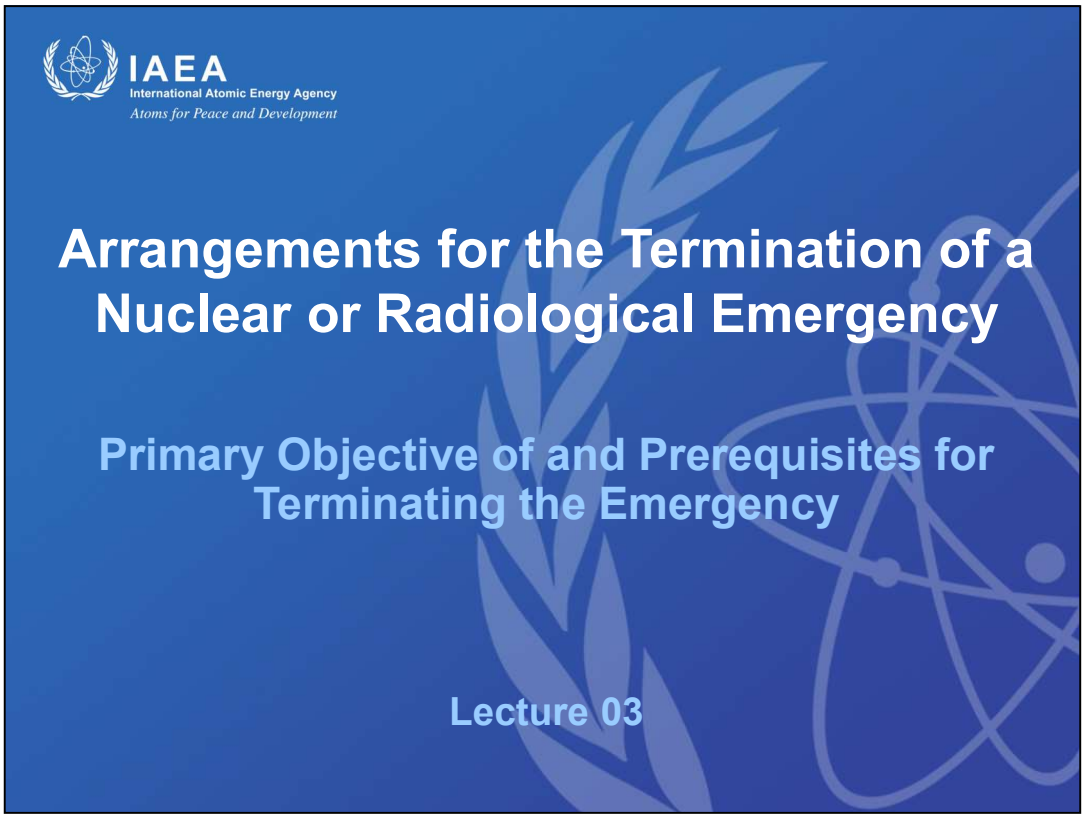
Arrangements for the Termination of a Nuclear or Radiological Emergency



Lecture: 03. Primary Objective of and Prerequisites for Terminating the Emergency

Purpose of the Presentation:

- Present and discuss the primary objective of the termination of a nuclear or radiological emergency as well as the prerequisites to be considered in planning and decision making regarding the termination of the emergency

Learning Objectives:

- Recognize the primary objective of the termination
- Identify prerequisites that need to be met for the emergency be declared ended and the transition from an emergency exposure situation to a planned exposure situation or an existing exposure situation to take place

Duration: 60 mins

References:

1. International Atomic Energy Agency, Preparedness and Response for a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSR Part 7, IAEA, Vienna (2015).
2. International Atomic Energy Agency, Arrangements for the Termination of a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSG-11, IAEA, Vienna (2018).

Introduction

- The situation faced in the aftermath of an emergency, once all actions to protect the public and to bring the source under control have been implemented, may be characterized by:
  - Active emergency response organization (24/7) that gradually integrates additional organizations that assume roles in the longer term.
  - Disrupted:
    - Practices involving nuclear or radioactive material and radiation technologies;
    - Public services and possibly infrastructure;
    - Businesses.

Introduction (cont'd)

- The situation faced in the aftermath of an emergency, once all actions to protect the public and to bring the source under control have been implemented, may be characterized by:
  - A protection strategy in place that might not be suitable for implementation in the longer term;
  - Displaced populations;
  - Increased interest by affected populations in ongoing activities to provide for their protection, safety and well-being.

Introduction (cont'd)

- Such a situation may not be suitable and sustainable in the longer term and may, therefore, call for preparations for the timely resumption of normal social and economic activity:
  - Ensure the continuation of activities that provide for public protection, safety and well-being **on a routine basis**.
- These preparations will be governed by activities during the transition phase that will allow the decision to end the emergency to be formally made.

Purpose

- Present and discuss the primary objective of the termination of a nuclear or radiological emergency as well as the prerequisites to be considered in planning and decision making regarding the termination of the emergency.

Learning objectives

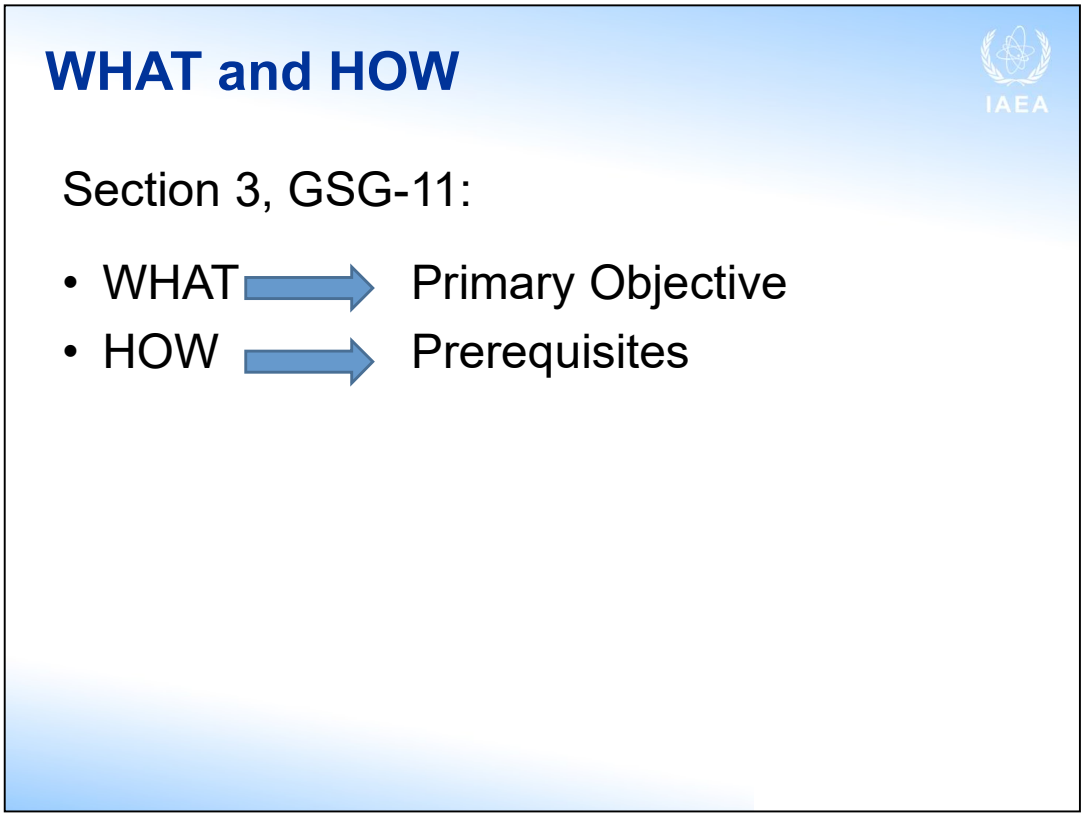
- Recognize the primary objective of the termination
- Identify prerequisites that need to be met for the emergency to be declared ended and the transition from an emergency exposure situation to a planned exposure situation or an existing exposure situation to take place

Discussion

- Can you name some conditions that may need to be fulfilled before an emergency can be formally ended?

Lecture notes:

Allow for about 3 mins. of discussion.



Lecture notes:

Section 3 of GSG-11 actually answers the following questions:

- What do we want to achieve with the termination of the emergency?
- How can we achieve this?

The 'what' question is related to the statement of the primary objective of the termination of a nuclear or radiological emergency.

The 'how' question is related to the detailed prerequisites that need to be fulfilled so that the emergency can be terminated and the transition to either a planned or existing exposure situation can take place.

Contents

- Primary objective
- General prerequisites
- Specific prerequisites
  - Transition to a planned exposure situation
  - Transition to an existing exposure situation
- Timeframes for the termination of an emergency
- Additional considerations

WHAT?
Primary objective

- The primary objective of the termination of the emergency is to facilitate the timely resumption of social and economic activity

Goal of emergency response, para. 3.2 (i) of GSR Part 7:

"*To prepare, to the extent practicable, for the resumption of normal social and economic activity*."

Lecture notes:

Reference:

1. International Atomic Energy Agency, Preparedness and Response for a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSR Part 7, IAEA, Vienna (2015).

HOW?
Prerequisites

- General prerequisites:
  - Applicable for any type of emergency.
- Specific prerequisites:
  - Applicable for transition to either an existing exposure or a planned exposure situation.

Lecture notes:

The general prerequisites need to be considered for any nuclear or radiological emergency, irrespective of its severity and consequences.

The specific prerequisites need to be considered in the context of the transition to either a planned or an existing exposure situation. Thus, they apply in the case of either a small scale or a large scale emergency, as discussed earlier.

General prerequisites

- Let's look closely at what needs to be accomplished prior to the termination of any nuclear or radiological emergency to achieve the primary objective.

Lecture notes:

Section 3, GSG-11, General prerequisites:

- A nuclear or radiological emergency should not be terminated until the necessary urgent protective actions and early protective actions have been implemented. When deciding on the termination of a nuclear or radiological emergency, some of the urgent protective actions and early protective actions (e.g. evacuation) might be already under consideration to be adapted or lifted. Other actions (e.g. restrictions on food, milk and drinking water) might remain in place in the longer term after the termination of the emergency, and some actions, such as iodine thyroid blocking, might already have been implemented and require no further consideration in the transition phase.
- Before the termination of the emergency, the exposure situation should be well understood and confirmed to be stable, meaning that the source has been brought under control, no further significant accidental releases or exposures resulting from the event are expected and the likely future development of the situation is well understood.

General prerequisites (cont'd)

- Characterize the radiological situation:
  - Identify exposure pathways;
  - Assess doses for affected populations.
- Assess the radiological situation against (as appropriate):
  - Reference levels;
  - Generic criteria;
  - Operational criteria;
  - Dose limits.

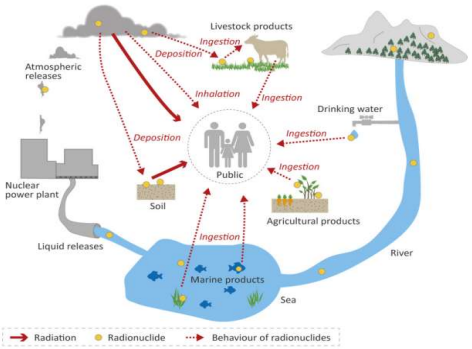


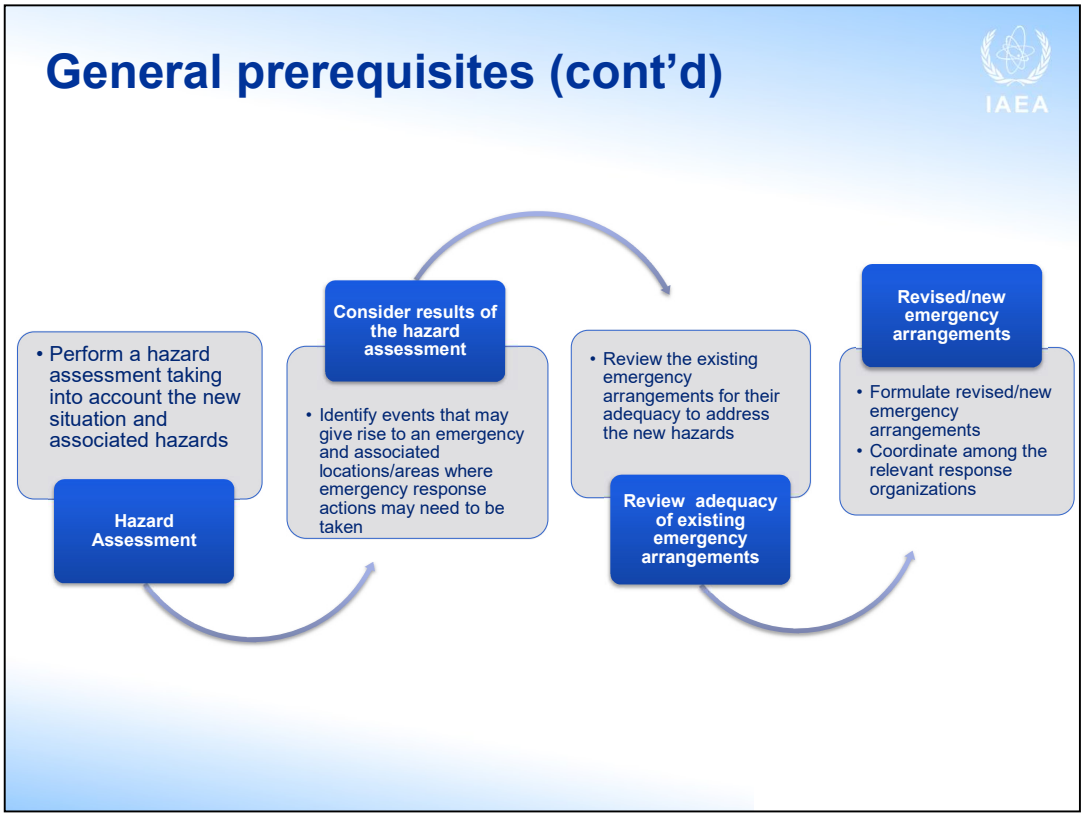
Image reproduced from 'The Fukushima Daiichi Accident', IAEA, Vienna (2015)

Lecture notes:

Section 3, GSG-11, General prerequisites:

- Before the termination of the emergency, the radiological situation should be well characterized, exposure pathways should be identified and doses should be assessed for affected populations (including those population groups most vulnerable to radiation exposure, such as children and pregnant women). This characterization should consider the impact of lifting and adapting the protective actions implemented earlier in the emergency response and, where applicable, possible options for the future use of land and water bodies (e.g. imposing restrictions or identifying alternative ways in which the land and water bodies can be exploited).
- The radiological situation should be assessed, as appropriate, against reference levels, generic criteria, operational criteria and dose limits, to determine whether the relevant prerequisites for the transition to either an existing exposure situation or a planned exposure situation, as appropriate, have been achieved.

FIG.: The main exposure pathways relevant to a nuclear accident, International Atomic Energy Agency, The Fukushima Daiichi Accident, Technical Volume 4/5, Radiological Consequences, IAEA, Vienna (2015)



Lecture notes:

Section 3, GSG-11, General prerequisites:

- Before any decision to terminate the emergency is made, a thorough hazard assessment should be performed in respect of the situation and its future development, consistent with Requirement 4 of GSR Part 7. The hazard assessment should provide a basis for preparedness and response for any new emergency that may occur.
- On the basis of the hazard assessment, those events and associated areas that may warrant protective actions and other response actions — including those that may mitigate the consequences of a future emergency — should be identified, and the existing emergency arrangements should be reviewed. The review should determine whether there is a need to revise the existing emergency arrangements and/or to establish new arrangements.

  For example, the hazards associated with a nuclear power plant in normal operation and its associated emergency arrangements will differ from the hazards associated with an accident damaged nuclear power plant and its associated emergency arrangements.

Lecture notes:

Section 3, GSG-11, General prerequisites:

- The emergency should not be terminated until revised or new emergency arrangements have been formulated and have been coordinated among the relevant response organizations. However, in some cases, the formal establishment of revised or new emergency arrangements might be a lengthy process. Therefore, the establishment of an interim response capability in the transition phase should be considered to prevent unnecessary delay in the termination of the emergency.

  The purpose of such an interim response capability is to provide an improved response to any future emergency, postulated on the basis of the hazard assessment, before the full emergency arrangements are put in place. This interim capability might not be optimal and would need to make use of all available means and resources with only minimal additional arrangements (e.g. training, a few revised procedures).

General prerequisites (cont'd)

- Confirm that the requirements for occupational exposure for a planned exposure situation can be applied to all workers to be engaged in recovery activities;
- Confirm that the source is secure;
- Establish a registry for those identified who require longer term medical follow-up.


Lecture notes:

Section 3, GSG-11, General prerequisites:

- Before the termination of the emergency, it should be confirmed that the requirements for occupational exposure in planned exposure situations established in Section 3 of GSR Part 3 can be applied for all workers who will be engaged in recovery operations and that the source is secured in a manner that is consistent with Nuclear Security Recommendations.
- A registry of those individuals who, by the time the emergency is to be terminated, have been identified as requiring longer term medical follow-up should be established before the termination of the emergency.

FIG. (on the left): Removing contaminated items from junkyard, International Atomic Energy Agency, The Radiological Accident in Goiânia, IAEA, Vienna (1988)

FIG. (on the right): Monitoring people for contamination at the Olympic Stadium, International Atomic Energy Agency, The Radiological Accident in Goiânia, IAEA, Vienna (1988)

General prerequisites (cont'd)

- Identify relevant non-radiological consequences and factors and consider actions to address them:
  - Psychosocial and economic;
  - Technology, land use options, availability of resources and social service, community resilience.
- Consider activities to manage any radioactive waste arising from the emergency.

Lecture notes:

Section 3, GSG-11, General prerequisites:

- Non-radiological consequences (e.g. psychosocial and economic consequences) and other factors (e.g. technology, land use options, availability of resources, community resilience, the availability of social services) relevant to the termination of the emergency should be identified, and actions to address them should be considered.

  Community resilience is the capacity of a community to be able to recover quickly and easily from the consequences of a nuclear or radiological emergency.

- Consideration should be given to the management of any radioactive waste arising from the emergency, as appropriate, before the termination of the emergency.

General prerequisites (cont'd)

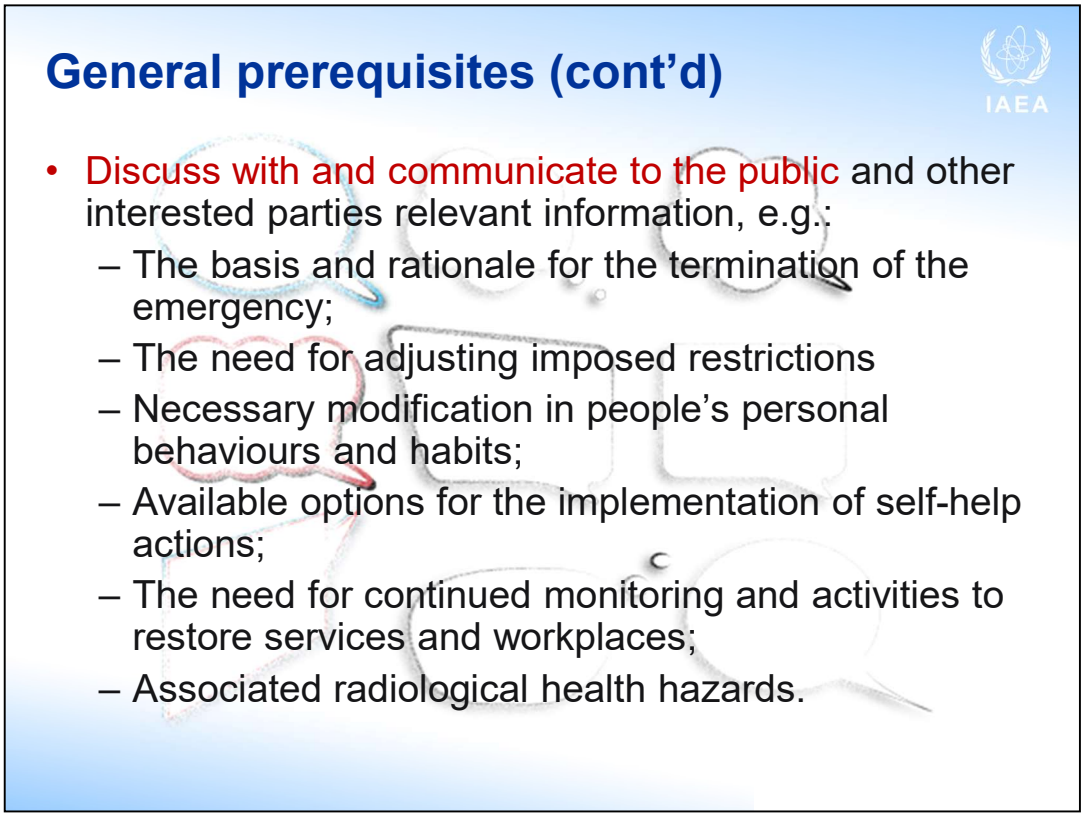
- Involve and consult interested parties:
  - To allow for public trust in and public acceptance of decisions but without unduly impeding the timely and effective decision making to terminate the emergency.

Lecture notes:

Section 3, GSG-11, General prerequisites:

- Consultation with interested parties is required before the termination of the emergency. This process should not unduly impede timely and effective decision making by the responsible authority with respect to the termination of the emergency; however, this process is intended to help increase the public trust in and the public acceptance of the decision to terminate the emergency.

FIG.: The first dialogue meeting at the Fukushima Prefectural Council Hall (26 and 27 November 2011). Discussion among stakeholders on the situation in the affected areas and on their concerns, http://www.icrp.org/page.asp?id=189 , ICRP Dialogue Initiative (2011-2015)



Lecture notes:

Section 3, GSG-11, General prerequisites:

- Before the termination of the emergency, the following should be discussed with and communicated to the public and other interested parties, as appropriate:

    a) The basis and rationale for the termination of the emergency and an overview of the actions taken and the restrictions imposed;

    b) The need to adjust imposed restrictions, to continue protective actions or to introduce new protective actions, as well as the expected duration of these actions and restrictions;

    c) Any necessary modifications to people's personal behaviours and habits;

    d) Options for the implementation of self-help actions, as appropriate;

    e) The need for continued environmental monitoring and source monitoring after the termination of the emergency;

    f) The need for continued efforts to restore services and workplaces;

    g) Radiological health hazards associated with the new exposure situation.

Lecture notes:

Section 3, GSG-11, General prerequisites:

- Examples of self-help actions include, but are not limited to, avoiding prolonged visits to certain areas, changing farming practices and land use, and reducing the consumption of certain foods.

Discussion

- Have you considered any of these prerequisites currently in your national EPR framework?

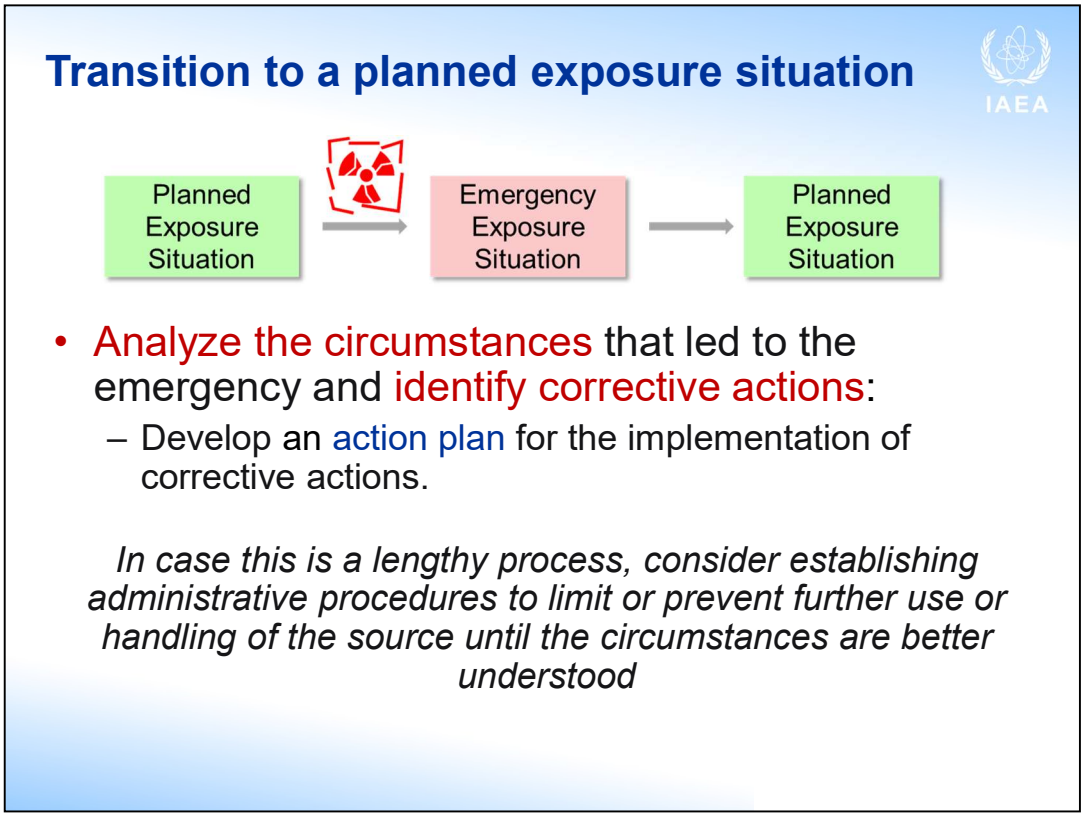
Lecture notes:

Base the discussion questions on the general prerequisites covered in the previous slides.

Allow for about 3 mins. of discussion.

Specific prerequisites

- In addition to the general prerequisites:
  - Let's look closely at what needs to be accomplished during the transition phase to allow for the transition to either a planned or an existing exposure situation for the primary objective to be achieved.

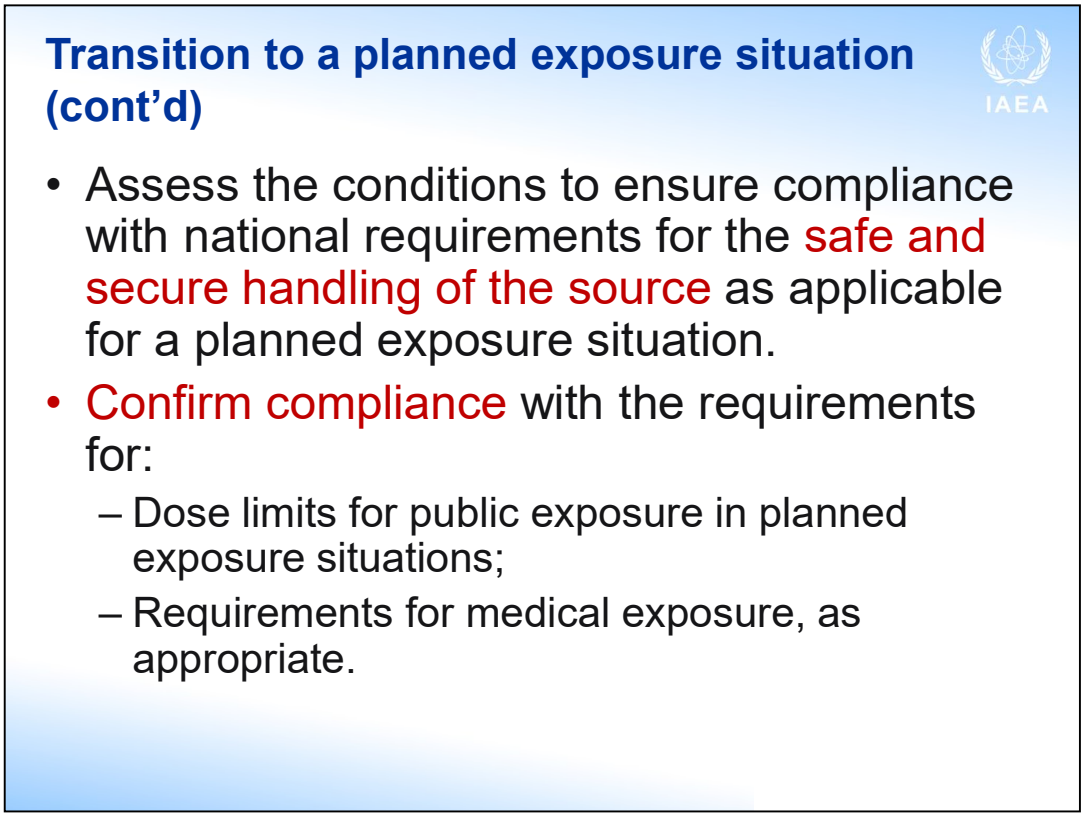


Lecture notes:

Section 3, GSG-11, Specific prerequisites:

- In addition to the general prerequisites, the following specific prerequisites should be met in order to be able to declare the termination of an emergency and to move to a planned exposure situation.

  The circumstances that led to the emergency have been analyzed, corrective actions have been identified and an action plan has been developed for the implementation of corrective actions by the respective authorities, as applicable, in relation to the facility, activity or source involved in the emergency. However, in some cases, the formal analysis and development of the action plan might be a lengthy process. Therefore, consideration should be given to establishing administrative procedures that limit or prevent the use or handling of the source until the circumstances that led to the emergency have been better understood, with the aim of preventing unnecessary delays in the termination of the emergency.



Lecture notes:

Section 3, GSG-11, Specific prerequisites:

- In addition to the general prerequisites, the following specific prerequisites should be met in order to be able to declare the termination of an emergency and to move to a planned exposure situation:
  - Conditions have been assessed to ensure compliance with the safe and secure handling of the source involved in the emergency in accordance with the national requirements set forth for the respective planned exposure situation;
  - Compliance has been confirmed with the dose limits for public exposures in planned exposure situations and with the requirements for medical exposure established in Section 3 of GSR Part 3.

  Depending on the type of emergency, the planned exposure situation can be associated with the normal operation of the facility or activity, with cleanup and decommissioning, or with the ending of the operational life of the source involved in the emergency.

Transition to an existing exposure situation

- Justified and optimized actions have been implemented to:
  - Comply with national generic criteria for enabling the transition to an existing exposure situation;
  - Ensure that the residual doses approach the lower bound of the reference level for an emergency exposure situation (~ 20 mSv effective dose in a year).

Lecture notes:

Section 3, GSG-11, Specific prerequisites:

- In addition to the general prerequisites, the following specific prerequisites should be met in order to be able to declare the termination of an emergency and to move to an existing exposure situation.

  Justified and optimized actions have been taken to meet the national generic criteria established to enable the transition to an existing exposure situation, with account taken of the generic criteria provided in appendix II to GSR Part 7, and it has been verified that the assessed residual doses approach the lower bound of the reference level for an emergency exposure situation.

Transition to an existing exposure situation (cont'd)

- Delineate areas:
  - Areas that are not permitted to be inhabited;
  - Areas where it is not feasible to carry out social and economic activity.

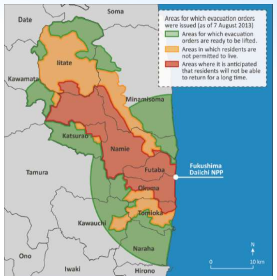


Image reproduced from 'The Fukushima Daiichi Accident', IAEA, Vienna (2015)

- Establish administrative and other provisions to monitor compliance with any restrictions imposed in relation to the delineated areas.

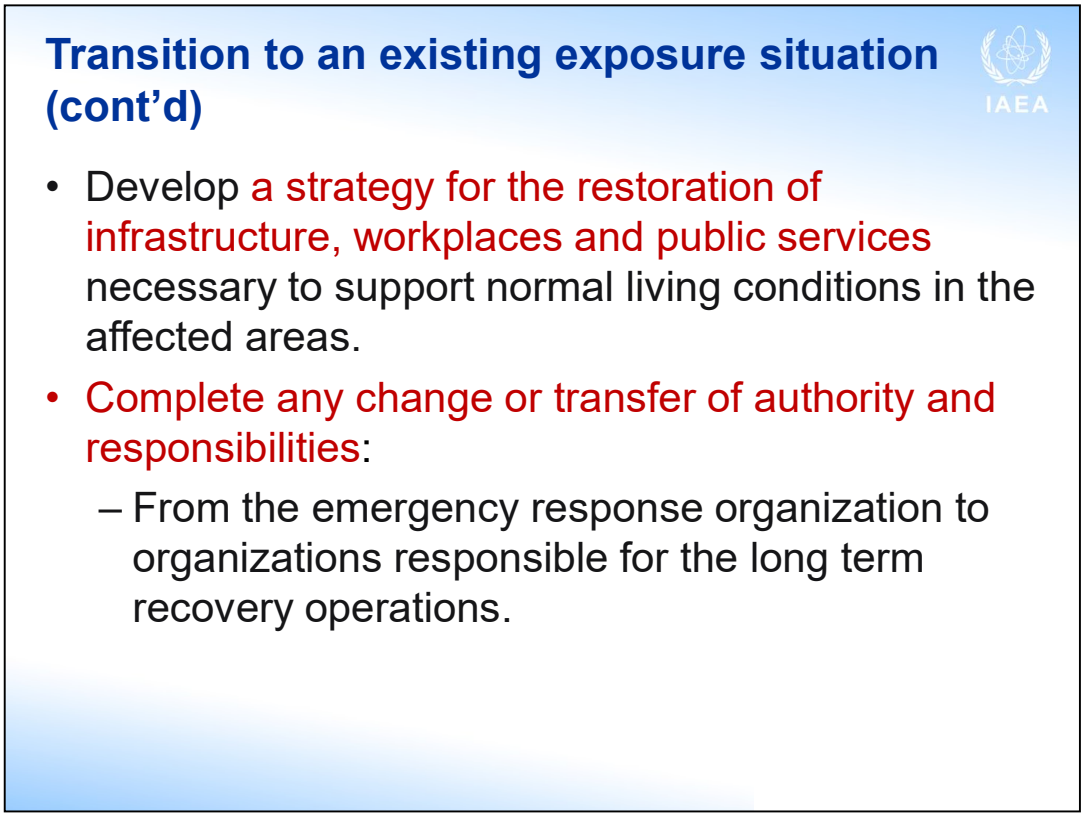
Lecture notes:

Section 3, GSG-11, Specific prerequisites:

- In addition to the general prerequisites, the following specific prerequisites should be met in order to be able to declare the termination of an emergency and to move to an existing exposure situation:
  - Areas have been delineated that are not permitted to be inhabited and where it is not feasible to carry out social and economic activity. This delineation relates to areas that, earlier in the emergency response, were subject to evacuation and/or relocation, and/or where specific restrictions were imposed that will continue to be implemented after the termination of the emergency;
  - For these delineated areas, administrative and other provisions have been established to monitor compliance with any restrictions imposed.

  This delineation relates to areas that, earlier in the emergency response, were subject to evacuation and/or relocation, and/or where specific restrictions were imposed that will continue to be implemented following the termination of the emergency.

FIG.: Completion of the arrangement for areas where evacuation orders have been issued, International Atomic Energy Agency, The Fukushima Daiichi Accident, IAEA, Vienna (2015)



Lecture notes:

Section 3, GSG-11, Specific prerequisites:

- In addition to the general prerequisites, the following specific prerequisites should be met in order to be able to declare the termination of an emergency and to move to an existing exposure situation.

  Before the termination of the emergency, a strategy has been developed for the restoration of infrastructure, workplaces and public services (e.g. public transportation, shops and markets, schools, kindergartens, health care facilities, and police and firefighting services) necessary to support normal living conditions in the affected areas, such as those areas in which evacuations or relocations were carried out.

  Public services that are necessary to support normal living conditions in the affected areas, such as those areas in which evacuations or relocations were carried out.

Transition to an existing exposure situation (cont'd)

- Put in place a mechanism and means for continued communication and consultation with all interested parties.
- Organize the sharing of any information and data germane to long term planning among the relevant organizations and authorities.
- Initiate the development of a long term monitoring strategy in relation to residual contamination.

Lecture notes:

Section 3, GSG-11, Specific prerequisites:

- In addition to the general prerequisites, the following specific prerequisites should be met in order to be able to declare the termination of an emergency and to move to an existing exposure situation:
  - A mechanism and the means for continued communication and consultation with all interested parties, including local communities, have been put in place;
  - Before the termination of the emergency, any change or transfer of authority and responsibilities from the emergency response organization to organizations responsible for the long term recovery operations has been completed;
  - The sharing of any information and data that were gathered during the emergency exposure situation and that are relevant for long term planning has been organized among the relevant organizations and authorities;

Lecture notes:

- Development of a long term monitoring strategy in relation to residual contamination has been initiated.

Transition to an existing exposure situation (cont'd)

- Develop a programme for longer term medical follow-up for the registered individuals.
- Develop a strategy for mental health and psychosocial support for the affected population.
- Give consideration to the compensation of victims for damage due to the emergency.
- Put in place administrative arrangements, legal provisions and regulatory provisions for the management of the existing exposure situation.

Lecture notes:

Section 3, GSG-11, Specific prerequisites:

- In addition to the general prerequisites, the following specific prerequisites should be met in order to be able to declare the termination of an emergency and to move to an existing exposure situation:
  - A programme for longer term medical follow-up for the registered individuals has been developed;
  - A strategy for mental health and psychosocial support for the affected population has been developed;
  - Consideration has been given to the compensation of victims for damage due to the emergency so as to provide for public reassurance, notwithstanding the fact that the processes for compensation will extend after the emergency is terminated;

Lecture notes:

- Administrative arrangements, legal provisions and regulatory provisions have been put in place or are being put in place for the management of the existing exposure situation, including provisions for the allocation of the necessary financial, technical and human resources.

Transition to an existing exposure situation (cont'd)

- No individual monitoring of members of the public for radiation protection purposes following the termination of the emergency is needed.
  - However:
    - Doses received by individuals can differ considerably depending on their individual habits, and therefore they will need to be assessed, and
    - Protection of these individuals may still need to be addressed in the long term protection strategy.

Lecture notes:

Section 3, GSG-11, Specific prerequisites:

- After the termination of the emergency, individual monitoring of members of the public should in general no longer be necessary for radiation protection purposes. However, the doses received by individuals can differ considerably depending on their individual habits; therefore, the doses received by such individuals will need to be assessed, and the protection of these individuals may still need to be addressed in the long term protection strategy.

  Individual monitoring is "Monitoring using measurements by equipment worn by individuals, or measurements of quantities of radioactive substances in or on, or taken into, the bodies of individuals, or measurements of quantities of radioactive substances excreted from the body by individuals" [GSR Part 3].

Transition to an existing exposure situation (cont'd)

Exceptional circumstances:

- If the circumstances do not allow to meet the generic criteria for enabling the transition to an existing exposure situation, a decision to terminate the emergency may still be taken as long as:
  - It is confirmed that no further justified and optimized actions are feasible, and
  - The generic criteria for taking early protective actions and other response actions provided in GSR Part 7 are not exceeded.

Lecture notes:

Section 3, GSG-11, Specific prerequisites:

- There might be exceptional circumstances in which it has not been feasible, within a reasonable time, to meet the national generic criteria for enabling a transition to an existing exposure situation. In such cases, a decision to terminate the emergency may still be taken, as long as it has been determined that no further justified and optimized actions are feasible and the generic criteria for taking early protective actions and other response actions provided in appendix II to GSR Part 7 are not exceeded.

Discussion

- How much time do you think it would take for all these prerequisites to be fulfilled after a large scale emergency (such as the Chernobyl accident or Fukushima Daiichi accident)?

Lecture notes:

Allow for about 3 mins. of discussion. Based on independent assessments carried out on this during the development of GSG-11, 7 to 8 months were identified to be sufficient, based on responses to these two emergencies.

Time frames for the termination of an emergency

- At the preparedness stage, a strategy should be developed for coping with specific aspects of the termination within a reasonable time frame:
  - Assess the time frames anticipated in which an emergency will be terminated for a range of postulated nuclear or radiological emergencies:
    - On the basis of a hazard assessment;
    - Account for unforeseen circumstances that would be difficult to take into account in the decision making.

Time frames for the termination of an emergency (cont'd)

- Proposed time frames for the termination of the emergency on the basis of the study of past emergencies:
  - In the range of several weeks to one year for terminating a large scale emergency;
  - In the range of a day to a few weeks for terminating a small scale emergency.

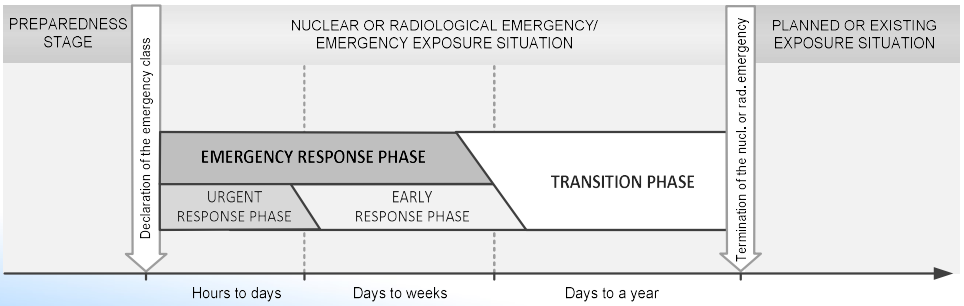
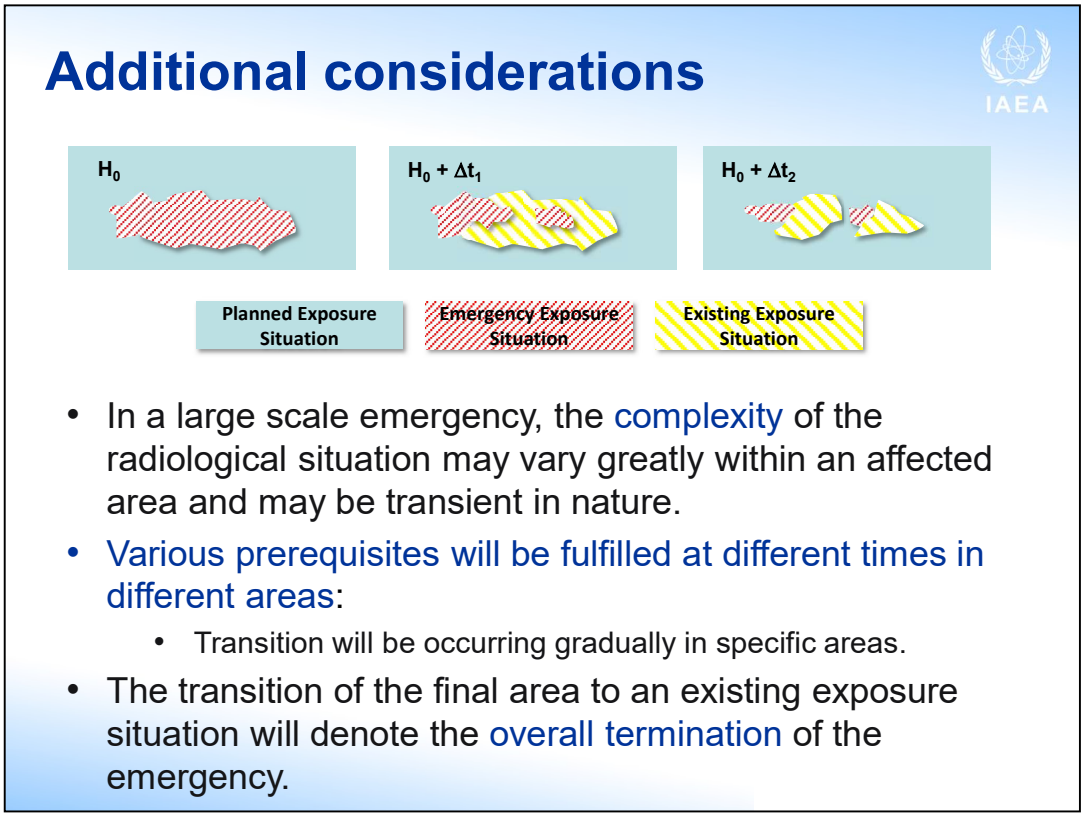


Image reproduced from GSG-11, IAEA, Vienna (2018)

Lecture notes:

FIG.: Temporal sequence of various types of protective actions and recovery operations for a nuclear or radiological emergency within a single geographical area or a single site, International Atomic Energy Agency, Arrangements for the Termination of a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSG-11, IAEA, Vienna (2018)



Lecture notes:

In the event of an emergency exposure situation, it is likely that exposure rates will vary in space and time so that the transition may take place at different geographical locations at different times. Therefore, the situation in some areas might be managed as a nuclear or radiological emergency, while the situation in other areas might be managed as a planned exposure situation or an existing exposure situation. This was illustrated before as well.

When the final area that was in an emergency exposure situation has transited to an existing exposure situation, the transition phase will end. The transition of this final area to an existing exposure situation will also denote the overall termination of the emergency.

Discussion

- How can these prerequisites be used by a country at the preparedness stage and during the response?

Lecture notes:

Allow for about 3 mins. of discussion.

Additional considerations (cont'd)

At the preparedness stage:

- To identify prerequisites that will need to be fulfilled for postulated emergencies at national level with account taken of the national circumstances to support:
  - Development of the protection strategy for the transition phase;
  - Identification of arrangements that need to be put in place for the transition phase;
  - Determining the time frames in which the prerequisites can be met for postulated emergencies, taking into account available resources and planning accordingly.

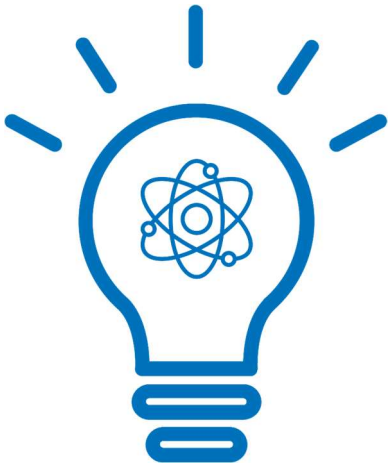
Additional considerations (cont'd)

During the response:

- A checklist of relevant prerequisites to be fulfilled so that responsible authority can make a decision to formally end the nuclear or radiological emergency:
  - Any such decision needs to be made public.

- Means to reassess the effectiveness of the protection strategy and the need to adjust to actual circumstances.

Summary



- The primary objective of the termination of an emergency is to facilitate the timely resumption of social and economic activity.
- The emergency should be terminated if the applicable prerequisites set forth in Section 3 of GSG-11 have been fulfilled.
- The primary objective and prerequisites should guide and support:
  - Development of a strategy to protect the affected individuals and to provide for their well-being;
  - Development of emergency arrangements for the transition phase;
  - Decisions for formally declaring an emergency ended.

Lecture notes:

Summarize the key points from the presentation.

Lecture notes:

Thank you!