controller in the ECC for authorisation of doses in excess of delegated limits

A2.2.9 Contamination Control (refer to annex 1 - Contamination Control)

Attributes	Indicators
Fixed and Mobile Facilities	• Segregation of incident access and egress • Air Flow: Clean to Dirty, (physical segregation is preferable) • Double barriers on exit with decontaminable surfaces/ floor • Routine area monitoring & decontamination/ air samplers running and checked
Dressing	• Appropriate PPE, Full change/ impervious outer suit with gloves/ boots taped • BA set/ respirator with suit hood taped over mask • Team members self checking/ checking each other for PPE seal/ BA pressure
Undressing	• By PPE protected assistants • Prioritised based on remaining air • Contam fixed/ removed (vac)/ damped down before monitoring/ undressing. (Watch for monitor probes touching clothing/ becoming contaminated, (appropriate unless alpha)) • Undressing into contaminated clothing containment bag

Housekeeping	• Top down/ glove changing before fitting clean respirator • Over first barrier in full change/ respirator/ overshoes for full monitor • Respiratory protection maintained until monitored clear • Contaminated clothing contained in sealed bags routinely monitored/ removed from operating area • Routine monitoring of floors/ barriers/ contamination found fixed or removed • Alarm air samplers running • Undressers on dirty side wearing PPE
Casualty Handling	• Casualty brought to first exit barrier monitored • Seriously hurt casualties fast tracked by wrapping in clean plastic (bagged) before passing over barrier without further decontamination (watch glove changing/ contamination of outside of 'bag') • Walking wounded decontaminated before being passed to Medical • Refer to annex 1 - Casualty Handling/ Medical Aspects

A2.2.10 On- & Off-site Survey Control (Refer to annex 1 – On- and Off-Site Surveys)

Attributes	Indicators
Strategy/ Control	• Early confirmation of on- and off-site position • Locate plume edges/ monitor changes of plume position • Minimise team's in-plume time
Deployment	• Vehicle integrity/ personnel PPE/ RPE • Vehicle roadworthiness checks • Instrument checks (function & calibration) • Communications checks & initial briefing • Deployment time/ time to first result
HP Advice	• Predictive modelling – interpolation & decisions on next measured position • Predictive/ measured data melded into clear on- & off-site advice • Clarity of presentation/ interface with FCC/ ECC/ SCC as structure develops

A2.2.11 Plant with Chemical / Dispersible Radioactive Source Terms (refer to annex 1)

Attributes	Indicators
Spills	• Source term • Spread - Wind direction/ ventilation flows • Approach to incident • Barriers, isolation from drains/ inactive areas

Criticality	• Recovery – potential criticality/ containers • Priorities when combined with other aspects of the incident • Local/ building inventory/ amount involved • Liquid systems chugging/ re-criticality on recovery • Ventilation contamination spread/ filter high radiation • Human moderator in fissile stores • Fire fighting limitations in, say, fissile stores
Access	• Air sampler alarms • Contamination monitoring of access/ egress routes • Restricted Area entry prohibition • Damaged windows/ high radiation fields
Monitoring	• Detection of unaged Pu • Instrument contamination • Detection of alpha in wet conditions
Multi-plant Sites	• Remote location mobile facilities • Site wide emergency response checking/ release of those not involved • Interlinkage of building ventilation
Security	• Prioritisation of security aspects • Interface of security and safety emergency arrangements • Protection of security staff from activity • On-site personnel movement for security reasons • Specialised search teams

ANNEX 1: DETAILED SUPPORTING GUIDANCE

EMERGENCY ARRANGEMENTS - CONTROL CENTRES AND ACTIVITIES

Contents

1 Introduction

1.1 The sections below provide detailed guidance on the issues that will require the attention of an inspector allocated to the identified centre or activity during a Level 1 demonstration emergency exercise. The sections should be read in conjunction with Appendix 2 of this document. They are based on a reactor structure; plants with dispersible radioactive source terms have similar centres, and additional points are dealt with under the Plant with Dispersible Radioactive Source Terms section. They are aimed at inspectors with only limited experience in judging emergency exercises; as such they are not intended to be fully comprehensive but to give a sound basis on which to base initial judgements. As experience is gained the inspector will develop his/her own list of points to be considered, hopefully adding to the issues identified here.

1.2 The sections are too detailed and extensive to be taken into exercise locations. They are intended to be read through in the office once an inspector knows which areas he/she will be inspecting. Appendix 2 of this document provides a simple aide memoire if required.

2 Supporting Guidance

2.1 Command and Control

- Controller to stand back and take strategic view – not involved in running of centre / incident point. He/she should provide calm, clear leadership of the team.
- Controller considers most likely and worst case outcomes – thinking ahead and basing actions on most likely outcome but putting (additional) resources in place for the worst case.
- Controller briefs the team regularly summarising the present position and providing the focus points (on a board visible to the whole team) for the next phase of the event. Everything should stop for the 90 secs (or so) that the briefing should take.
- Decision making is clear, timely, and based on best information; decisions and associated actions are transmitted clearly to the team. Decisions should be on strategic issues.
- Key objectives will be to protect the public; recover casualties/ protect on-site personnel; bring the incident back under control/ stop or mitigate any release (sometimes put public/ people/ plant/ environment/security); and provide information to (and liaise with) off-site centres.
- Controller to monitor the achievement of the strategic actions and intervene if they go off track.
- The Controller should be thinking ahead and monitoring the progress/ completion of his/ her strategy for handling the incident. He/ she should be monitoring the completion of actions placed – both within the room and on subordinate control centres – and intervening if they are not being achieved.

2.2 Off and On-site countermeasure advice

- The Police will require written public protection advice as early as possible. This is likely to have been provided by the FCC on declaration but should be reviewed by the ECC when it takes over.
- Wind direction and strength (usually available in the FCC) should be used to make an initial assessment of any muster points that could be in the plume. Steps should then be put in hand to have those individuals moved to safer areas.
- The first advice will be based on an initial assessment of the event (possibly based on fence post monitors or on-site survey results). It will need to be reviewed and possibly amended once off-site survey information becomes available. Erring on the side of caution is preferable. If not already required, the review should include the requirement to apply automatic counter measures, e.g. KIO3 tablets for both on and off-site personnel and emergency services (reactor site).
- Routine reconsideration of off-site advice is required until the off-site centre is operational and takes the role. Hand over to off-site should be clear cut.
- Evacuation of on-site muster stations within the plume should be considered.
- Evacuation of non-essential personnel from site should be considered.

2.3 Roll call/ on-site personnel management and information

- The site should be closed up; access and egress should be controlled.
- Reconciliation of roll call and identification of missing personnel should be completed in time to allow the search and rescue teams to retrieve injured parties within the ‘golden hour’.
- Consideration should be given to movement of staff with emergency handling skills e.g. first aiders, additional entry team members, Health Physics (HP) support, movement of materials (e.g. recharged BA bottles), etc. as well as access/ egress for shift change over.
- Safe routes should be established for essential personnel movement.

- Staff at muster stations should be told the ECC has taken over from the Facility Control Centre (FCC) and subsequently kept informed of the situation by regular appropriate communications, e.g. tannoy announcements – and should be reminded to keep doors and windows shut, ventilation systems turned off, etc.

2.4 Emergency Services Liaison

2.4.1 Interface with the ECC

- Team leaders/ liaison officers from Fire Services, Ambulance, Police will attend the ECC and require initial/ routine briefs about the current position, the likely hazards, safe routes, what they are being asked to do, etc.
- Emergency services should input information that comes directly to them through their radio links with their teams and the off-site centre.
- ECC Controller should be kept informed of emergency services resource position and should factor it into his/ her forward thinking.

2.4.2 Reception

- The emergency services should be met by a member of the licensee's staff whose specific role is facilitating their entry to site.
- There should be people available who can escort the emergency services and/ or their leaders to the required places on site.
- Vehicles should be routed to a holding area to ensure the gate remains clear; this may be in an intermediate position (out of the plume) or close to the ICP. Both the gate and the roads inside/ outside the site should be considered when avoiding congestion.
- The senior team leader will be routed to the FCC/ ECC (depending how quickly they arrive) for briefing; the operating leaders will go with their teams to the holding area and thence to the ICP.

2.4.3 Safe Routes

- Emergency Services should not be allowed to enter site until they have a safe route – out of the plume – to their holding/ assembly area.
- This will apply to the team leaders seeking to reach the FCC/ ECC or the ICP, and the vehicles moving to their holding/ assembly area.
- Depending on the time taken for the services to arrive the safe routes should be provided by the FCC or the ECC.
- If the emergency services are unfamiliar with the site (NB some teams may contain site staff as retained firemen) vehicles and team leaders should be escorted by site staff to ensure they follow the route provided and park in the right place.
- Once the vehicles are parked the escorts can then take the operating team leaders to the appropriate ICP.

2.4.4 PPE

- The emergency team members should be issued with a standard pack of dosimetry – usually a dosemeter, KIO3 tablets (Reactor sites), and (for the Fire Brigade at least) Electronic Personal Dosemeters (EPDs) to be used during their entries.
- While initially moving into position on the site the teams will not be wearing their PPE - although their vehicles will give them some protection. They should not be routed through the plume.
- Any vehicle leaving the site should be monitored – although ambulances leaving with severely injured casualties are likely to be waved through.

2.4.5 Communications

- It should be remembered that the radio frequencies used by the ambulance, the fire service and the site will all be different so that messages/ instructions that come in to the gate house e.g. from the FCC/ ECC may have to be hand carried if the teams have already left for their assembly point.

2.5 On and off-site communication

- The ECC should be in routine communication with the FCC, ICP, the on-site and off-site survey vehicles, the SCC, and the off-site technical support centre.
- Strategic focus points (and even copies of status boards) should be faxed to the FCC & ICP and their tactical focus points/ status boards should be returned to the ECC.
- Tactical issues should be dealt with by the subordinate centres; strategic issues should be passed to the ECC for resolution.
- Of key importance is the transmission of public protection advice (i.e. counter measures) to the Police and until the SCC is able to take over.
- Requests for resources/ information/ technical questions beyond the capability of those on-site should be passed to the licensee senior management (technical centre where available) through the ECC.

2.6 Information management, action management & record keeping

- Boards should be updated regularly. They should be segregated e.g. incident info, casualties, action tracking, etc. It should be possible to follow the event from the board information. Key information should be timed.
- The action board is of key importance – this should be run by the deputy controller.
- Actions should have both an initiation and completion time. Actions should not go over the completion time – although this can be updated.
- A record should be kept of the boards as the event progresses (before they are overwritten) to assist with any later inquiry.
- Records should be kept of communications to and from the SCC/ECC/ICP to allow for later analysis.

2.7 Tenability

Unless designed to withstand a worst case event, the centre should be monitored initially and then regularly thereafter for radiation/ air activity levels, gas concentration (gas reactor), etc. If the centre is not tenable the backup centre should be used.

2.8 Declaration

- The first task is to recognise the emergency and its severity - and whether it is likely to cause (or could escalate to cause) an off-site release.
- These decisions will be based on the symptoms coming from plant indications, the physical environment (as seen on CCTV) and, if available, indications from site monitoring systems. In addition, maintenance work ongoing/ just started should be checked as a possible cause of the incident.
- The possible diagnosis of the incident should consider the most likely and the worst possible causes for input into the declaration decision.
- The declaration should be made on the best available information and should be timely – not waiting for more and more information.
- Once the declaration decision is made, the site alarms should be sounded and the required instructions communicated, e.g. tannoy announcements. This should cover what is thought to have happened (in outline), what people are required to do (e.g. go to muster

station, close all doors and windows/ shut down ventilation, take KIO3 tablets, etc.), affected areas, etc. Information on safe routes for people to reach their emergency / muster stations should be provided.
- Initial steps in the off-site notification chain should then be carried out. This can include automatic electronic notification systems reaching the general public.

2.9 Plant Control

- The Facility Control Centre staff should seek to understand the extent of the incident, its likely causes and its implications.
- If possible, steps should be taken to mitigate the event – e.g. for a gas reactor blowing down through an iodine bed to reduce the pressure as quickly as possible and thus limit the release.
- Use should be made of instructions aimed at handling beyond design basis events, e.g. situation based emergency response guidelines (SBERGs) on reactor sites.
- Manual operation of plant could be required – the relevant instructions/ operator familiarity should be apparent.
- The FCC needs to get the plant to a safe, stable state. This can be an intermediate state e.g. making use of the Xe peak in reactors or provision of containment in process plants, but longer term thinking is required to make sure the plant goes into a safe state and stays there.

2.10 FCC Interface with ICP/ ECC

- The FCC needs to brief the ICP on the diagnosis of the event and what the initial entry team(s) should aim to achieve.
- The FCC should brief the ECC Controller before he takes over on the incident information available so far and the actions taken – on the plant, to protect the on-site personnel and to protect the public off-site. Any interactions with the emergency services should be included.
- There should be a regular exchange of status and focus point information between the FCC, the ICP and the ECC to ensure the whole emergency team remains in step and attacks the strategic objectives being set by the ECC.

2.11 Entry Team co-ordination and control

- In the first phase the first incident review team (IRT) should be put into the incident area as soon as possible to assess the situation on the ground. Before any team goes into the incident area there should always be a back-up team of at least two people dressed, wearing appropriate RPE /PPE (BA if the incident requires) i.e. ready to go at a moment's notice to support the entry team if they get into trouble/ require assistance.
- Each team will require a clear brief before entry. Information from facility monitoring stations / CCTV cameras should be used to inform the briefing, (See Briefing 2.15.4).
- Once the IRT team has reported in or has returned and been debriefed, the second phase begins. Decisions will be made by the ICP controller on the next set of objectives that the teams have to achieve – e.g. search and rescue, further assessment of areas not seen by the initial team, casualty recovery, assessment of specific environmental conditions in specific areas, damage repair preparations, etc.
- Decisions on priorities and on whether to run teams in series or parallel will need to be made - parallel teams usually reduce the time to locate injured casualties (but can load up the decontamination area as the teams leave the incident area). The objectives and how they are to be achieved should be briefed to the ICP team.
- Information brought back by the teams should be entered on the boards and key issues fed to the FCC and the ECC. This will enable progress to be monitored, priorities reassessed, and thought to be given to what is required to mitigate/ terminate the incident.

Instructions – usually from the FCC - are then given to initiate work to be undertaken by the Damage Repair Team (DRT)..

- The ICP controller or deputy will need to have a clear picture of what has been searched and what remains to be done – recorded on one of the boards. This board should be used by the controller to amend his tactics for finding the missing persons. Missing persons should be accounted for once they have been recovered to the ICP. Key achievements should be briefed to the ICP and fed to the FCC and ECC.
- On return from an entry the doses that each team member has incurred should be recovered from the EPDs and recorded. This information should be checked before team members are allowed to enter for a second or subsequent time.

2.12 Breathing Apparatus (BA) Control

- Before entry into the incident area, all team members (TMs) must supply their BA tag or tally to the BA board controller. One individual should be in charge of the BA board full time.
- The BA board controller should put on the board the TMs name, tag number and the time of entry.
- In general all TMs wearing BA should be under one BA control system. However, sometimes Fire Brigades (FB) insist on using their own system and two boards are run in parallel – one by the licensee and one by the FB.
- Before entry the dressing of TMs should be checked – usually by other TMs. BA set pressures should also be checked to establish bottles are full.
- On exit the names/ TAG numbers must be removed from the board(s).

2.13 Contamination Control

- All entry TMs should have PPE and RPE appropriate to the incident. This usually involves a top layer of oversuit / hoods (or chemical suits for FB) over a full change, gloves/ boots, and respirators or BA sets depending on the hazards. Some site FBs use their usual fire protection clothing plus BA –plastic oversuits not being appropriate for fires.
- The entry and exit areas/ routes to/ from the incident should be well separated to avoid cross contamination.
- The exit area should have double barriers separated by an area for monitoring/ further decontamination, if possible with decontamination zones physically separated and air flow from the clean to dirty side of the barrier. In order to simplify decontamination, the floor of the space between barriers should be covered with a removable or decontaminable surface.
- On return TMs should be prioritised according to the amount of air they have left. TMs should not undress themselves; they should be undressed by disrobers.
- Disrobers on the dirty side of the barriers should likewise be wearing full change/ oversuits/ hoods and respirators. They should change their gloves when they start disrobing another TM and before they handle clean equipment e.g. before fitting of a clean respirator during BA change-over.
- Before undressing contamination can be fixed (taped, glycerol spray), damped down (by shower) or removed (by vacuuming) to reduce the spread/ keep it out of the air.
- The TM should be undressed on the dirty side of the first barrier - often standing in/ on a large plastic bag that will contain the contaminated clothing once undressing is finished. Starting with the head and thorax the hood and upper clothes are removed, if worn the BA set face piece is taken off and a clean respirator fitted. It is essential that clean gloves are worn when handling the clean respirator to avoid cross contamination. The team member is then undressed to remove the PPE, puts on a pair of overshoes as the boots are removed, and passes over the first barrier to be monitored. Respiratory protection should be maintained until monitored clear. If clean the TM can pass over the second barrier on to the clean side to be debriefed. Some sites break the supply from the BA bottle and

provide a fixed clean air supply. The connections of these hoses need to be kept scrupulously clean since any contamination on them may result in a contamination intake.
- While being monitored the probe should not touch the potentially contaminated surface – this can contaminate the probe foil and make it useless for further work – but it is sometimes appropriate for final clearance monitoring for alpha nuclides.
- Dirty clothing/ contaminated equipment should be routinely bagged, monitored and shifted to a clean area store to keep the exit area clear of clutter.
- A severely injured casualty will need to be fast tracked through the ICP. Once they have been monitored they should be 'bagged' (wrapped in a clean plastic sheet; clean gloves are needed when handling the outside of the bag) and passed over the barriers as a 'clean bundle' for onward transmission to the Medical centre/ Occupational Health centre/ First Aid area.
- The areas on the top of the barriers, between barriers, and on the clean side should be routinely monitored and any contamination spots found cleaned up or fixed to prevent spread or reduce material in the air.
- Alarming air samplers should be run to check activity in air.

2.14 Dose Control

- Although IRRs are disapplied, if a REPPIR Radiation Emergency is declared, it is still necessary to keep doses to all individuals ALARP.
- All team members should be equipped with EPDs with the alarms set to appropriate levels. They should not be set on 'standard' limits e.g. 20 mSv if teams are going into low dose rate areas.
- Consideration must be given to setting team tasks with a view to minimising the dose commitment to TMs e.g. setting up the approach to fire fighting to minimise fire team dose or moving deployed teams to low dose areas while decisions are made on task variations.
- There must be a system for recording the dose that each TM receives during an entry. The entry dose/ dose rate must not exceed some predetermined limit (usually set in the EPD) and the accumulated dose should be kept within the limit specified in the Emergency Plan (which will have been agreed with ONR).
- The ICP controller will usually have discretion to allow doses up to some pre-agreed limit, with the ECC Controller approving doses up to the emergency limit.
- Checking of the prior dose commitment must be done before TMs are allowed to go on a second or subsequent entry.
- Dose control for Fire Team members must be integrated into the facility system for recording doses.

2.15 Entry Teams

2.15.1 Communications

- Communications to teams should be tested before entry.
- In the ICP it is preferable that the communication to teams is handled by a single individual preferably in a quiet area. Key information being fed back should be fed into the rest of the ICP team via the boards.
- Communication frequency should be agreed before team goes in. If the teams hit any radio dead spot(s) this should be noted and fed back at the debrief.

2.15.2 Team composition

- All team members (TMs) should be trained for their likely roles prior to the emergency. They should have given their consent to being part of the teams. Entry teams should never be less than two people; a minimum of 3 is preferred for the initial entry teams.

- Initial entry teams – e.g incident assessment, search and rescue – should include facility personnel who are familiar with the layout and potential hazards. They should show respect to those hazards, e.g. not walking into hot gas clouds, very high radiation areas, contamination areas, etc.
- Initial teams should include HP personnel who have the necessary radiation, contamination and (reactor sites) gas monitoring instrumentation.
- Once conditions have stabilised and are known, teams can be led by experienced facility personnel or well briefed fire personnel. However, note that if there is a fire to be fought, some FB teams will not accept the inclusion of facility personnel (but can accept site fire team members).
- Initial teams should contain personnel who are competent to give first aid to stabilise any casualties they encounter. They should also have been trained in casualty handling by whatever means (e.g. stretcher, portable chair) is used for recovering casualties on the facility.
- Teams should have members who are competent to undertake the task they have been allocated.
- For integrated teams of the FB and facility staff the lead/ follow position should be clearly understood.

2.15.3 PPE/ RPE/ Dosimetry

- Initial entry teams should operate in full change and a (preferably impervious) protective top layer – which can be a plastic suit/ hood, normal (onsite) FB uniform, or (offsite FB) chemical suit. Gloves/ gauntlets and suitable footwear (e.g. boots) should be worn and taped to the outer layer to prevent/ reduce the possibility of contamination ingress. [Note that nothing keeps out tritium!]
- Initial teams should go in wearing BA sets until the extent of the hazard has been established and the incident is stabilised. It may be possible to switch to respirators at that point.
- All TMs should carry EPDs with the alarms set (by HP in the ICP) for both dose rate and accumulated dose for the entry.
- Before entry TMs should check each other to establish that they are correctly dressed (e.g. hoods attached properly/ over BA face masks, etc.) and that they have adequate air pressure in the bottles.

2.15.4 Briefing

- As the incident response progresses more will be known about what has happened and what the conditions are that the team will face. Briefing will therefore need to change to match the knowns and unknowns.
- Initial assessment teams will need to know what is believed to have happened, what the team is required to do (and how they will know they have done it), known and likely/ possible hazards, dose limitations (both rate and accumulated), action to take if EPDs go into alarm, action to take if they encounter adverse conditions (e.g. hot gas), action to take if the team has a problem (e.g. a team member is injured), routes in and out/ areas believed to be safe in the event of a problem, communication frequency, action to take if casualties are encountered, etc.
- For search and rescue they will also need to know which areas have already been searched, how many are still missing, what they had gone in to do, where they are believed to have been last (all of which should help the search concentrate on most likely areas first), what to do if multiple casualties are encountered, positions of stretchers, etc.
- For DRTs information required includes routes in and out, known conditions in the area they have to work in, time in repair area (if working in a high radiation environment), and dose control limitations (which could vary for each team member!).

2.15.5 Approach to Entry

- All equipment – communication, cameras, radiation instrumentation, repair tools, etc. – should be tested to establish they work before the team goes over the barrier.
- Before they go in, the team should be perfectly clear about what they have to do, how they will know they have done it, what their limitations are, and what to do if things do not go to plan.
- Before they go in TMs should check each other to ensure all are properly dressed, the BA sets have adequate pressure, and everyone is comfortable.
- Once over the barrier initial entry teams should be led by the HP TM who has, and uses, the radiation, contamination and hot gas checking instrumentation (reactors). The instrumentation should be switched on. They should move forward cautiously checking before they go round blind corners or enter corridors/ closed areas to establish what the hazard is before committing to go in.
- Information should be requested from Umpires – it should not be fed to the team whether they ask or not. They may have to be told they can hear escaping gas/ steam, or feel increasing heat, see a large fire, have just heard a loud noise, have seen an extensive pool of water, etc., because these cannot always be simulated in a realistic way.
- As a matter of routine TMs should check each other for the symptoms of heat exhaustion, remaining BA bottle pressure, protective clothing still in position, etc.
- Later entries where safe routes/ areas have been established should recognise that the situation can have changed - requiring care at all times. Once the safe area limits are reached e.g. a new area is to be searched, the same level of caution and checking is required as was required during the initial team entry.
- Teams should keep to the agreed communication frequency – reporting in regularly so that the ICP can keep track of their progress – and find them if they get into trouble.
- The communication capability of the teams throughout the incident area should be checked and any radio black spots noted. In addition, difficulties with using radios in BA gear will also need to be addressed – using throat mikes for example.
- If the team is required to split up (e.g. to handle multiple casualties) the team members should always be in pairs so that they can check each other.

2.15.6 Back up Rescue Team

- When any entry team is in the incident area a back-up team of two people (minimum) should be available, e.g. fully dressed wearing their BA sets (except for the face masks and hoods). They should be available to leave instantly to provide support to any team that gets into trouble or simply goes missing.
- The team will need a clear brief – similar to an initial entry team - if they are called to respond to an entry team getting into difficulties. Clearly if the team simply goes missing they will be going into an unknown situation and will require a cautious approach.
- Members of the back-up team will need to be rotated regularly because even sitting around in full gear is tiring and will affect their performance.

2.15.7 Equipment

- All equipment that is going to go into the incident area should be tested before entry to ensure it will work when called upon to do so. This should also be used to check TMs know how to use it and it can be used wearing all the protective gear.
- Any complex task (repair proposals) should be thought through by technical staff to optimise the approach from a TM dose commitment/ hazard reduction viewpoint.
- If complicated tasks are to be undertaken e.g. during the repair phase, they should be rehearsed in a clean, low radiation area so that each TM knows what they have to do; they should also consider what to do in various situations when all does not go to plan.

- Consideration should be given to the ability to handle equipment deemed necessary for carrying out repairs, etc. The ability to transport it and use it when fully dressed and wearing BA sets should be taken into consideration before the task is attempted.

2.16 On- and Off-Site Surveys

2.16.1 Observing the surveys

- There are 3 ways to observe the off-site survey i.e. travel with one of the vehicles, go with a licensee observer or follow the teams in your own car.
- Staying with a single vehicle limits what an inspector can see and makes it difficult to get back on to site to see other aspects.
- Joining a licensee observer provides more mobility, providing you both agree to see the same aspects. In addition, the licensee observer is likely to have a radio so the traffic between survey teams and the centre can be monitored.
- If you use your own car it is worth obtaining a radio so you can monitor the survey team/ centre traffic and know where the teams are being sent.
- On-site observation is clearly less difficult – although a radio will help the monitoring of both on- and off-site teams.

2.16.2 Team assembly/ vehicle checks

- As soon as the site alarm is sounded, the HP teams that staff the on- and off-site survey teams should assemble either in the HP control room or at the vehicle garage.
- Team members must muster and, if required, take KIO3 tablets (Reactors).
- They should receive an initial brief – either in the HP control room or after they have established that their vehicles are ready to leave the garage.
- The brief should cover (in outline) what is believed to have happened, wind direction/ strength, where they are expected to sample first, what they will be looking for e.g. activity in air, radiation levels, ground contamination, soil and grass samples, water samples, CO_2 concentrations (Gas reactor) – or perhaps all of these.
- On arrival at the garage the teams should check the vehicles are roadworthy – e.g. checking tyres, the brake pedal does not go straight to the floor, oil and fuel levels, it starts, the lights work, etc. (These checks may instead be part of an EMIT schedule).
- In parallel with checking the vehicle, the instruments and PPE (suits, overshoes, gloves, respirators, etc.) in the vehicle should be inventoried and the instrument calibration dates and functionality should be checked.
- Once this has been done, communications can be checked when the team reports that it is ready to leave the garage.
- Their primary sample point should then be confirmed. The on-site vehicle will head for its first sample point and the off-site vehicles will leave site.

2.16.3 Instrumentation/ sampling

- The vehicles will take the team into the path of the plume and must be capable of being sealed to provide additional protection; otherwise TMs will require appropriate RPE/PPE. It is good practice to be able to get activity in air samples without leaving the vehicle.
- Once they arrive at the sample point the air sampler, (Maypack for Reactors), should be fitted to the sampler and the pump started to pull air through it. The sample flowrate and time will be required fairly accurately so the volume of air sampled will be known.
- Care should be taken when fitting/ removing the air sampler to ensure cross contamination from one sample to the next does not occur. This is also true of the measuring instrumentation.
- The sample can be counted on a scalar or a ratemeter or returned to the HP control room for counting. If a ratemeter is used, the sample may be off scale and it will be necessary

to use an attenuator – or deal with it in some other way. If you are not an HP expert note what is done and check it with an ONR HP.
- If the team decide to leave the vehicle to get other sample results e.g. ground contamination (which usually gives a quicker indication of abnormal levels than air samples) before the air sample result is known, they should be wearing protective clothing and a respirator.
- If they leave the vehicle, precautions should be taken to ensure the interior of the vehicle does not become contaminated as they leave and re-enter. The interior should be monitored and any spots of contamination should be cleaned up.
- The interior should be checked routinely in any case to ensure contamination is not escaping from the samples/ sampling systems.
- Once the results have been obtained they should be radioed to the centre together with the time of sample and the location.
- The team should then be directed to their next sample point – or to a waiting station out of the plume.

2.16.4 Survey Strategy/ Control

- For both on- and off-site teams, the first sample point should be chosen so that it yields some positive information, i.e. down wind and close to the plant or site.
- The results should confirm (or not) that activity is being released on- and off-site. The data should be used to establish whether the on- and off-site precautions to protect staff and the public are appropriate and whether they need to be strengthened.
- Subsequent samples should be aimed at defining the extent to the plume and its boundaries. It is usual for the sites to have predetermined fixed survey points so the teams do not have any difficulty in finding them.
- Off-site checks downwind will provide information on the deposition of activity, the radiation and ground contamination levels, CO_2 levels, etc. at specific locations (e.g. perhaps in local 'centres' of population) to facilitate decisions of public protection counter measures.
- On-site, the team can be used to define the boundaries of the plume and then parked just outside the boundary to monitor the impact of any changes in wind direction, etc.
- Neither team should be left sitting in the plume while the centre decides where to sample/ what to do next.

2.16.5 Communication

- The information from the survey teams should be radioed back to the central HP team in as soon as it becomes available.
- As the emergency develops, for some reactor sites, the technical centre (Central Emergency Support Centre (CESC)) takes over the off-site survey control, and evaluation/ interpretation of results. Handover from one centre to the other needs to be clearly defined so it is always clear who is in control.
- There are specific radio networks designed to handle the survey team/ centre exchanges and these should be tested during the exercise. For certain exercises the main network will be deemed to be failed and the back up system will be tested.
- Once the information has been received and processed it should be fed to the FCC or ECC Controller (depending who is in control in the initial stages) for interpretation into on- and off-site radiological consequences. This will be used to formulate on-site and off-site public protection advice.
- Ultimately it will go to the SCC once this centre has come on line to inform the public protection strategy and actions.
- Handover of responsibility for off-site protection from site to SCC must be clearly defined.

2.16.6 Information Presentation and recording

- The measurements are usually translated into colour coded points on a map of the area surrounding the facility/ site/ station (plume plots).
- The HP team should use a plume model to confirm their understanding of the developing situation, provide interpolation where there is no immediate data, decide where the data is most needed next, etc.
- They should use the combined output of measured results and the model predictions to provide information on the likely radiological consequences both on- and off-site.
- The consequences information, and significant changes thereto, should be brought to the attention of the ECC Controller while the ECC is responsible for the provision of the public protection advice.
- The base measurement data and its interpretation in radiological advice should be recorded, e.g. by keeping copies of plume plots as they develop. This information will be of key importance for the review of actions taken that will follow a real event.

2.17 Mustering

2.17.1 Roll Call Methods

- A range of methods are possible – from full site-wide electronic systems, facility paper lists, collation of security passes/ identity cards/ criticality lockets, etc. For any system there should be a back-up available.
- For sites where a single event can affect the whole site almost instantaneously, e.g. failure of a reactor pressure circuit component, site-wide electronic systems are prevalent.
- For sites where operations are segregated into buildings designed to withstand/ contain the worst effects of an incident, local systems (e.g. based on identity passes) can be used to establish who was in the building at the time. The whole site muster will be required to be completed, but on a longer timescale than the immediate problem of knowing who was in the building at the time of the event.
- Seriously injured casualties usually require to be recovered within the ‘golden hour’. Once beyond this time the prognosis becomes steadily worse for the casualty. Roll call effectiveness should be judged on the ability of the licensee to demonstrate it can identify and account for all missing persons to allow recovery within the golden hour.
- Seriously injured casualties should not be considered accounted for until they are in the Medical Centre being treated.

2.17.2 Office Personnel muster points

- People should muster quickly and not over an extended period.
- One individual should assume the role of the assembly point controller (APC).
- The APC should supervise the operation of the roll call system – be it paper or electronic.
- The system should handle internal and external visitors as well as all the observers/ umpires, etc. associated with the exercise.
- Any known casualties or missing persons should be fed to the muster co-ordinating team immediately.
- The APC should ensure that automatic countermeasures are applied:
    - KIO3 tablets are taken if this is appropriate (Reactors). This should be simulated properly – with the necessary water available for people to drink.
    - All doors and windows should be shut and ventilation systems turned off.
- Muster points should be large enough to handle the likely number assembling.
- The tenability of the muster point should be checked initially and then regularly thereafter.
- There should be instrumentation to do this e.g. radiation and/ or activity in air monitoring, CO_2 concentration (gas reactors), etc.

- The instrumentation may be used to check whether the plume is passing directly over the muster point.
    - If this is the case the APC should, if at all possible, get permission before moving people.
    - Permission will come from the FCC/ ECC depending on who is in control at the time.
    - If a move is required, there should be sufficient respirators available to enable those assembled to evacuate through the plume should this prove necessary.
- The site tannoy, where used, should be clearly audible to all of the people at the muster station and it should be used to keep them informed of the development of the event on a regular basis.

2.17.3 Muster points for those involved in the incident

- In addition to the issues identified above, those who could have been involved could be contaminated. There will need to be a quick screening process to segregate those contaminated from those not.
- Segregated decontamination facilities will be needed – perhaps showers with effluent handling facilities. Contaminated clothing should be collected and bagged to keep contamination out of the air. Air samplers should be running to detect whether contamination is being brought into the muster point – or the plume is passing overhead.
- The clean and dirty areas should be regularly monitored and any spots of contamination found cleaned up or fixed to prevent it getting into the air.
- EPDs should be collected to allow urgent assessment of individuals' dose. Records will need to be kept of this information.
- Individuals should be debriefed to establish what they know about the incident and who else was in the incident area with them. This information should be passed to the muster co-ordinators as soon as possible.

2.17.4 Additional points for Criticality Events

- In addition to the above, personnel may have absorbed radiation doses that could give rise to deterministic effects.
- Personnel should be checked to establish those who were close to the event – they could need urgent medical attention.
- An immediate dose assessment method is required e.g. criticality lockets, indium foils in identity pass carriers, activated Na in the body.
- Those (probably HP staff) handling the people should be actively looking for the effects of radiation sickness (nausea, confusion, passing out, etc.) that could indicate exposure to high doses requiring urgent medical attention.
- If individuals are identified as having potentially absorbed a very high dose they must be immediately transferred to a medical facility for treatment.

2.18 Casualty Handling/ Medical Aspects

2.18.1 PPE/ RPE

- There should be a Medical Centre – usually on the edge of the active area - capable of providing triage for contaminated casualties.
- It is sometimes connected to the outside world so that, once treated, patients can be transferred to an ambulance to be sent to a local hospital which has expertise in handling contaminated patients.
- The people staffing this facility – ideally one or two nurses/ first aiders, a doctor and a HP monitor – should be wearing oversuits, (multiple pairs of) gloves, overshoes and

respirators. This provides protection when they 'unwrap' patients and cut away contaminated clothing to get at the injuries; it also facilitates contamination control.
- Gloves should be changed regularly to avoid cross contamination / wound uptakes (alpha nuclides).

2.18.2 Contamination control

- Ideally the centre should be segregated into a dirty and clean area with the air flow from clean to dirty.
- The floor of the centre should either be covered with a removable surface or be a readily decontaminable finish.
- The centre should have an activity in air monitor running.
- The clean and dirty sides should be monitored regularly and/ or between each patient (if this is possible) and any contamination spots found should be cleaned up or fixed.
- Ideally the exit from the area to the waiting ambulance should be through an air lock to limit the spread of contamination.
- A supply of clean blankets, plastic sheets, etc. should be available to wrap patients who are still contaminated after treatment and require transfer to hospital in the ambulance.
- Contaminated clothing/ wrapping material, etc. should be bagged and stored out of the way to ensure the activity is not resuspended.
- The centre should have available a supply of body bags to handle contaminated dead bodies.

2.18.3 Communication

- The medical centre should be briefed, about contaminated casualties who will need triage, by the ICP before they are sent to the centre.
- The medical centre should keep the ECC informed on the status of the casualties.
- The ECC should be warned when a casualty is to be dispatched to hospital so that the ambulance can be cleared through the gatehouse and off-site.

2.18.4 Liaison with Ambulance Service

- Ambulance staff are not usually dressed to be in contaminated areas and should, therefore, be kept on the clean side of the facility.
- The ambulance team should be briefed on the extent of any remaining contamination. If this is very extensive the casualty should be accompanied by a licensee health physicist who can give advice on how to handle the casualty both within the ambulance and at the hospital.
- Once the ambulance returns from delivering a contaminated casualty it, and its team, should be monitored to confirm the effectiveness of contamination control measures.

2.18.5 Overview of Exercise personnel

- First aiders, nurses, and site doctors are usually heavily involved in exercises playing their normal roles.
- In addition to their normal role in the exercise they should be monitoring other staff as they exercise to ensure they are not excessively stressed.
- General fatigue and, for BA teams, heat exhaustion can reduce team members' performance and lead to accidents. The medical staff deployed should be looking for indications that this is occurring and should intervene if necessary.

2.19 Plant with Chemical / Dispersible Radioactive Source Terms

These plants are usually located on an extended site that contains multiple facilities housed in different buildings. While the facilities required for emergency response will be similar to those for reactor sites, the titles of the various centres usually differ. However, if the principal function of a particular centre is known it can be inspected using the guidance given above. It should be noted that, unlike a reactor where the primary radioactivity is (at least initially) contained in a fixed matrix (fuel pins), chemical plant radioactivity can be in a highly mobile form. The primary containment is the equipment envelope, glove boxes and the vessel ventilation systems, with the cells/ caves within which the plant is housed and the cell/ cave ventilation system as the secondary containment. This can give rise to a somewhat different type of incident and produce different constraints on the emergency response. The key issues noted below have been chosen to provide guidance on likely issues.

2.19.1 Incident type

Spills

- Solid or liquid spills need an assessment of the amount spilled to provide a source term. There should be records of the inventory of the original containers available in the originating plant.
- The approach to the spill requires care and the appropriate PPE/ RPE. If external to buildings a knowledge of wind direction and the likely wind pattern around groups of buildings needs to be considered. Inside buildings the building air flow pattern/ ventilation system impact will need to be considered when deciding on the potential to spread material.
- The area will need to be barriered off/ isolated and steps taken to limit the spread of activity to areas not designed to handle it e.g. storm drains, sumps, etc.
- Barriers should be set up with the intention of controlling access and contamination spread. For an external incident a mobile ICP – with all the associated requirements – should be set up if the licensee has such a thing. Ad hoc arrangements are not good practice and any arrangements should be assessed against the ICP criteria.
- If material is to be picked up, consideration of the potential for a criticality during this phase should be considered if fissile material is involved.
- Material picked up should be held in appropriate containers, i.e. designed to handle the level and type of activity which is being recovered.
- If the spill is the result of a road traffic accident (RTA) which also involves injured/ trapped personnel, careful consideration of protection for the rescue services, prioritisation of casualty recovery, the potential to make the incident worse, possible delay in the assessment of incident impact, etc. will need to be considered.

Criticality

- When dealing with a fissile material incident it is essential to know the inventory of material in the immediate vicinity of the event and within the building/ environment as a whole. This enables realistic and worst case source terms to be estimated.
- When dealing with liquid systems or the movement of dispersed solid fissile material, the potential for recovery operations to precipitate an initial or a further criticality must be considered.
- Liquid systems can have continuing pulse criticalities (e.g. Tokaimura criticality accident, 1999) and this possibility should be considered when dealing with incidents involving fissile material in solution.
- When considering firefighting operations, areas of the plant where it is inappropriate to use water should be identified and communicated clearly to the firefighting teams being sent into those areas e.g. fissile material stores.
- Before entry is allowed into areas in which fissile material is stored, the increase in moderation caused by the water in the bodies of the entry team should be taken into consideration.

- The potential to distribute fissile material/ fission products through the plant and building ventilation systems needs to be considered when assessing the possible impact of the incident. Collection of activity on unshielded ventilation filters can provide an unexpected source of high radiation. In addition, the potential for loaded ventilation filters to pass activity should be checked by looking at the instruments monitoring the discharges.

Miscellaneous

- When looking at chemical plant incidents it should not be forgotten that other hazards may dictate the required response. For example, a fire incident may involve C_2H_2 (acetylene) cylinders in a waste store; sensitised explosive material may be present; there could be releases of NOx, N_2H_4, H_2, tritium, etc., all of which are capable of energetic reactions which can require additional precautions to be taken.

2.19.2 Access to incident

- Entry teams should make use of any fixed or mobile activity-in-air sampler systems in the building/ incident area by checking the status of the alarms as they inspect the plant to get a general idea of the spread of contamination.
- Entry teams should be briefed on any areas which they should not enter under any circumstances i.e. regardless of damage. Such areas could be the interiors of cells/ caves containing high levels of radiation or contamination, fissile stores, etc.
- Entry teams should also be warned to be careful near cave windows and check for high radiation levels. For caves with ZnBr windows loss of liquid means loss of shielding – even if the alpha glass remains in place preventing contamination release. Damage to a lead glass window can allow neutrons to stream up the sides.
- The ingress and egress routes to/ from the contaminated area should be monitored routinely to ensure contamination control is being successful. For some plants trolley mounted floor monitors are available to check large areas comparatively quickly – but see comments under monitoring.

2.19.3 Monitoring for released material

- Detection of Pu can be difficult, especially if the levels of Pu 241/ Am 241 are low. If the Pu is such that reliance has to be placed on alpha detection, probes need to be in close proximity to detect effectively. This, however, gives rise to the possibility that the probe touches the contaminated surface and thus becomes contaminated itself. It then becomes useless for detecting whether surfaces are clean or not. In such situations back-up monitoring equipment should be available to replace probes contaminated in this way.
- Detection of even aged Pu can be difficult in the wet. Thus external contamination spread can be difficult to judge on a wet day. Licensees should be asked how they would deal with a real situation in such circumstances. HP expertise will be useful in understanding the response.

2.19.4 Multi-Plant Site Issues

- These plants are frequently located on multi-facility establishments with significant physical distances between interdependent plants, e.g. waste producers and waste stores. In these circumstances incidents can occur which require emergency response far from the ‘owner facility’ and (from time to time) far from any fixed emergency facilities. In these circumstances licensees would be expected to have a mobile ICP that can be deployed close to the scene of the incident to provide the control and management of the incident.
- On chemical plants building ventilation systems can be interlinked downstream of the building filters and close to the discharge stack. Release of activity beyond a building into the ventilation system can cause contamination of the interlinked system; this should not be overlooked.

- Complex sites with multiple plants and possibly multiple licensees/ non licensee companies (e.g. tenants / contractors) on site mean that protection of personnel site-wide can become difficult. From time to time these satellite operations should be checked to ensure they participate and the employees have not, for example, all taken the day off to avoid becoming involved in the exercise.
- On complex sites with multiple licensees/ non-licensee companies it is worth considering how long it is necessary to keep the site closed up during the exercise. Care is required in releasing such individuals to ensure they do not plough through the exercise area as they return to their normal duties.

2.19.5 Security conflicts

- If the emergency is initiated by a security incident, the emergency response will need to consider the prioritisation of other operations, e.g. armed security guards searching for armed intruders, the requirement to search for improvised explosive devices (IEDs), etc. If activity is believed to have been released, protection of individuals will need to be considered. Security and safety emergency arrangements require careful interface to ensure that all constraints are addressed.
- The possibility that the security situation will dictate actions on the site should be considered, e.g. which areas are considered safe to shelter on-site personnel to maintain them out of the line of fire.
- Security considerations require different training and skills to routine nuclear safety events, etc., and response teams must be selected accordingly.