EPR–A&P

2019

EMERGENCY PREPAREDNESS AND RESPONSE

Operations Manual for IAEA Assessment and Prognosis during a Nuclear or Radiological Emergency

DATE EFFECTIVE: 20 FEBRUARY 2020

IAEA
International Atomic Energy Agency

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OPERATIONS MANUAL FOR IAEA ASSESSMENT AND PROGNOSIS DURING A NUCLEAR OR RADIOLOGICAL EMERGENCY

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The Agency's Statute was approved on 23 October 1956 by the Conference on the Statute of the IAEA held at United Nations Headquarters, New York; it entered into force on 29 July 1957. The Headquarters of the Agency are situated in Vienna. Its principal objective is "to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world''.

EPR-A&P (2019)

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INTERNATIONAL ATOMIC ENERGY AGENCY
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For further information on this publication, please contact:

Incident and Emergency Centre
International Atomic Energy Agency
Vienna International Centre
PO Box 100
1400 Vienna, Austria
Email: Official.Mail@iaea.org

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Foreword

The IAEA has longstanding capabilities to assess a situation during a nuclear or radiological incident or emergency. Guidance procedures covering various aspects of emergency response, including monitoring and assessment during nuclear and radiological emergencies were developed and published in the late 1990s and were used for training emergency preparedness and response staff in Member States. These technical guidance publications were also used by the IAEA during exercises and actual emergencies.

Since 2011, the IAEA's role in responding to a nuclear or radiological incident or emergency has been significantly expanded. In response to the accident at the Fukushima Daiichi nuclear power plant, the IAEA Member States, in September 2011, unanimously adopted the IAEA Action Plan on Nuclear Safety, the purpose of which was to define a programme of work to strengthen the global nuclear safety framework. As part of the efforts to enhance the transparency and effectiveness of communication and to improve the dissemination of information, the Action Plan called upon "the IAEA Secretariat to provide Member States, international organizations and the general public with timely, clear, factually correct, objective and easily understandable information during a nuclear emergency on its potential consequences". This was to include "an analysis of available information and a prognosis of possible scenarios based on the evidence, scientific knowledge and the capabilities of Member States". The 57th General Conference (2013) subsequently emphasized that this IAEA response role was to cover all nuclear and radiological emergencies.

This manual provides details of the IAEA assessment and prognosis process, including its technical basis. It is complemented by a dedicated website, which provides access to assessment and prognosis tools and procedures. These tools provide a detailed technical workflow that is populated based on information submitted by the Accident State during a nuclear or radiological incident or emergency. This manual also serves as a companion publication to the Operations Manual for Incident and Emergency Communication (EPR–IEComm 2019), which contains a full documentation of the communication procedures for Contact Points identified under the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency.

DISCLAIMER

The views expressed in this publication do not necessarily reflect those of the governments of States that are IAEA Member States or of Parties to either or both of the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, of other relevant intergovernmental organizations or of the Governments of other States.

Guidance provided in this manual, describing good practices, represents expert opinion but does not constitute recommendations made on the basis of a consensus of Member States.

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The IAEA has no responsibility for the persistence or accuracy of URLs, for external or third party Internet websites that may be referred to in this publication, and does not guarantee that any content on such websites is, or will remain, accurate or appropriate.

Every effort has been made to ensure the accuracy of the information contained in this manual. However, neither the IAEA's Secretariat nor its Member States assume any responsibility for consequences that may arise from its use.

NOTES FOR THE USER

This manual describes arrangements operative as of 20 February 2020. Responsible personnel are encouraged to immediately begin to make any necessary changes to their operational systems. These arrangements are supported by a dedicated IAEA Assessment and Prognosis Tools website which provides access to assessment and prognosis tools and procedures and describes the type of detailed technical information that should be shared by Member States during a nuclear or radiological incident or emergency.

It is important to note that the IAEA assessment and prognosis does not replace the responsibility of an Accident State to perform its own assessment, implement needed protective actions and other response actions, as well as to communicate with the public.

The IAEA's Incident and Emergency Centre is ready to provide any clarification on the implementation of the arrangements described in this publication and may be contacted at:

email: iec-routine@iaea.org

fax: +43 1 2600 7 29309

telephone: +43 1 2600 22026

Contents

Section 1

1. INTRODUCTION

1.1. Background

The IAEA has longstanding capabilities to assess a situation during a nuclear or radiological incident or emergency. Publications such as Generic Assessment Procedures for Determining Protective Actions during Reactor Accident (IAEA-TECDOC-955) [1], Generic Procedures for Assessment and Response during a Radiological Emergency (IAEA-TECDOC-1162) [2] and Generic Procedures for Monitoring in a Nuclear or Radiological Emergency (IAEA-TECDOC-1092) [3] were developed and issued in the late 1990s and were used for training emergency preparedness and response (EPR) staff in Member States. These technical guidance publications were also employed by the IAEA during exercises and actual emergencies.

Through the adoption of the IAEA Action Plan on Nuclear Safety [4] in 2011 — which requests that the IAEA Secretariat "provide Member States, international organizations and the general public with timely, clear, factually correct, objective and easily understandable information during a nuclear emergency on its potential consequences, including analysis of available information and prognosis of possible scenarios based on evidence, scientific knowledge and the capabilities of Member States" — the IAEA's role in an emergency has been expanded to include the function of providing a prognosis of the potential evolution of an accident and an assessment of its possible consequences. The IAEA shares the results of assessment and prognosis with Member States and relevant international organizations to assist them in their own analysis of a situation. This information is also used by Member States to prepare overviews and briefings for the public and the media.

This publication describes the details of the IAEA assessment and prognosis process, including the technical basis for the conduct of this process. It is supported by the IAEA's IEC Assessment and Prognosis Tools website,[1] which contains specialized tools and procedures and describes the type of detailed technical information that should be shared by Member States during a nuclear or radiological incident or emergency (see Section A.4). This manual also serves as a companion publication to the IAEA's Operations Manual for Incident and Emergency Communication (EPR–IEComm 2019) [5], which provides full documentation of the communication procedures for Contact Points (IAEA CPs) identified under the Convention on Early Notification of a Nuclear Accident (Early Notification Convention) and the

[1] This website is available at https://iec.iaea.org/iecat. Access is provided to all users of the Unified System for Information Exchange (USIE) but can also be granted to relevant counterparts upon request.

Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Assistance Convention) [6].

1.2. Objective

The objective of this publication is to provide information on the IAEA assessment and prognosis process during nuclear or radiological incidents or emergencies[2] and to describe the interactions relevant to the process between the IAEA Secretariat, Member States, States Parties to the Early Notification Convention and the Assistance Convention, relevant international organizations and other States during the preparedness for and the response to nuclear or radiological emergencies. The manual provides guidance to the IAEA Member States, States Parties and relevant international organizations on their interface with the IAEA Secretariat regarding the sharing of technical data and the use of the available tools supporting the IAEA's assessment and prognosis process.

1.3. Target audience

The target audience of this publication comprises IAEA CPs [8] that are directly involved in the IAEA assessment and prognosis process through the exchange of technical information with the IAEA and/or the review of the output of the process. The steps involved in the assessment and prognosis process, as defined by the IAEA, are explained, and the outputs are described in detail so that IAEA CPs can update any of their internal procedures to support this process.

This publication is also intended to be a reference for IAEA CPs, which may use the IAEA's assessment and prognosis process during a nuclear or radiological emergency to keep other governmental organizations and the public within their respective countries informed of the situation.

1.4. Scope

- The manual describes arrangements and outlines the procedures for the conduct of the IAEA's assessment and prognosis during a nuclear or radiological emergency[3], as one of the IAEA's roles during a nuclear or radiological emergency. This publication is an integral part of the international EPR framework. of EPR–IEComm (2019) [5].
- The Appendix provides an overview of the information that needs to be exchanged during the assessment and prognosis process.

[2] Hereinafter, the term 'nuclear or radiological emergency' is used instead of 'nuclear or radiological incident or emergency'. An incident, unlike an accident, can be caused intentionally [7]; therefore; the term 'nuclear or radiological emergency' is appropriate, as nuclear or radiological emergencies include events caused intentionally (i.e. nuclear security events) and unintentionally.

[3] For all other event-specific communication procedures, including the response time objectives, see EPR–IEComm (2019) [5].

1.5. Definitions[4]

Accident Any unintended event, including operating errors, equipment failures and other mishaps, the consequences or potential consequences of which are not negligible from the point of view of protection and safety [7].

Accident State The State where an event resulting in a nuclear or radiological emergency occurred.

Advisory message An official message to a national or international organization by an authorized authority providing details of an actual, potential or perceived nuclear or radiological emergency, without the explicit obligation under international treaty or expectation according to international safety standards to do so. The purpose is, inter alia: (1) to provide relevant information about a nuclear or radiological emergency as early as possible in order to minimize transboundary radiological consequences; (2) to pre-empt legitimate requests for information from other States;[5] (3) to prompt the IAEA to offer its good offices;[6] (4) to provide advance warning to the IAEA, other participating organizations and States of a developing situation so that they can be ready to respond should the situation worsen;[7] (5) for the IAEA, other participating organizations and States to initiate a response and/or provide advice to the public or media on a developing situation of actual, potential or perceived radiological significance; (6) to alert the IAEA's emergency response staff .

Alert channel The primary emergency communication channels (i.e. electronic mail, facsimile and the SMS function of mobile telephones) by which IAEA CPs choose to receive an alert message when an EMERCON message form is published on USIE with a request for confirmation.

Arrangements (Emergency arrangements) The integrated set of infrastructural elements, put in place at the preparedness stage, that are necessary to provide the capability for performing a specified function or task required in response to a nuclear or radiological emergency [7].

Authentication The process of confirming that a message received originates from an IAEA CP.

Competent Authority (CA) An IAEA CP in a State or international organization that has one of the following competencies and responsibilities: notify/report a nuclear or radiological emergency to the IAEA; receive notifications from other States or the IAEA on nuclear or radiological emergencies that could affect its State; or make and receive requests for and accept offers of assistance. Competent Authorities (CAs) include the Competent Authorities for a Domestic Emergency (CA(D)s) and the Competent Authorities for an Emergency Abroad (CA(A)s). In relation to matters of nuclear or radiological emergencies, they also include Competent Authorities for Other Conventions under the auspices of the IAEA (CAOC).

EMERCON A descriptor referring to the official system for issuing and receiving notifications, urgent information exchange, request for and provision of assistance through the IAEA's Incident and Emergency Centre (IEC) in the event of a nuclear or radiological emergency.

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4 The absence of a reference in a definition means that it is used for the purposes of this manual.

5 See article 2 of the Early Notification Convention [6].

6 See article 5 of the Assistance Convention [6].

7 In order to enable States and organizations, such as the IAEA, to carry out their functions under article 4 of the Early Notification Convention [6].

Emergency A non-routine situation or event, that necessitates prompt action, primarily to mitigate a hazard or adverse consequences for human life, health, property or the environment. This includes nuclear and radiological emergencies and conventional emergencies such as fires, release of hazardous chemicals, storms or earthquakes. It includes situations for which prompt action is warranted to mitigate the effects of a perceived hazard [7], [10].

Exercise Any practical implementation of response plans and procedures in a simulated situation. This includes drills, table top exercises, partial and full scale exercises, as well as field exercises. The preparation and conduct of each exercise vary in complexity, scope and objectives.

IAEA assessment and prognosis Provision by the IAEA Secretariat to Member States, international organizations and the general public of timely, clear, factually correct, objective and easily understandable information during a nuclear emergency on its potential consequences, including analysis of the available information, and prognoses of possible scenarios based on evidence, scientific knowledge and the capabilities of Member States [4].

IAEA Contact Point (CP) IAEA CPs consist of: National Warning Points (NWPs); Points of Contact, competent authorities or CAs of States Parties as defined in the Early Notification Convention, the Assistance Convention and other relevant Conventions under the auspices of the IAEA; Permanent Missions of the Member States to the IAEA (States' PMs); INES National Officers; IRMIS Data Providers; and CPs of relevant international organizations.

Incident Any unintended event — including operating errors, equipment failures, initiating events, accident precursors, near misses or other mishaps — or unauthorized act, malicious or non-malicious, the consequences or potential consequences of which are not negligible from the point of view of protection and safety [7].

INES National Officer The named person who is officially designated by the Government of his/her State to communicate events rated on INES to the international community, via USIE and NEWS, on behalf of the State.

National Warning Point (NWP)[8] An IAEA CP that is staffed or able to be alerted at all times for promptly responding to, or initiating a response to, an incoming notification, advisory message, request for assistance or request for verification of a message, as appropriate, from the IAEA. The NWP role in a nuclear or radiological emergency is assigned to a **single** institution in a State that is authorized by its Government to perform these functions.

Notification (1) A report submitted promptly to a national or international authority providing details of an emergency or a possible emergency, for example as required by the Early Notification Convention [7], [10].

(2) A set of actions taken upon detection of emergency conditions with the purpose of alerting all organizations with responsibility for emergency response in the event of such conditions [7], [10].

Notifying State The State Party that is responsible for notifying (see 'Notification') potentially affected States and the IAEA of an event of actual, potential or perceived radiological significance for other States. This includes: (1) the State Party that has jurisdiction or control over the facility or activity (including space objects) in accordance with article 1 of the Early Notification Convention; and (2) the State that initially detects or discovers

[8] In the Early Notification Convention and the Assistance Convention, the term 'point of contact' is used. However, the term was found to be confusing and was often misused by Parties. The term 'National Warning Point' is used here to make it clear that this is the CP that needs to be available 24 hours per day, 7 days per week, for receipt of a notification, an advisory report or a request for information or assistance.

	evidence of a transnational emergency, for example by: detecting significant increases in atmospheric radiation levels of unknown origin; detecting contamination in transboundary shipments; discovering a dangerous source that may have originated in another State; or diagnosing clinical symptoms that may have resulted from exposure outside the State [7], [10].
Nuclear or radiological emergency	An emergency in which there is, or is perceived to be, a hazard due to: (a) the energy resulting from a nuclear chain reaction or from the decay of the products of a chain reaction; (b) radiation[9] exposure [7], [10].
Nuclear security event	An event that has potential or actual implications for nuclear security that must be addressed [7], [10].
Offer of good offices	A message sent by the IAEA to the IAEA CPs of States affected or potentially affected by a nuclear or radiological emergency whereby the IAEA offers its services.
Public Information Officer	The person who is responsible for providing transparent, timely, clear and accurate information to, and to communicate with, the public and the news media.
Public statement	An official statement updating the public and media about an event, issued by local, regional, national or international authorities or organizations. Public statements contain unrestricted information and may be issued, inter alia, in the form of press releases and updates, media briefings and advisories, social media and website postings or through other public information channels.
Relevant international organization	An international intergovernmental organization[10] that, according to the information provided to the IAEA, has a significant legal or statutory role and/or the capability to provide advice or assistance in the event of a nuclear or radiological emergency.
Reporting State	The State that informs potentially affected States and the IAEA of an event of actual, potential or perceived radiological significance. The State sends the information voluntarily (see 'Advisory message'), without a legal obligation to do so.
Significant transboundary release	A release of radioactive material to the environment that may result in doses or levels of contamination beyond national borders from the release which exceed generic criteria for protective actions and other response actions, including food restrictions and restrictions on trade [7], [10].
State Party / States Parties	A State or States having deposited an instrument of ratification, acceptance, approval or accession to the Early Notification Convention and/or the Assistance Convention.
Status Summary Report (SSR)	A report prepared periodically by the IAEA during a nuclear or radiological emergency containing the latest summary of authenticated information from an Accident State and other relevant States and the results of IAEA assessment and prognosis. The SSR typically includes dedicated sections such as the status of the facility, the status of radiological conditions (on-site and off-site) and the status of implemented protective actions (on-site and off-site). Other sections could be included in the SSR depending on the type of the event addressed in the response.
Transnational emergency	A nuclear or radiological emergency of actual, potential or perceived radiological significance for more than one State. This may include: (1) a significant transboundary release of radioactive material (however, a transnational emergency does not necessarily imply a significant transboundary release of radioactive material); (2) a General Emergency at a

[9] In IAEA publications, the term 'radiation' normally only refers to ionizing radiation. The IAEA has no statutory responsibilities in relation to non-ionizing radiation.

[10] The relevant international intergovernmental organizations are specified in the EPR–JPLAN 2017 [9].

facility or other event that could result in a significant transboundary release (atmospheric or aquatic) of radioactive material; (3) discovery of the loss or illicit removal of a dangerous source that has been transported across, or is suspected of having been transported across, a national border; (4) an emergency resulting in significant disruption to international trade or travel; (5) an emergency warranting the taking of protective actions for foreign nationals or embassies in the State in which it occurs; (6) an emergency resulting in, or potentially resulting in, severe deterministic effects and involving a fault and/or problem (such as in equipment or software) that could have serious implications for safety internationally; and (7) an emergency resulting in, or potentially resulting in, great concern among the population of more than one State owing to the actual or perceived radiological hazard [7], [10]. See 'Significant transboundary release'.

USIE The Unified System for Information Exchange in Incidents and Emergencies (USIE) is a single unified website for national CPs under the Early Notification Convention and the Assistance Convention, as well as for INES National Officers, to report and exchange information on nuclear and radiological emergencies.

USIE Administrator The person who has (a) the right to register and give USIE access to all designated USIE Users within their respective CP (for users who use the same email domain); and (b) the responsibility and the right to keep the organizations' contact details up to date, check the validity of registered USIE Users and keep other settings (such as alert channels) current on the USIE and USIE Exercise websites.

USIE Users All staff and individuals who are authorized by their CPs to have access to the USIE website. The CPs are responsible for making sure that a sufficient number of users in their organizations have access to the USIE website, and that users have been assigned appropriate roles to be able to perform critical functions at any time, e.g. submitting an event notification and acknowledging receipt.

Verification The process of confirming that the information in a message is properly understood (see also 'Authentication').

1.6. Abbreviations and acronyms

CA	Competent Authority
CA(A)	Competent Authority for an Emergency Abroad, according to the Early Notification Convention and the Assistance Convention
CA(D)	Competent Authority for a Domestic Emergency according to the Early Notification Convention and the Assistance Convention
CAOC	Competent Authority for other Conventions under the auspices of the IAEA
CP(s)	Contact Point(s)
DIRAC	DIrectory of RAdiotherapy Centres
EC	European Commission (of the European Union)
EMERCON	Emergency Convention
EMERCON GENF	EMERCON General Emergency at Nuclear Facility Form
EMERCON RFA	EMERCON Request for Assistance Form
EMERCON SRF	EMERCON Standard Report Form
EPR	Emergency Preparedness and Response
EPRIMS	EPR Information Management System
ERF	Event Rating Form (for submitting INES rated events)
GENF	General Emergency at Nuclear Facility Form
IAEA	International Atomic Energy Agency
IAEA CP(s)	IAEA Contact Point(s)
ICSRS	International Catalogue of Sealed Radioactive Sources and Devices
IEC	Incident and Emergency Centre (of the IAEA)
IEComm	Operations Manual for Incident and Emergency Communication
IES	Incident and Emergency System (of the IAEA)
INES	International Nuclear and Radiological Event Scale
INTERPOL	International Criminal Police Organization
IRMIS	International Radiation Monitoring Information System
NACs	National Assistance Capabilities
NEWS	Nuclear Events Web-based System
NPP	Nuclear Power Plant
NWP	National Warning Point
OECD/NEA	Organisation for Economic Co-operation and Development/Nuclear Energy Agency
OPIC	Office of Public Information and Communication (of the IAEA)
PM	Permanent Mission of a Member State to the IAEA

PRIS	Power Reactor Information System
RANET	Response and Assistance Network (of the IAEA)
RRDB	Research Reactor Database of the IAEA
RSMC	Regional Specialized Meteorological Centre (of the WMO)
SCC	Security Control Centre of the UN Security and Safety Services located at the Vienna International Centre
SRF	Standard Report Form
SSR	Status Summary Report
USIE	Unified System for Information Exchange in Incidents and Emergencies

Section 2

2. BACKGROUND OF ASSESSMENT AND PROGNOSIS DURING A NUCLEAR OR RADIOLOGICAL EMERGENCY

2.1. Basis of the IAEA's assessment and prognosis

Basic Elements

The international EPR framework consists of international legal instruments, IAEA safety standards and operational arrangements. The main international legal instruments on EPR are the Early Notification Convention [6], the Assistance Convention [6], the IAEA Safety Standards and various operational arrangements. These are supplemented by decisions of the IAEA's policy making organs, such as the adoption of the IAEA Action Plan on Nuclear Safety [4].

IAEA Action Plan on Nuclear Safety

The IAEA Action Plan on Nuclear Safety expanded the IAEA Secretariat's response role in an emergency at a nuclear power plant (NPP) to cover the need "to provide Member States, international organizations and the general public with timely, clear, factually correct, objective and easily understandable information during a nuclear emergency on its potential consequences, including analysis of available information and prognosis of possible scenarios based on evidence, scientific knowledge and the capabilities of Member States"[4]. Based on the IAEA Action Plan on Nuclear Safety, the role of assessment and prognosis during a nuclear or radiological emergency was added to the previously existing response roles of the IAEA Secretariat.

IAEA Board of Governors

The purpose of assessment and prognosis during a nuclear or radiological emergency was presented in 2013 in the Report by the Director General to the IAEA Board of Governors entitled IAEA's Assessment and Prognosis in Response to an Emergency at a Nuclear Power Plant.[11] The report outlined the objectives, basis, process, constraints and limitations for the operational implementation of the IAEA's response role in an emergency at an NPP with regard to the analysis of available information and the

[11] GOV/INF/2013/13, IAEA, Vienna (2013).

prognosis of possible consequences and likely emergency scenarios, as defined in the IAEA Action Plan on Nuclear Safety.

IAEA General Conference

Furthermore, at the 57th IAEA General Conference in September 2013, a resolution was adopted on Measures to Strengthen International Cooperation in Nuclear, Radiation, Transport and Waste Safety,[12] which requested "the Secretariat, in close cooperation with Member States, to continue to develop an effective public communication strategy and to maintain and further develop arrangements to provide Member States, international organizations and the general public with timely, clear, factually correct, objective and easily understandable information during a nuclear or radiological emergency, including the analysis of available information and the prognosis of potential consequences". This clarified that the IAEA assessment and prognosis was applicable to any nuclear or radiological emergency, and was not just limited to emergencies at an NPP.

IAEA Safety Standards as reference material

IAEA Safety Standards[13] and technical documents provide reference material for the IAEA assessment and prognosis. The IAEA's Statute makes the safety standards binding on the IAEA in relation to its own operations.

The primary reference publications relevant for the IAEA assessment and prognosis are the following:

General Safety Requirements:

- Preparedness and Response for a Nuclear or Radiological Emergency (jointly sponsored by FAO, IAEA, ICAO, ILO, IMO, INTERPOL, OECD/NEA, PAHO, CTBTO, UNEP, OCHA, WHO, WMO), IAEA Safety Standards Series No. GSR Part 7 (2015) [10].

Safety Guides:

- Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency (jointly sponsored by FAO, IAEA, ILO, PAHO, WHO), IAEA Safety Standards Series No. GSG-2 (2011) [11];
- Arrangements for Preparedness for a Nuclear or Radiological Emergency (jointly sponsored by FAO, IAEA, ILO, PAHO, OCHA, WHO), IAEA Safety Standards Series No. GS-G-2.1 (2007) [12];
- Arrangements for the Termination of a Nuclear or Radiological Emergency (jointly sponsored by FAO, IAEA, ICAO, ILO, IMO, INTERPOL, OECD/NEA, OCHA, WHO, WMO), IAEA Safety Standards Series No. GSG-11 (2018) [13].

EPR Series and related publications

The EPR Series is a specific series of IAEA publications on emergency preparedness and response. The publications in this series cover a wide range of topics in emergency preparedness and response and may support the IAEA assessment and/or prognosis.

[12] GC(57)/RES/9, IAEA, Vienna (2013), https://www.iaea.org/About/Policy/GC/GC57/GC57Resolutions/English/gc57res-9_en.pdf

[13] The IAEA Safety Standards can be found online on the IAEA publications website at www-pub.iaea.org/books/IAEABooks/Series/33/IAEA-Safety-Standards-Series

EPR Series publications:

- Method for Developing Arrangements for Response to a Nuclear or Radiological Emergency, EPR–METHOD 2003 [14] — this publication updates IAEA-TECDOC-953;
- Generic Procedures for Medical Response during a Nuclear or Radiological Emergency (co-sponsored by IAEA and WHO), EPR–MEDICAL 2005 [15];
- Dangerous Quantities of Radioactive Material (D-values), EPR–D-Values 2006 [16];
- Manual for First Responders to a Radiological Emergency (jointly sponsored by CTIF, IAEA, PAHO, WHO), EPR–FIRST RESPONDERS 2006 [17];
- Cytogenetic Dosimetry: Applications in Preparedness for and Response to Radiation Emergencies (jointly sponsored by IAEA, PAHO, WHO), EPR–Biodosimetry 2011 [18];
- Generic Procedures for Response to a Nuclear or Radiological Emergency at Research Reactors, EPR–RESEARCH REACTOR 2011 [19];
- Generic Procedures for Response to a Nuclear or Radiological Emergency at Triga Research Reactors, EPR–TRIGA RESEARCH REACTOR 2011 [20];
- Communication with the Public in a Nuclear or Radiological Emergency, EPR–Public Communications 2012 [21];
- Actions to Protect the Public in an Emergency due to Severe Conditions at a Light Water Reactor, EPR–NPP PUBLIC PROTECTIVE ACTIONS 2013 [22];
- Operational Intervention Levels for Reactor Emergencies and Methodology for Their Derivation, EPR–NPP-OILs 2017 [23].

Related publications:

- Generic Assessment Procedures for Determining Protective Actions during a Reactor Accident, IAEA-TECDOC-955 (1997) [1];
- Generic Procedures for Assessment and Response during a Radiological Emergency, IAEA-TECDOC-1162 (2000) [2];
- Generic Procedures for Monitoring in a Nuclear or Radiological Emergency, IAEA-TECDOC-1092 (1999) [3];
- Development of an Extended Framework for Emergency Response Criteria: Interim Report for Comments (jointly sponsored by IAEA and WHO) (2005), IAEA-TECDOC-1432 (2005) [24];
- Placing the Radiological Health Hazard in Perspective in an Emergency due to Severe Conditions at a Light Water Reactor, www-ns.iaea.org/downloads/iec/health-hazard-perspec-charts2013.pdf [25].
- INES: The International Nuclear and Radiological Event Scale, User's Manual, (co-sponsored by IAEA and OECD/NEA), 2008 Edition [26];
- The Use of the International Nuclear and Radiological Event Scale (INES) for Event Communication (2014) [27].

Depending on the nature of the emergency, additional IAEA publications are available which contain technical information that could support the IAEA assessment and/or prognosis. Such IAEA publications are referenced as needed during an emergency. Any use of a technical reference will be indicated in the IAEA assessment to clearly identify the basis for the respective part of the assessment.

2.2. IAEA roles during a nuclear or radiological emergency

The IAEA's roles during a nuclear or radiological emergency

The IAEA has five roles during the response to a nuclear or radiological emergency, irrespective of its cause:

1. Provision of notification, exchanging and sharing official information with States and international organizations;
2. Performing assessment of potential consequences and prognosis of likely emergency progression;
3. Timely coordination and provision of assistance or advice, upon request, to States/international organizations;
4. Provision of timely, clear, factually correct, objective, consistent and easily understandable public information;
5. Coordination of the interagency response.

Incident and Emergency System

The IAEA fulfils its roles through its Incident and Emergency System (IES) and the IEC. The IEC is the IAEA's focal point for nuclear and radiological emergency preparedness and response and the custodian of the IES.

The IAEA emergency response is organized through: (1) a 24/7 warning point; (2) an on-call system; (3) an on-duty system; and (4) an IES Steering Group.

The Security Control Centre (SCC), which is located in the Vienna International Centre, serves as an integrated 24/7 warning point and telecommunications backup for the IAEA's IEC.

Media and public requests for information are dealt with by the IAEA's Office of Public Information and Communication (OPIC): www.iaea.org/press

The on-call system ensures that the initial response to any incoming message is timely and adequate. The following on-call officers are available on a 24/7 basis to facilitate and coordinate the initial response: an emergency response manager (ERM); a nuclear installation specialist; a radiation safety specialist; a nuclear security specialist; an external event specialist; a public information officer; and a logistics support officer.

The on-duty system ensures that the IAEA Secretariat's response is effective and commensurate with the nature and magnitude of the emergency. It is managed from only one focal point within the IAEA Secretariat — the IEC. It consists of three modes of operations (activation levels), a set of response functions and a roster of trained staff members.

The IES Steering Group oversees the IAEA Secretariat's response and guides the response on matters of policy.

In order to ensure a coordinated response, all response actions, including the provision of assistance, are performed within the IES.

2.3. Actions of the Accident State(s) related to the IAEA assessment and prognosis process

For IAEA's assessment and prognosis to be successful, it is necessary that the Accident State(s):

- Provide in a timely manner the technical information on the current situation and the emergency response activities; and
- Provide the feedback on IAEA assessment and prognosis outputs as they are made available for comments to the Accident State(s).

The provision of information is implemented on an obligatory or voluntary basis, depending on the relevance of the event to the specific articles of the Early Notification Convention [6].

2.4. Actions of other Member States related to the IAEA assessment and prognosis process

Member State support through RANET

During the response to a nuclear or radiological emergency, other Member States with pre-identified advanced assessment capabilities registered in RANET may support the IAEA assessment and prognosis, by the IAEA's request. Member States with advanced assessment capabilities may register within the appropriate area in the IAEA's Response and Assistance Network (RANET) [8] and are invited to participate in exercises to practise and evaluate this process.

IRMIS

Other Member States may also share data with the IAEA, on a voluntary basis, to support the IAEA assessment and prognosis process. For example, radiation measurement data to determine the extent of the spread of a radioactive plume may be needed from other Member States during an emergency involving a radioactive release. The IAEA has developed an International Radiation Monitoring Information System (IRMIS) for the purpose of providing and sharing such data [28].

2.5. Actions of international organizations related to the IAEA assessment and prognosis process

During the response to a nuclear or radiological emergency, relevant international organizations may be requested to support the IAEA assessment and prognosis. Such support may be provided according to the roles and responsibilities of the relevant international organizations, as described in EPR–JPLAN 2017 [9] and, as the case may be, in the interagency arrangements and procedures. The support for the IAEA

assessment and prognosis could be activated following the communication procedures outlined in EPR–JPLAN 2017 [9] and in EPR–IEComm (2019) [5].

In support of the IAEA assessment and prognosis, surveys of protective and other response actions decided or recommended by governments, other than the government of the Accident State, are performed by the OECD/NEA. The IAEA posts the results of these surveys on USIE.

Section 3

3. CONCEPT OF OPERATIONS FOR THE IAEA ASSESSMENT AND PROGNOSIS

Concept of operations

The following actions, which are consistent with and part of the overall process defined in EPR–IEComm 2019 [5], need to be taken during the IAEA assessment and prognosis process:

- Reviewing authenticated and verified information regarding the nuclear or radiological emergency;
- Gathering information from existing IAEA resources, databases and tools regarding the facility or facilities, activity or activities, sources and/or other materials involved in the emergency, thereby reducing the need of the Accident State to provide such information during its response activities;
- Reviewing reference material from IAEA Safety Standards, technical guidance and assessment and prognosis tools that may be applicable to a given emergency;
- Determining if any additional information is needed for a clear understanding of the situation and the response activities conducted or planned by the Accident State;
- Requesting additional information from the Accident State as needed to perform assessment and prognosis;
- Conducting the assessment and prognosis of the nuclear or radiological emergency using reference materials such as IAEA Safety Standards, technical guidance and assessment and prognosis tools;
- Developing a message harmonized between the Accident State, the IAEA Secretariat and any Member State(s) supporting the process for dissemination among IAEA Member States, the public and the media;
- Developing a technical statement harmonized between the Accident State, the IAEA Secretariat and any Member State(s) supporting the process — using an appropriate level of detail and language to describe the conclusions reached — to be disseminated through:

- IAEA emergency communication channels (e.g. USIE);
- IAEA public communication channels;
- Other IAEA communication channels as needed (for example, Member States' briefings conducted at IAEA Headquarters during an emergency).

- Repeating the described process as the situation develops and additional information becomes available.

These actions have been developed into a process that is outlined fully in Section 4

Section 4

4. IAEA ASSESSMENT AND PROGNOSIS PROCESS

4.1. Process of performing the IAEA assessment and prognosis

The IAEA assessment and prognosis process is summarized in Fig. 1. This process builds on the existing international emergency preparedness and response framework and is based on the IAEA Secretariat's capabilities, complemented by Member States' capabilities through RANET and/or other arrangements.

Assessment and prognosis process summary

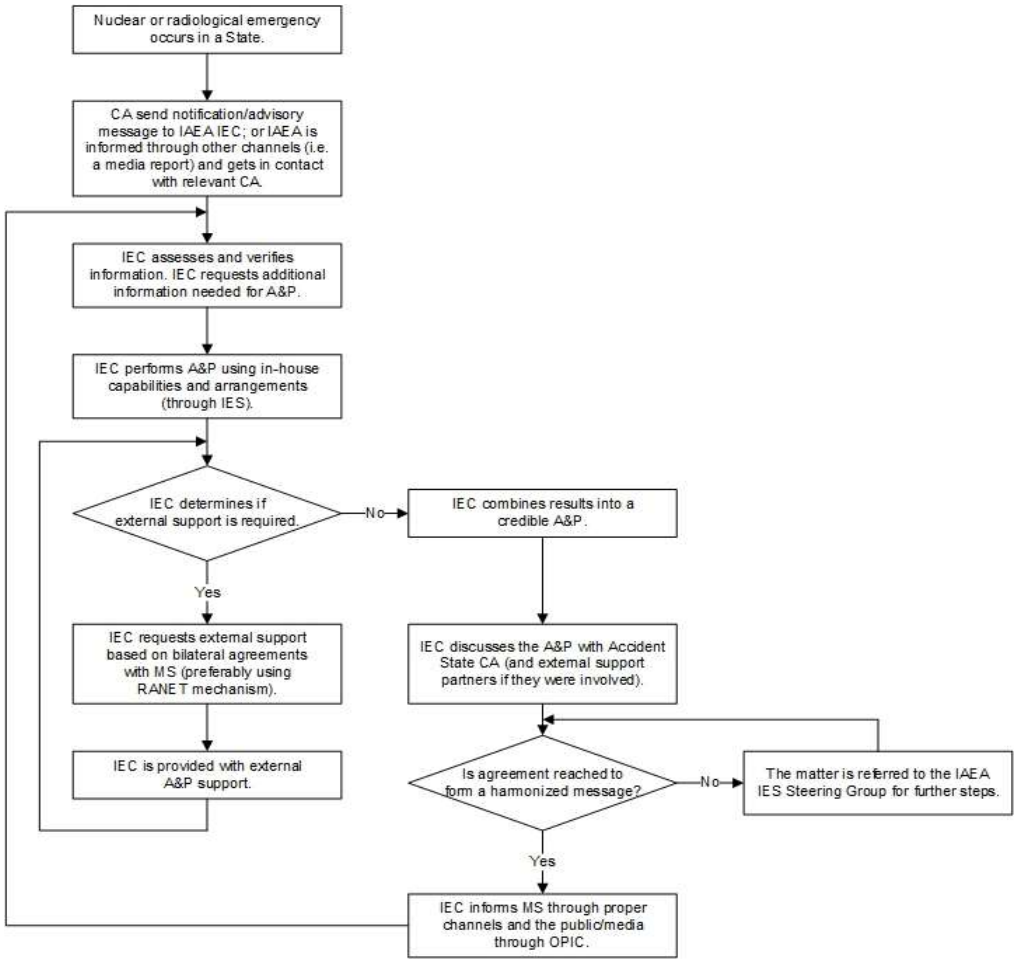

FIG. 1. Summary of the IAEA assessment and prognosis process.

4.1.1. Initiating the process

The assessment and prognosis process is initiated at the IAEA once notification or information of an emergency has been received through the emergency communication channels. However, it is also possible that the IAEA assessment and prognosis process is initiated following a request for information from a Member State (other than the Member State in which the emergency occurs) or from the media. In that case, the first action of the IAEA will be to contact the Member State in which the emergency occurs to request information regarding the event.

Activation on notification

Upon notification of a potential or actual nuclear or radiological emergency, the IAEA responds according to the procedures detailed in EPR–IEComm (2019) [5]. This includes declaring an elevated activation level[14], such as basic or full response mode, if needed. At these levels of activation, trained IAEA technical experts responsible for the conduct of the assessment and prognosis activities start their work as part of the technical team within the Incident and Emergency System (IES).

4.1.2. Initial assessment and prognosis

Internal capabilities

The IAEA Secretariat performs its assessment and prognosis on the basis of information received from the Accident State, using its own resources and capabilities. The assessment employs reference materials such as IAEA Safety Standards, technical guidance and assessment and prognosis tools. The IAEA process is carried out in accordance with procedural flowcharts developed by the IAEA. These procedures are regularly updated and shared with IAEA CPs, which are also notified when IAEA Safety Standards and technical guidance are updated.

4.1.3. Exchanging technical information

Emergency communication channels

The IAEA receives information through the following emergency communication channels:

- Emergency website — USIE;
- Telephone;
- Facsimile;
- Electronic mail;
- Video conferencing.

The information received through the above mentioned channels is supplemented with data shared on IRMIS.

As information is received by the IAEA, it is evaluated to determine if it is comprehensive enough to carry out the IAEA assessment and prognosis or if additional information is required. If follow-up information is required, the IAEA contacts the Accident State and requests that this data be provided through the emergency communication channels. The preferred channel for short communication follow-ups is the direct telephone contact with the competent authorities (CAs) in the Accident State. During discussions with the Accident State, the IAEA clarifies the Accident State's preferred communication channel that should be used to comment in a timely manner on any outputs of the assessment and prognosis process.

[14] These levels are defined in EPR–IEComm (2019) [5].

IAEA assessment and prognosis tools

During a nuclear or radiological emergency, such as a nuclear emergency at an NPP, it is possible for an Accident State to exchange technical information with the IAEA by sharing the specific output which can be obtained using the IAEA assessment and prognosis tools.[15] In its first request for technical information for the purpose of assessment and prognosis, the IAEA asks its counterparts if they are able to use the IAEA assessment and prognosis tools on the IAEA's IEC Assessment and Prognosis Tools website to generate the specific output.

External use of IAEA assessment and prognosis tools

The IAEA asks its counterparts to use the relevant tool for the specific emergency scenario (for example, the reactor assessment tool during an NPP emergency) and to provide the output report via an emergency communication channel (e.g. USIE), **if this is possible**.

If the IAEA counterpart cannot provide the output report from the IAEA assessment and prognosis tool relevant to the specific emergency scenario via an emergency communication channel, the IAEA will continue to request technical information by following the procedures documented in EPR–IEComm 2019 [5]. The technical information received is used as input for the IAEA assessment and prognosis tool which is relevant for the specific emergency scenario.

Early on during an emergency, the IAEA consults with the Accident State's CPs and agrees on the expected frequency of information updates. The purpose of this discussion is to manage the expectations by both the IAEA and the Accident State regarding the frequency of communications. An update provided at an agreed frequency could be a simple message indicating **'No change'** — for example, with respect to areas such as protective actions, other response actions or on-site mitigatory actions.

4.1.4. External support mechanism

RANET

The IAEA Secretariat begins its own assessment using its internal capabilities as soon as it has been notified. However, when required, it is also supported by pre-identified assessment capabilities in Member States. The IAEA Secretariat provides these Member States with the input data received from the Accident State, requesting assessment of the situation and prognosis of the likely progression. Member States with pre-identified advanced assessment capabilities that are able to support this process are encouraged to register their capabilities in RANET [8][16] during the preparedness stage.

During an emergency, if external support is needed, the IAEA alerts the appropriate NWP(s) and requests coordination with the relevant coordinator(s) of the CAs and the National Assistance Capabilities (NACs)[17]. The CA/NAC coordinator(s) inform(s) the IEC about the availability of resources for assistance; if required, the resources are then placed on standby or activated to provide the required support. The IAEA discusses technical information requirements, time frame requirements and the appropriate communication process for this support at that time.[18]

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[15] As pointed out previously, a link to the IAE's IEC Assessment and Prognosis Tools website is available in USIE, but access can also be granted to relevant stakeholders upon request.

[16] To avoid creating a new registration system for Member State capabilities, Member States registered in certain RANET functional areas are asked if they are able to support the IAEA assessment and prognosis process, if feasible, during a nuclear or radiological emergency on a case by case basis.

[17] An NAC coordinator appointed by the State or international organization is the IAEA IEC's single official RANET contact point.

[18] This part of the procedure is identical to the regular RANET process, presented in Ref. [8], for providing assistance to a requesting Member State.

If a Member State requests a modified/different activation process of an NAC for the purpose of supporting the IAEA in its assessment and prognosis process, the matter will be discussed and agreed between the IAEA and the Member State offering assistance. Such situations could include, for example, an offer to consider providing support for the assessment of certain reactor technologies for which the NAC has unique technical expertise.

4.1.5. Compilation of results between IAEA and supporting Member State(s)[19]

Harmonization with assisting parties

Once the initial assessment and prognosis results are available, the IAEA Secretariat contacts all Member States that are supporting the process. The IAEA leads discussions and compiles a joint message in the form and content of a draft IAEA Status Summary Report (SSR) and/or a draft IAEA public statement, based on the results of all assessments and prognoses. After all parties have discussed the joint message, the IAEA approaches the Accident State for the development of a final harmonized message.[20]

4.1.6. Developing a harmonized message with the Accident State

Harmonization with Accident State

The IAEA contacts the Accident State through official channels (email to the emergency address provided or an alternative channel previously indicated by a CP) and presents the output(s) of its assessment and prognosis process in the form of a draft IAEA SSR and/or a draft IAEA public statement.

The elaborations of both the draft IAEA SSR and/or the draft IAEA public statement are time sensitive. It is expected that the personnel of the designated emergency channels who communicate with the IAEA have established procedures in place to review and provide comments on these documents in a timely manner. CPs are expected to:

- Acknowledge initial receipt of the document(s);
- Provide their response via email or direct telephone communication **in a prompt manner** after acknowledging receipt.[21]

Special note: If the assessment of the situation by the IAEA (and any supporting parties) results in specific concerns with regard to public protective actions or other response actions, the IAEA immediately contacts the Accident State for clarification following the major comment resolution process (see below). As emergency response is a national responsibility, such concerns would be brought to the immediate attention and consideration of the counterparts at the Accident State's CPs for bilateral[22] discussions with the IAEA.

4.1.7. Mechanism for resolving issues with the harmonized message

Comments received from the Accident State regarding the output of the assessment and prognosis produced by the IAEA are reviewed and classified as either minor or major comments.

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[19] If applicable.

[20] If a supporting Member State is unable to agree to a joint message, the support that it rendered to the assessment and prognosis process will not be mentioned or included in the agreement of those States and/or organizations which supported the assessment.

[21] Thirty minutes is the suggested default response time. Depending on the nature of the assessment and/or the evolution of the event, both sides may agree to change this response time objective.

[22] If the IAEA's assessment was supported by any Member States, they may also be included in the discussion to help explain the basis of the specific concern.

Minor comment resolution process

Minor comments include, for example, such issues as updating technical data of the latest information available at the Accident State counterpart. These comments are directly addressed as indicated, and no follow-up clarification between the Accident State and the IAEA Secretariat takes place.

Once corrected, the IAEA Secretariat publishes the SSR on USIE and/or issues the public statement on the IAEA website.

Major comment resolution process

Major comments are those which require further clarification between the Accident State and the IAEA Secretariat in order for the final text to adequately present the situation. Examples include a clear understanding of the basis for the emergency classification, protective actions and the decision making process in the Accident State. These comments are reviewed by the IAEA Secretariat; if necessary, they are also reviewed by any supporting Member State(s) that provided input to the SSR.

The IAEA Secretariat contacts the Accident State using the established emergency communication channels[23] and may ask to be put in direct contact with the group that reviewed the IAEA assessment and prognosis in order to address the major comment(s). Using video conferencing or telephone communication to discuss the issue(s), an effort is made to reach a harmonized position.

If a clear understanding is reached, any necessary corrections are made to the SSR. The discussion also addresses the question of whether the SSR needs to be reviewed again by the (technical) counterparts of the IAEA CPs in the Accident State after the corrections have been made.

If the comments remain unresolved, they are submitted to the IAEA's IES Steering Group headed by the Director General of the IAEA, which seeks to resolve the issue through consultations at the appropriate decision making levels in the Accident State.

4.1.8. Delivery of information to IAEA Contact Points, the media and the public

Communication with CPs, the media and the public

According to the communication procedures outlined in EPR–IEComm (2019) [5]:

- SSR and public statement for which a consensus has been reached are shared with the IAEA CPs;
- Public statement for which a consensus has been reached is shared with the media and the public.

4.1.9. Feedback process for continual reassessment as the situation develops

Continual process

As the emergency further develops, the process is repeated as needed at a frequency commensurate with the evolution of the event.

4.2. Expected output of the IAEA assessment and prognosis process

The output of the IAEA assessment and prognosis process includes IAEA SSRs and/or IAEA public statements that explain the result of the assessment in language appropriate for the target audience. These reports and public statements typically

[23] As described in EPR–IEComm (2019) [5].

include sections on the status of the event facility or facilities, the radiological conditions (on-site and off-site), actions implemented on-site to protect workers and responders, and the public protective actions that have been implemented.

4.3. The IAEA assessment and prognosis process within the implementation of the IAEA's response roles

No impact on regular updating of information

The assessment and prognosis process does not delay or otherwise impact the regular sharing of information that is submitted via USIE as indicated in EPR–IEComm (2019) [5].

The IAEA makes every attempt to ensure that any assessment and prognosis is shared through the emergency communication channels with other Member States as soon as it has gone through the process indicated in Section 4.1.

TABLE 1 outlines a generic example of the assessment and prognosis process during the overall response to a General Emergency at a nuclear installation as described in EPR–IEComm (2019) [5]. The specific points related to the IAEA assessment and prognosis process have been rendered in bold. The response to any other type of nuclear or radiological emergency follows a similar pattern.

TABLE 1. ACTIONS BY THE IAEA AND CONTACT POINTS DURING THE RESPONSE TO A GENERAL EMERGENCY AT A NUCLEAR INSTALLATION AS DESCRIBED IN EPR–IEComm (2019)***** [5]

	GENERAL EMERGENCY	
	ACTIONS BY CPs	**ACTIONS BY THE IEC**
Notification or initial advisory message From notifying / reporting State	CA(D) sends notification/advisory message to the IEC's primary emergency fax or email using EMERCON GENF, possibly with attachments and/or URL of its own website, or submits the notification using an EMERCON GENF to USIE.	Acknowledges the notification/advisory message on USIE.
	Response time objective: within 2 hours[24] after receiving information on a General Emergency.	*Response time objective:* within 15 minutes after receiving the notification/advisory message.
	CA(D) calls the IEC on the primary emergency telephone to confirm receipt of the notification/advisory message if no acknowledgment from IEC has been received.	Calls the designated CA(D) of the notifying/reporting State on the primary emergency telephone to authenticate and verify the content of the notification/advisory message.
	Response time objective: 30 minutes after the notification/advisory message was sent by CA(D).	*Response time objective:* within 30 minutes after receiving the EMERCON GENF.
		Offers the IAEA's good offices to the notifying/reporting State. Establishes 24/7 response mode (Full Response Mode), including dedicated telephone and email connections with the notifying/reporting State. **Activates a technical team composed of experts in nuclear installation safety, radiation safety and nuclear security, who will review the technical information received using internal procedures and the tools available on the IAEA's IEC Assessment and Prognosis Tools website.**
	Note: Receipt of an alert message requires the CP to activate the alert channels on USIE on the 'Organizational Preferences' tab in USIE/Settings, as described in the USIE User Manual [29].	Publishes the notification/advisory message on USIE, including any attachments and/or links to the notifying/reporting State's website. Sends an alert message via the USIE alert channels to the NWPs and CA(A)s of States within 1000 km of a nuclear power plant, or within 50 km of a research reactor, requesting them to confirm receipt of the notification/advisory message on USIE.

*** Text in bold refers to points related to the IAEA assessment and prognosis process.**

[24] The CA(D) is encouraged to send the notification to the neighbouring countries immediately after receiving it from the operator.

GENERAL EMERGENCY	
ACTIONS BY CPs	**ACTIONS BY THE IEC**
	Informs relevant international organizations. Sends a copy of the notification/advisory message to all CPs by primary emergency fax/email. **Note:** The primary emergency fax/email list contains the preferred primary emergency communication channel as indicated in the USIE Address Book for each CP.
	Offers the IAEA's good offices to potentially affected States. Contacts the NWPs of States within 1000 km of a nuclear power plant, or within 50 km of a research reactor, that have not confirmed receipt of the notification/advisory message either on USIE or by message to the IEC's primary emergency fax, email or telephone, and establishes a dedicated telephone contact with relevant CA(A)s. Establishes separate telephone liaison with CAs of other States or States' PMs to the IAEA and relevant international organizations.
Provides the IAEA with the technical information needed for the assessment and prognosis (if information is available). Ideally, this would be performed through direct phone communication between the IAEA and a technical person within the official CP's organization. If possible, this could include using IAEA Assessment and Prognosis tools and sharing the output with the IAEA.	**After technical review of the content shared, re-establishes direct contact with the CA(D) via telephone to request additional information (if needed) to support IAEA assessment and prognosis. This call will be kept short (ideally, a maximum of 5 minutes) and will be conducted by a team of technical experts at the IAEA seeking to speak to a team of technical experts in the Accident State.**
Further information exchange From notifying / reporting State	
CA(D) periodically sends further relevant information to IEC's primary emergency fax or email on EMERCON GENF or EMERCON SRF, or submits the forms to USIE, possibly with attachments and/or URL of its own emergency website. IRMIS Data Provider(s) upload(s) the monitoring data in IRMIS if applicable.	Periodically distributes further information to all CPs' primary emergency fax/email. Publishes follow-up information on USIE, including any attachments and/or URL of the notifying/reporting State's website.

	GENERAL EMERGENCY	
	ACTIONS BY CPs	**ACTIONS BY THE IEC**
	Note: If applicable, CA(A)/CA(D), through the Encrypted Information Publisher(s) designated in their organizations, submit encrypted information that may be relevant for other States on EMERCON SRF to USIE.	
	Response time objective: not later than 4 hours after notification/advisory message was sent.	
Meteorological products from notifying/reporting State	CA(D) may generate national meteorological products or request these from the appropriate WMO RSMC[25]; CA(D) sends the results to the IEC's primary emergency email or submits these as attachment on an EMERCON GENF to USIE.	Requests and receives meteorological products from relevant WMO RSMC(s). Publishes meteorological products on USIE.
Information from potentially affected States	*State from which information is requested* CA(A) sends relevant information and the URL of the national website on EMERCON SRF to the IEC's primary emergency fax or email, or submits the form to USIE, or sends the URL of the national emergency website providing the relevant information to the IEC's primary emergency email. IRMIS Data Provider(s) upload(s) the monitoring data in IRMIS if applicable.	Requests the required information from the State. Sends a message to the primary emergency fax or email of the CA(A) of other States within 1000 km of an NPP, or within 50 km of a research reactor, requesting to provide — on EMERCON SRF — information about protective actions taken or planned and a summary of radiation monitoring data that could be of relevance for the protective actions taken or planned.
Requests for information from other States	*State requesting information* The CA(A) or the State's PM requests information via message to the IEC's primary emergency fax, email or telephone, or submits an EMERCON RFI to USIE.	Compiles requests and distributes answers to CPs requesting the information to their primary emergency fax, email or by the telephone.
	State(s) from which information is requested The CA(D) of the notifying/reporting State, or the CA(A) of other relevant States, sends replies to the IEC's primary emergency fax or email, or provides answers by telephone or submits the requested information to USIE.	**Note:** If several States request the same type of information or if there is a need to counteract false rumours, the IEC sends a message to the CA(A)s' primary emergency fax/email of all States, or publishes the information on USIE.

[25] Regional Specialized Meteorological Centre. At present, there are eight RSMCs, which operate sophisticated atmospheric simulation models to provide information on actual and anticipated atmospheric transport, dispersion and deposition of airborne radioactivity. Their locations are: Exeter and Toulouse (for Europe and Africa); Washington, DC, and Montreal (for North, Central and South America); Beijing, Obninsk and Tokyo (for Asia); and Melbourne (for South West Pacific) [7].

	GENERAL EMERGENCY	
	ACTIONS BY CPs	**ACTIONS BY THE IEC**
Assessment and prognosis	The notifying/reporting State sends relevant and available information to the IEC's primary emergency fax or email or submits the information as an attachment to an EMERCON GENF to USIE for assessment and prognosis.	Reviews the information received.
	Note: If possible, this includes the results of State assessment and prognosis and results from IAEA assessment and prognosis tools application.	Establishes direct contact with the CA(D) to request additional information (if needed) via the primary emergency telephone.
	Reviews the SSR and identifies any changes that may be required. If there are areas of significant concern, immediately contacts the IAEA for discussion.	**Compiles and analyses information; assesses the potential consequences and prognosis of the likely development of the event; discusses the results with the notifying/reporting State; sends a summary to all CPs' primary emergency fax/email and publishes the information on USIE.** Establishes links to other States' emergency websites on USIE. Contacts States registered in RANET on their primary emergency fax/email about the availability of their resources to provide support for the IAEA assessment and prognosis, as required. Acts as described in Section 4.4 of this manual. **Discusses with the CA(D)s of the Accident State and supporting States any requested changes to the SSR and implements them in the report as required.** **Sends the SSR to all CPs and publishes it on USIE.**
Provision of advice or assistance	CAs or the State's PM may send a request for assistance to the IECs primary emergency fax or email using EMERCON RFA, or submit the request to USIE (see Section 4.5 of EPR–IEComm (2019) [5]).	Acknowledges the request for assistance and verifies the content. Assesses the request and contacts the requesting State on their primary emergency telephone. Becomes the focal point for the facilitation and coordination of international assistance. Acts as described in Section 4.5 of EPR–IEComm (2019) [5].

	GENERAL EMERGENCY	
	ACTIONS BY CPs	**ACTIONS BY THE IEC**
Assistance Action Plan	*Requesting and providing States*	
	Review and revise the Assistance Action Plan and associated documents, as applicable, and sign them off.	Drafts an Assistance Action Plan and associated documents as described in EPR–RANET 2018 [8] and provides them to all involved CPs on their primary emergency fax/email.
	Requesting State	
	Supports the implementation of assistance.	Facilitates and coordinates implementation of assistance.
Provision of public information	CA(D) sends copies of any press releases or URLs of relevant public websites to the IEC's primary emergency fax or email, or submits these to USIE. INES National Officer(s) of the notifying State may submit INES Event Rating Forms (ERFs) on USIE in coordination with relevant CAs.[26]	Publishes press release and/or URLs on USIE. **IAEA:** May publish public statement(s) on the IAEA's public website.
Inter-agency coordination	CPs, in accordance with their mandates, may establish relevant links and communication channels with their MSs (including respective national focal points), other competent organizations or agencies, regional centres and programmes. May send any additional/specific information in relation to the emergency that they may be aware of.	Triggers the activation of the JPLAN and acts as the focal point for response coordination.
Additional response actions if the emergency is triggered, or suspected of being triggered, by nuclear security event(s)	CA(A)/CA(D) and/or CAOC may use the EMERCON SRF on USIE to share encrypted information — such as sensitive and/or nuclear security related information — that may be relevant to other States. (The text provided in the 'Other relevant information' section of the EMERCON SRF can be encrypted to allow confidential information to be shared.)	Authenticates and verifies the message and contacts CA(A)/CA(D) and/or CAOC. May establish liaison with EUROPOL, INTERPOL and/or other relevant international organizations as per JPLAN and its provisions.[27] May inform relevant CPs on their primary emergency fax/email that encrypted information is available on USIE.

[26] The ERF is submitted when relevant information about the event is available and according to the national plan of using INES for communication in emergencies.

[27] Respecting instructions from the notifying State with due regard to the principle of protection of sensitive information.

GENERAL EMERGENCY	
ACTIONS BY CPs	**ACTIONS BY THE IEC**
Termination of emergency The CA(D) sends information about termination of the nuclear emergency and for transition to an existing/planned exposure situation using the EMERCON GENF to the IEC's primary emergency fax or email or submits the form to USIE. The CA(D) calls the IEC on its primary emergency telephone to confirm receipt of the message.	Publishes the information on USIE. Informs all CPs on their primary emergency fax/email about the termination of the emergency.

4.4. Relevant exercises during the preparedness phase

ConvEx-2e

Standard exercises are prepared, performed and evaluated to test key response objectives within the scheme described in EPR–IEComm (2019) [5].

To test the IAEA's assessment and prognosis process and to practise its implementation, the IAEA, in 2014, established ConvEx-2e exercises.

Flexible scope depending on the scenario

This exercise is conducted at the discretion of CPs. Upon request and with advance notification, the IEC participates[28] in exercises (generally national level exercises) to practise and test the assessment and prognosis process.[29] The scope of the exercise is agreed between the IEC and the participating State(s). The scope may include some or all of the following types of activities:

- The IEC reviews messages submitted on the USIE Exercise website for technical content, verifies the information and requests additional data needed for the IAEA assessment and prognosis.
- Based on information provided by the Accident State, the IEC generates an IAEA SSR and/or a press release containing the outputs of the IAEA assessment and prognosis process.
- Member States support the development of IAEA assessment and prognosis through established mechanisms (e.g. RANET), if agreed and arranged in advance.
- The Accident State reviews IAEA assessment and prognosis outputs and provides comments to the IEC, if any, within the expected time frames.
- The IEC discusses the simulated release of a harmonized message with the Accident State and simulates its publication through relevant channels.

[28] The IEC makes every effort to participate in exercises to which it is invited. However, due to limited resources, or if the lead time provided is insufficient, the IEC may not be able to participate in all exercises.

[29] Other activities outside of the IAEA's assessment and prognosis process can also be tested if requested.

Invitation process

Interested Member States are encouraged to consider inviting the IEC to any appropriate exercise to become familiar with and practise the IAEA's assessment and prognosis process. Invitations can be made through the routine emergency communication channels provided in EPR–IEComm (2019) [5].

4.5. IAEA Contact Points and their functions during the IAEA assessment and prognosis process

Emergency communication procedures are detailed in EPR–IEComm (2019) [5]. Table 2 summarizes the roles and the functions of each CP, as outlined EPR–IEComm (2019) [5], in supporting the IAEA's assessment and prognosis process described in this manual.

TABLE 2. IAEA EMERGENCY CONTACT POINTS AND THEIR CORRESPONDING TASKS DURING THE IAEA ASSESSMENT AND PROGNOSIS PROCESS

IAEA CPs	Key functions as described in EPR–IEComm 2019	Key functions relating to the IAEA assessment and prognosis process
IEC IAEA Incident and Emergency Centre	The IAEA's focal point for emergency preparedness and response to a nuclear and radiological incident or emergency, irrespective of its origin; also the custodian of the IES.	Implementing the operational procedures described in this manual. Maintaining the IAEA's IEC Assessment and Prognosis Tools website.
NWP National Warning Point	A single institution in a State that is designated by its Government and authorized to receive a notification/initial advisory/follow-up message, a request for/offer of assistance and a request for information or verification. It is available 24/7 to act immediately upon receiving the message.	No specific functions are required.
CA(D) Competent Authority for a Domestic Emergency	One or more institutions within a State designated by their Governments and authorized to issue, as appropriate, a notification/initial advisory/follow-up message, a request for/offer of assistance and a request for information or verification; they are also authorized to reply to a request for information or verification regarding a nuclear or radiological emergency originating at a facility or activity under the jurisdiction of that State.	Provide the technical information required, as described in the Appendix. This task will need to address situations in which the information needed is available from another organization within the country (example: an operator of an NPP). Quickly review and provide feedback on the IAEA assessment and prognosis outputs, as described in Section 4.1.6. This task will require any other arrangements for national

IAEA CPs	Key functions as described in EPR–IEComm 2019	Key functions relating to the IAEA assessment and prognosis process
		Government approval to be considered. If, during the review of any IAEA assessment and prognosis output, an issue is identified, this organization will need to have the capability for a technical reviewer to communicate with the IAEA technical team to review and discuss the issue.
CA(A) Competent Authority for an Emergency Abroad	A single institution within a State designated by its Government and authorized to receive a notification/initial advisory/follow-up message, a request for/offer of assistance and a request for information or verification; it may also issue follow-up messages, a request for/offer of assistance and a request for information or verification regarding a nuclear or radiological emergency originating in another State.	Provide the technical information required, as described in the Appendix. If this organization is supporting the IAEA assessment and prognosis process by providing expertise, the CA(A) will need to have the capability for a technical reviewer to communicate with the IAEA technical team to review and discuss the issue.
CAOC Competent Authority for other Conventions	An institution designated as a contact point under other relevant conventions. See Section 3.2.4 of EPR–IEComm (2019).	Provide technical information relevant to the emergency for events within the scope of other conventions.
INES National Officers	One or more specialists within a State designated by their respective Governments and authorized to perform an INES rating of an event in accordance with the INES methodology and to post the event rating on USIE by using the ERF.	No specific functions are required.
IRMIS Data Providers	One or more technical organizations within a State authorized by the CA to report radiation monitoring data (routine and emergency) on IRMIS.	Provide technical information concerning the off-site monitoring data situation in a timely manner, which is needed as part of the IAEA assessment and prognosis process.
State's PM to the IAEA Permanent Mission of a	The State's PM to the IAEA receives copies of relevant communications sent from the IEC to its State's CPs, as appropriate, and it may have read-only access to the USIE website. The	No specific functions are required.

IAEA CPs	Key functions as described in EPR–IEComm 2019	Key functions relating to the IAEA assessment and prognosis process
State to the IAEA	State's PM is requested to assist in the event of communication problems between the IEC and the State and to assist if the State has not yet nominated an NWP or CAs. It also assists with matters such as obtaining visas for personnel entering the State and with customs clearance for equipment being brought into the State as part of providing assistance, if requested.	
CPs in international organizations	The officially designated CPs in international organizations within the framework of the JPLAN [9].	If possible, provide support to the IAEA's assessment and prognosis in accordance with agreed arrangements for the organization's area of specialization.

APPENDIX: INFORMATION TO BE EXCHANGED

A.1. Background

For the IAEA's assessment and prognosis to be performed during a nuclear or radiological emergency, information is needed concerning the situation at the event location (on-site) and/or in the surrounding area where members of the public are located (off-site). The IAEA will rely on the authorities of the Accident State to provide this information. The type of information that needs to be exchanged depends on the nuclear or radiological material/technology involved and on the emergency scenario.

To minimize the information that needs to be exchanged at the time of the response, certain information needs to be shared during activities in the preparedness phase. This requires identifying the information that can be shared at the preparedness stage (e.g. the details of a nuclear facility) and the information that can only be shared during the response phase (e.g. actions taken in response to an emergency, the status of a safety system, etc.). These two categories of information are termed 'Static Technical Parameters' and 'Dynamic Information'.

For assessment and prognosis outputs to be produced within a reasonable time frame, information needs to be shared in a timely manner and through existing communication channels. This requires procedures and plans to be in place at all levels: on-site, off-site and at the national level. This information will come to the IAEA from the designated CA (or CAs) or a party designated by a CA as being able to provide this information during an emergency.[30]

A.2. Static Technical Parameters

Static Technical Parameters

The term 'Static Technical Parameters' refers to all the information that can be shared at the preparedness stage involving nuclear and radiological technologies and national emergency response arrangements. This information would be specifically relevant to support an assessment or prognosis and includes:

- Diagrams of the technology needed to communicate the output of an assessment or prognosis (e.g. a diagram of a radiography device or the configuration of a system within a power reactor);
- Normal operational parameters of the technology (e.g. a description of the use of the technology during normal practices or the normal operating range of a system, such as the temperature of the primary circuit within a power reactor);

[30] Such as a technical support organization, which is not an officially designated CA but has been authorized by the CA to provide such information to the IAEA during an emergency.

- Key emergency operational parameters (e.g. conditions such as the temperature at which a system is susceptible to failure; the design pressure of the containment for a power reactor);

- Details of the emergency response plans for the organization(s) that use the technology to allow external parties to understand the response actions being implemented.

IAEA resources

Several different IAEA databases exist that have Static Technical Parameters and other information that may be useful during a nuclear or radiological emergency, depending on the scenario. When needed, these databases will be used as a reference by the IAEA during the conduct of its assessment and prognosis. Each database has its own specific purpose.

EPRIMS

- Emergency Preparedness and Response Information Management System.

  The Emergency Preparedness and Response Information Management System (EPRIMS) is an interactive, web based tool for Member States to share information on their national arrangements for emergency preparedness and response to nuclear or radiological emergencies. During a nuclear or radiological emergency, EPRIMS may be referenced by technical users at the IAEA to review information on the national response arrangements and look up terminology, e.g. the applied emergency classification schema being used.

EPRIMS RTI

- EPRIMS Reactor Technical Information Database

  EPRIMS contains a knowledge management database of static nuclear reactor technical information (RTI). During preparedness activities, Member States are able to provide technical information regarding their nuclear power reactors, including technical schematics and figures, which can be used during an emergency for improving communication with the public. This information will be leveraged by the IES Technical Team for the conduct of assessment and prognosis activities to minimize information sharing requests to the accident. To ease the population of this database and reduce overhead for Member States, the RTI has been partly prepopulated using data available on the IAEA Power Reactor Information System (PRIS)[31] database. The data structure of the EPRIMS RTI is provided in an annex to the Technical Guide for IAEA Assessment and Prognosis during a Nuclear or Radiological Emergency, which is available on the IAEA IEC Assessment and Prognosis Tools website (see Section A.4 below).

RRDB

- Research Reactor Database

  The Research Reactor Database (RRDB) is an online application that stores information on research reactors all over the world. RRDB contains inherent

[31] The Power Reactor Information System (PRIS), developed and maintained by the IAEA for over five decades, is a comprehensive database focusing on nuclear power plants worldwide. PRIS contains information on power reactors that are in operation, under construction or being decommissioned. Technical information in PRIS is automatically shared in EPRIMS RTI. See www.iaea.org/pris

features of research reactors, which vary in terms of neutron flux, power level, core configuration, type of fuel used and schedules of operations. RRDB is used by a large audience in the Member States.

ICSRS

- International Catalogue of Sealed Radioactive Sources and Devices

  The International Catalogue of Sealed Radioactive Sources and Devices (ICSRS) contains key manufacturing data for source and device models. ICSRS can help identify the model of an individual source or device and provide information on the manufacturer, application area and threat level associated with a source model. The information provided by ICSRS can, therefore, help in the safe handling of a given source or device. Note that it does not contain a list of actual physical sources or devices with their serial number, owner or location.

DIRAC

- DIrectory of RAdiotherapy Centres[32]

  The DIrectory of RAdiotherapy Centres (DIRAC) database contains information related to available teletherapy and brachytherapy machines in hospitals and clinical institutions worldwide. Based on an assessment of the information in DIRAC during an emergency, the IAEA Secretariat may ask questions related to the status of identified dangerous sources/devices involved in or impacted by the emergency.

A.3. Dynamic information

Dynamic information needed during an emergency

The term 'Dynamic Information' refers to all the information that can only be shared during the response to a radiological or nuclear emergency. This information would be specifically relevant in supporting an assessment and prognosis and can include matters such as:

- The current status of the fission product barriers and the critical safety functions at a nuclear power plant during the declaration of a General Emergency;
- The declared public protective actions, such as evacuation or sheltering, that have been taken in response to the release of radioactive material from a nuclear power plant;
- The radius of a cordoned off area during a transport emergency involving nuclear or radiological material.

Different types of nuclear or radiological emergencies require different dynamic information to be made available. To clarify what type of information may be needed during a nuclear or radiological emergency, the IAEA Secretariat has provided access to the IAEA's IEC Assessment and Prognosis Tools website[33] for all Member State USIE counterparts.[34] The tools have been made available to IAEA Member States

[32] www.iaea.org/resources/databases/dirac

[33] https://iec.iaea.org

[34] This website is available at https://iec.iaea.org/iecat. Access is provided to all users of the Unified System for Information Exchange (USIE) but can also be granted to relevant counterparts upon request.

for the purpose of dissemination and to facilitate the IAEA assessment and prognosis process. Member States are encouraged to support implementation of this process by using these tools as required. They are intended to be used by experts trained in their use and applicability.

In addition, the IAEA's IEC Assessment and Prognosis Tools website contains technical documentation for technical experts within the IAEA's IEC during full response mode operations. The procedures detail the kind of information that may be requested during a nuclear or radiological emergency and provide instructions to the IAEA staff who will be conducting the assessment and prognosis.

The tools and procedures that have been developed for this process consider many of the possible emergencies in which the IAEA is required to provide its assessment and prognosis. This includes considerations for nuclear or radiological emergencies as shown in FIG.2.[35]

[35] Adapted from IAEA EPR–Method 2003 [14].

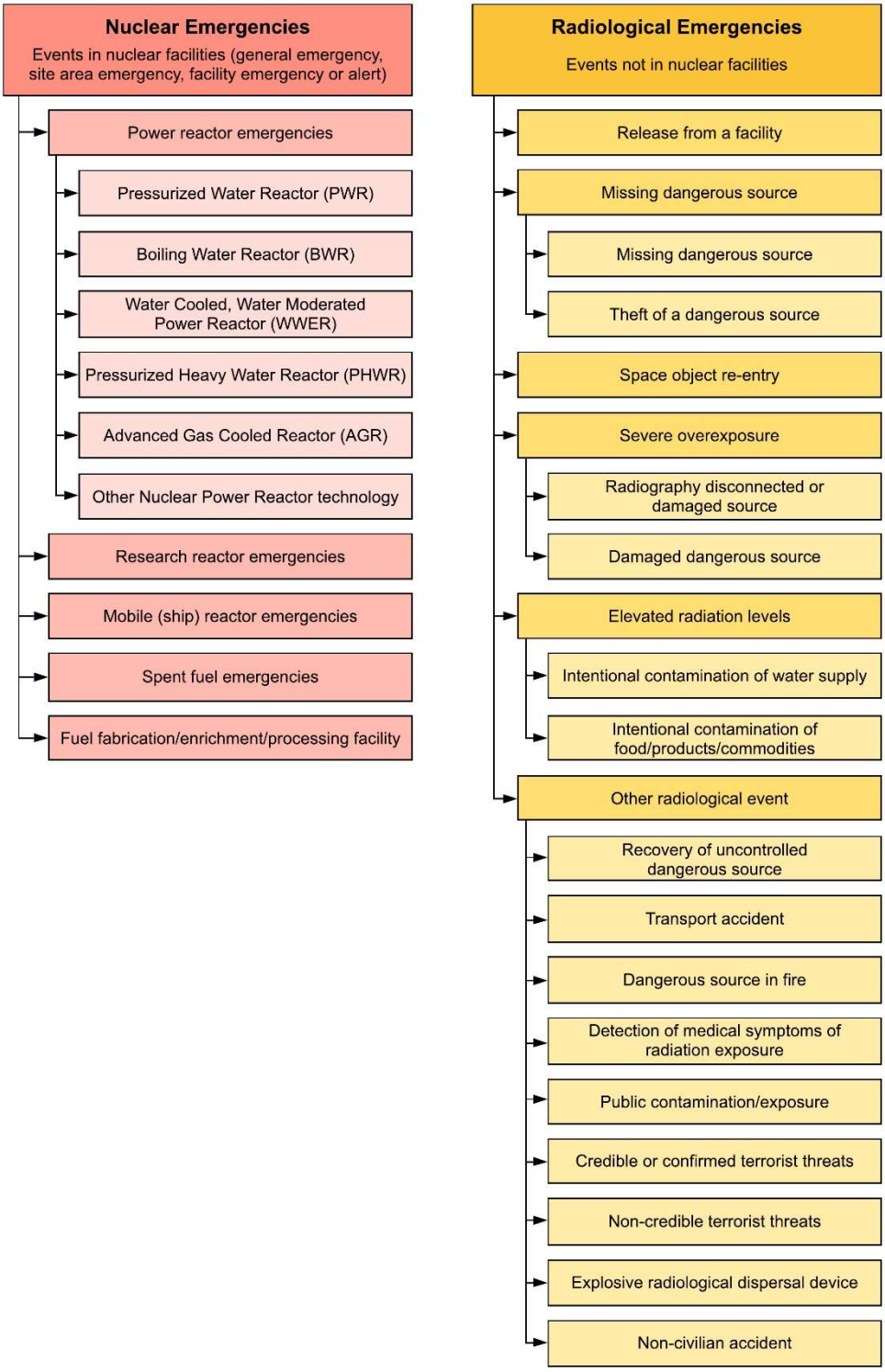

FIG.2. Examples of nuclear and radiological emergencies considered in developing the IAEA's IEC Assessment and Prognosis Tools website.

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A.4. Technical Guidebook for IAEA Assessment and Prognosis during a Nuclear or Radiological Emergency

The IAEA IEC Assessment and Prognosis Tools website[36] contains a manual entitled Technical Guidebook for the Operations Manual for IAEA Assessment and Prognosis during a Nuclear or Radiological Emergency. This A&P Technical Guidebook provides the detailed technical basis for the IAEA's assessment and prognosis process during a nuclear or radiological emergency. It is designed to meet the needs of IAEA CPs that are involved in the IAEA assessment and prognosis process and are responsible for exchanging technical information with the IAEA and/or reviewing the output of the process.

The A&P Technical Guidebook also serves as a companion to the online tools on the IAEA's IEC Assessment and Prognosis Tools website. It provides a reference for the methodology that is used to assess different types of technical information received from an Accident State during a nuclear or radiological emergency.

The A&P Technical Guidebook is not intended to serve as a singular reference for all related IAEA Safety Standards and technical publications that may be applicable to the IAEA's assessment and prognosis process. It is intended as an initial reference for users examining the technical basis of the IAEA's assessment and prognosis process before the full text available in the IAEA Safety Standards and technical publications is referenced. As new Safety Standards and technical guidance documents are published, the A&P Reference Material is updated to reflect any potential changes.

[36] This website is available at https://iec.iaea.org/iecat. Access is provided to all users of the Unified System for Information Exchange (USIE) but can also be granted to relevant counterparts upon request.

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1 INTRODUCTION

2 BACKGROUND OF ASSESSMENT AND PROGNOSIS DURING A NUCLEAR OR RADIOLOGICAL EMERGENCY

3 CONCEPT OF OPERATIONS FOR THE IAEA ASSESSMENT AND PROGNOSIS

4 IAEA ASSESSMENT AND PROGNOSIS PROCESS

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