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Information exchange and technical support in relation to food and agriculture in the case of a nuclear or radiological emergency

Co-operative arrangements between FAO and IAEA

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Co-operative arrangements between FAO and IAEA for information exchange and technical support in relation to food and agriculture in the case of a nuclear or radiological emergency

This document describes a common understanding of the practical arrangements between FAO and IAEA for notification, information exchange and provision of technical support in relation to food and agriculture in the case of a nuclear or radiological emergency and its aftermath. The document does not establish legal obligations. The arrangements described are also reflected in the Joint Radiation Emergency Management Plan of the International Organizations (EPR-JPLAN 2002)[1].

There are three annexes to the arrangements, which set out details of the present approach and the advice that FAO will provide in relation to food and agricultural aspects of preparedness and response for a nuclear or radiological emergency.

1. ABBREVIATIONS

AG	FAO's Agriculture Department
AGE/NAFA	The Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture is part of both AG and NA. The Division is based at IAEA HQ and known as NAFA or AGE in FAO. The Director of AGE is FAO's designated Warning Point.
Codex	The Codex Alimentarius Commission is the body that implements the Joint FAO/WHO Food Standards Programme
ECG	FAO's in-house Emergency Co-ordination Group
ENAC	Emergency Notification and Assistance Convention protected web-site (operated by the IAEA ERC, effective December 2000)
ERC	Emergency Response Centre of the IAEA
ESN	FAO's Food and Nutrition Division
FAO	Food and Agriculture Organization of the United Nations
IACRNA	Inter-Agency Committee for the Response to Nuclear Accidents
IAEA	International Atomic Energy Agency
NA	IAEA's Department of Nuclear Sciences and Applications
NS	IAEA's Department of Nuclear Safety
TCES	Special Emergency Programmes Service, Division of Emergency Operations and Rehabilitation (FAO's operational focal point responsible for responding to nuclear emergencies)
TC	FAO's Technical Cooperation Department (the Assistant Director-General of TC is the Chairperson of ECG)

2. LEGAL BASIS, OBLIGATIONS AND CAPABILITIES

The IAEA has been assigned functions by – and the FAO is party to – the Convention on Early Notification of a Nuclear Accident ('Early Notification Convention') and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency ('Assistance Convention').

The IAEA must have arrangements to address actions initiated by States adopting GS-R-2, Safety Requirements on Preparedness and Response for a Nuclear or Radiological Emergency[2], co-sponsored by FAO, IAEA and other international organizations.

The IAEA's role is primarily in regard to facilitating information exchange and the provision of assistance in the case of a nuclear or radiological emergency, as well as its statutory function of establishing and, on request, applying safety standards for protection of health and property.

The IAEA fulfils its role in an emergency through the Emergency Response Centre (ERC), which develops arrangements and procedures, trains staff, maintains equipment, maintains rosters of experts/teams, and carries out exercises and drills.

The IAEA also provides the Secretariat for the IACRNA, of which FAO is a member, and which develops and maintains the Joint Radiation Management Plan of the International Organizations (EPR-JPLAN).

Pursuant to Article 14, paragraph 5(c) of the Convention on Assistance in the case of a Nuclear Accident or Radiological Emergency, the Director-General of FAO has declared that, within its constitutional mandate to monitor and evaluate the world security situation, FAO is competent to advise governments on measures to be taken in terms of agricultural, fisheries and forestry practices to minimize the impact of radionuclides and to develop emergency procedures for alternative agricultural practices and for decontamination of agricultural, fisheries, forestry products, soil and water. Through the Joint FAO/WHO Codex Alimentarius Commission FAO provides advice and standard setting activities relating to food safety.

FAO can provide the assistance through the provision of scientific information and financial assistance, and the fielding of specialist teams,[3] and by providing, in co-operation with the IAEA, analytical services and experts.

Under the Conventions on Early Notification and Assistance, FAO must maintain a 24-hour contact point for receipt from IAEA of notifications, advisory messages, requests for advice or assistance, and information.

Details of the FAO/IAEA obligations and capabilities to meet them are provided in EPR-JPLAN(2002), Appendix B.

3. DEFINITIONS

Advisory	An official announcement by an authorized national or international competent authority providing details of a nuclear accident or radiological emergency, without the explicit obligation to do so under the Early Notification Convention, but to pre-empt legitimate requests from other States for 'assistance' in obtaining information.
Contact point (CP)	The point of contact designated by a State or an International Organization that has a role in liaising with ERC in response to a nuclear accident or radiological emergency.
FAO contact points	AGE (focal point)[4], TCES, regional and national offices relevant to the incident.
Notification	(1) A report submitted promptly to a national or international authority providing details of an emergency or a potential emergency, e.g. as required by the Convention on Early Notification of a Nuclear Accident. (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.
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 international intervention levels or action levels for protective actions, including food restrictions and restrictions on commerce.

Transnational emergency	A nuclear or radiological emergency of actual, potential or perceived radiological significance for more than one State. This includes: (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 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 event resulting in significant disruption to international trade or travel; (5) An emergency warranting the implementation 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 implications for safety internationally; (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.
Warning Point (WP)	A contact point that is staffed or able to be alerted at all times for promptly responding to, or initiating a response to, an incoming notification (meaning (1) in this glossary), warning message, request for assistance or request for verification of a message, as appropriate, from the IAEA.

4. OBJECTIVES OF THE ARRANGEMENTS

IAEA	- To fulfil notification obligations towards FAO as a party to the conventions, including co-ordinating information exchange and actions with headquarters, regional and national officers. - To minimize multiple requests for information/technical support from, and to the extent practicable to develop a common understanding about the accident situation with, States Party and FAO, by keeping FAO informed about information/technical support requested by the IAEA contact points. - To provide timely, truthful, consistent and appropriate releases of information to the news media and the world wide web.
FAO	- To have arrangements in place in AGE, ECG, TCES and regional and country offices to respond in a timely, appropriate and co-ordinated manner to an actual or potential nuclear or radiological emergency. - To be warned in advance of a developing situation that may require technical support so as to have advice ready sooner for requesting governments. - To keep the IAEA apprised of information/technical assistance requested by and provided to FAO contact points and of countermeasures taken.

5. EMERGENCY CLASSES

Two emergency classes are used for indicating the level of response needed to an ongoing and developing emergency at a nuclear installation.

EMERGENCY CLASS	IAEA ACTION	FAO ACTION
Site Area Emergency - events resulting in a major decrease in the level of protection for the public or on-site personnel at a nuclear installation	IAEA ERC moves to 'full response' mode, sends an advisory message to AGE	No action although staff go on standby if deemed necessary by FAO (Dir-AGE)
General Emergency - events resulting in an actual or substantial risk of a release from a nuclear installation, necessitating urgent protective actions off the site	IAEA ERC moves to 'full response' mode, sends notification to AGE	Staff the FAO desk in the ERC[5] and work with ERC staff to prepare a preliminary assessment of the scale and potential impact of the emergency for food and agriculture[6]

All other types of nuclear or radiological emergency are described by 'Other Radiation Emergency or Threat'

Other Radiation Emergency or Threat - where the emergency involves radioactive contamination of people, water, surfaces, food or commodities that may warrant urgent protective actions, or for which precautionary protective actions have been taken	IAEA ERC sends notification or an advisory message to AGE; establishes liaison with AGE as appropriate	Staff man the FAO desk in the ERC as appropriate and work with ERC staff to prepare a preliminary assessment of the scale and potential impact of the emergency for food and agriculture

6. DETAILED CONCEPT OF OPERATIONS

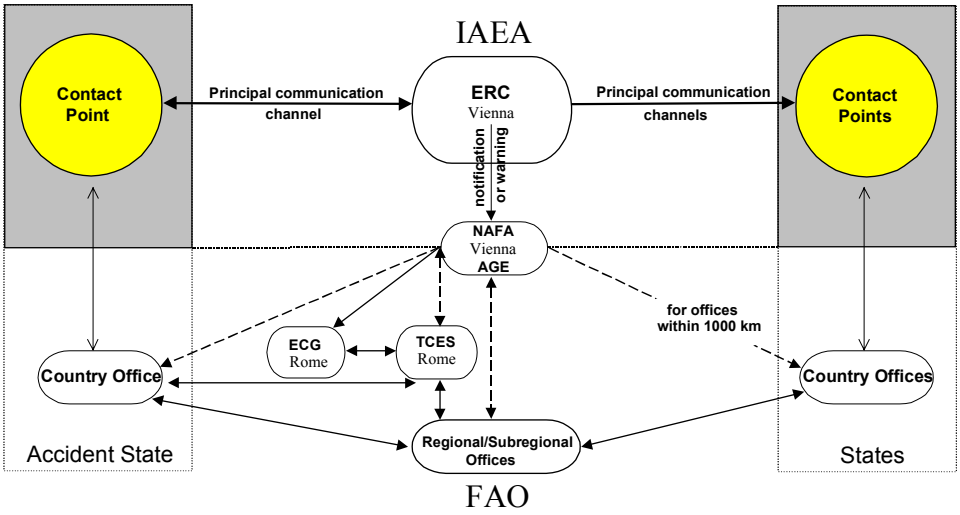

Figure 1. Concept of operations for notification and advisory information exchange between FAO and IAEA. Notes: The dotted lines represent initial contacts triggered by an ERC notification or warning. FAO's in-house Emergency Co-ordination Group (ECG) would comment on and/or prepare recommendations on a preliminary impact assessment prepared by staff at the ERC. Activities are then implemented through the Special Emergency Programmes Service (TCES), which is FAO's operational focal point responsible for responding to nuclear emergencies.

6.1. Notification or advisory message and further relevant information from the IAEA

Unless a message is specifically marked as 'Site Area Emergency', 'General Emergency' or the ERC establishes liaison with AGE specifically with respect to an 'other radiation emergency or threat', no action is normally needed by FAO to messages sent by ERC regarding other emergencies (such as lost sources, etc.)

6.1.1. Class: site area emergency

On receipt from a State of an advisory message regarding a 'site area emergency' at a nuclear installation, the IAEA's ERC prepares and issues an official legible EMERCON advisory message by fax to all IAEA national warning points, clearly marked 'site area emergency' and alerts duty officer AGE. This initial information will contain as a minimum the accident State and site co-ordinates.

The IAEA ensures that national warning points of all States within 1000 km of the site have received the advisory message. AGE informs Regional FAO offices within 1000 km of the accident site and sends an e-mail message providing relevant information and asks for confirmation of receipt of the message. The IAEA sends additional relevant information by fax to warning points and to AGE as appropriate. The IAEA may also post the information on ENAC. AG, AGE, TCES and ECG have read-access to ENAC by username/password.

AGE may consult with ERC at any time with regard to the potential development of an emergency situation.

6.1.2. Class: general emergency

On receipt from a State of a notification regarding a 'general emergency' at a nuclear installation, the IAEA's ERC prepares an official legible EMERCON notification and faxes all national warning points and AGE. AGE staffs the FAO desk in the ERC, immediately informs FAO CPs within 1000 km of the accident site and asks Regional Offices for confirmation of receipt of the message. FAO's TCES in Rome is put on standby by AGE. AGE and FAO staff assigned by TCES may attend regular briefings in the IAEA ERC.

The IAEA sends additional relevant information by fax to warning points, and AGE as appropriate. The IAEA may also post the information on ENAC. AG, AGE, TCES and ECG have read-access to ENAC by username/password.

6.1.3. Other radiation emergency or threat

On receipt from a State of information regarding a nuclear or radiological emergency or a threat, which involves radioactive contamination of people, water, surfaces, food or commodities and may warrant urgent protective actions, or for which precautionary protective actions have been taken, the IAEA's ERC prepares an official advisory or EMERCON notification and faxes all national warning points and AGE/NAFA. The ERC liaises with AGE/NAFA to assess, decide on the need to staff the FAO desk in the ERC, distribute information to FAO CPs and/or put FAO's TCES in Rome on standby.

The IAEA sends additional relevant information, reviews the product from WMO, may add commentary of its own with regard to source term, for example, and may send the results by fax to warning points, and AGE/NAFA and FAO Rome as appropriate. The IAEA may also post the information on ENAC. AG, AGE, TCES and ECG have read-access to ENAC by username/password.

6.2. Provision of advice/assistance in relation to food and agriculture

During a period of acute radionuclide deposition, actions by States are expected to be taken automatically according to local prearranged plans. Subsequent actions by States will depend on the nature and extent of the contamination. However, it is possible that requests for advice on food and agriculture will come from (1) FAO contact points, in which case FAO responds under its statutory mandate, or (2) IAEA or IAEA contact points, in which case FAO responds under the Assistance Convention.

IAEA's goal is to facilitate effectively the provision of advice and assistance so as to minimize the consequences for health, property and the environment.

FAO's goal is to contribute effectively to the minimization of the impact of radionuclide contamination on agriculture and food security.

If FAO receives a request for assistance in the event of a nuclear or radiological emergency, it will inform the IAEA of such a request and co-ordinate the provision of assistance, as appropriate, with IAEA. Similarly if IAEA receives under the Assistance Convention a request for assistance in relation to food and agriculture, it will co-ordinate with FAO as envisaged by the Convention.

In order to be able to monitor and evaluate the world food security situation, and to be able to advise governments on:

a. measures to be taken in terms of agricultural, fisheries and forestry to minimize the impact of radionuclides;

b. development of emergency arrangements for alternative agricultural practices; and

c. decontamination of agricultural, fisheries and forestry products, soil and water.

FAO maintains a database on agricultural countermeasures and a register of experts so as to be able to obtain specialist and qualified advice. It also facilitates international trade by assisting together with WHO in the application of the Codex Alimentarius Guideline Levels for Radionuclides in Foods Moving in International Trade.

6.3. Public information

Any press releases in the early phase will be factual and based on the role, responsibility and actions taken by the respective organization. Where the subject matter of the press releases involves the competence of both organizations, FAO and IAEA will confer and agree, to the extent practicable, on the content of any press releases. Should this not be possible, the organizations should limit their press releases to their own areas of competence. Copies of any FAO press releases should be provided to the IAEA for posting on ENAC, or for establishing a hyperlink in ENAC to the FAO web-site.

7. ADMINISTRATIVE MATTERS

The Director of Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture and the Director Division of Radiation and Waste Safety, IAEA, are delegated the responsibility of developing and maintaining the Annexes and their implementation. In accordance with IAEA SEC/NOT 1846 Rev. 1, NAFA will nominate a liaison officer and alternate to the IAEA's Inter-departmental Liaison Group for Emergency Preparedness. FAO is represented by AGE/NAFA on the Inter-Agency Committee for Response to Nuclear Accidents. This officer will have primary responsibility for maintaining preparedness activities, including the maintenance of the Annexes to these arrangements and the logistical infrastructure, and for ensuring FAO participation in such exercises as required by IACRNA/EPR-JPLAN and related activities including consultants' meetings. These activities go beyond over those previously undertaken by FAO and this should be reflected in the FAO and IAEA budget allocation.

For response purposes, arrangements will include the nomination of staff from AGE/NAFA, to be on the ERC call-out list, and FAO will nominate an officer and an alternate to be the contact point in TCES.

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ANNEX I

FAO STRATEGY FOR STRENGTHENING STATES' PREPAREDNESS

1. General Considerations

The International Strategy for Disaster Reduction[7] encapsulates FAO's approach to disaster management, namely to proceed from protection against hazards to the management of risk by integrating risk prevention into sustainable development.

2. Co-ordination

The ECG[8] is responsible to "ensure coherent preventive action and systematic response from all the concerned units within FAO, through enhanced collaboration at all stages in the emergency, entailing both normative elements (establishing clear and practical guidelines and procedures) and operation elements (ensuring high levels of synergy between field operations at each stage)".[9] Activities are then implemented through the Special Emergency Programmes Service (TCES), which is FAO's operational focal point responsible for responding to nuclear emergencies. According to the ECG Working Group on prevention and preparedness this needs to be an integral part of agricultural development work that is systematically incorporated into all programme activities. This task was assigned to the PAIA on "Disaster Prevention, Mitigation and Preparedness and Post-Emergency Relief and Rehabilitation".[10]

3. Reducing Agricultural Vulnerability

Existing FAO resources aimed at reducing agricultural vulnerability include:

- Global Information and Early Warning Service (GIEWS)—providing information on droughts, floods and insect plagues;
- Emergency Prevention System for Transboundary Animals and Plant Pest Diseases (EMPRES)—promoting the effective containment and control of the most serious epidemic livestock diseases / Transbounday Animal Diseases (TAD) as well as newly emerging diseases by progressive elimination on a regional and global basis through international co-operation involving Early Warning, Early Reaction, Enabling research, Coordination;
- National Food Insecurity and Vulnerability Information and Mapping System (FIVIMS)—integration of agro-ecological and socio-economic information required for disaster prevention and mitigation;
- Tools for reducing climate related risk such as Local Climate (LocClim) and the rapid agricultural disaster assessment routine (RADAR);
- FAO Regional and Country officers managing field projects aimed at preparedness planning and vulnerability reduction including crop and food supply assessment missions.

Progress has been made in georeferencing of data and developing databases and models on land use/resources and resource management. However, often the resolution is insufficient to enable tactical application of agricultural countermeasures following a nuclear emergency.

4. Intervention plans relating to food

A general strategy for introducing food controls and agricultural countermeasures should be established in the planning for emergency response. Since States 'have the ultimate responsibility to protect life, property, the environment and quality of life on their territories'[1] it follows that they should have developed emergency response plans.

States adopting the Safety Requirements on Preparedness and Response for a Nuclear or Radiological Emergency[2] are required to make appropriate plans, in particular in accordance with paragraphs 4.85–4.93, which relate to food and agriculture. Any FAO and IAEA guidance in this regard will be in accordance with these requirements.

The FAO should ensure it is informed of such plans that relate to food and agriculture through regional or country offices or, where these do not exist, through AGE. On request, the FAO will advise on the suitability of these plans and may, if it deems necessary, offer unsolicited comment and advice. In the event of an emergency the FAO will support the application of emergency plans to the extent possible. Capacity building will be necessary and it is envisaged that FAO Department of Technical Co-operation would be involved.

Guidance on formulating plans is given in *Generic Assessment Procedures for Determining Protective Actions During a Reactor Accident* (TECDOC-955 IAEA, Vienna 1997), *Guidelines for Agricultural Countermeasures following an Accidental Release of Radionuclides* (Technical Report Series No. 363 IAEA, Vienna 1994) and Doc Master[11]. The FAO will review the latter at appropriate intervals to ensure they are up to date. The FAO would wish to ensure that:

a) the national organization responsible for intervention related to food is fully integrated into the general response plans;

b) there is a plan for sampling foodstuff;

c) there are procedures to make ingestion protective action decisions (including pre-determined Intervention Levels, see Annex III);

d) there are procedures to request additional sampling and analysis support from neighbouring countries;

e) there are plans to implement and enforce food and water control considering local availability of replacement food;

f) national intervention levels for long-term restrictive actions and restriction of food are consistent with international guidance;

g) there are plans and means to monitor and control export of food and products;

h) there are plans that deal with the assessment and application of agricultural countermeasures for a range of possible situations.

The outlines of a basic emergency response plan are set out in the Annex II.

ANNEX II

A BASIC EMERGENCY RESPONSE PLAN FOR FOOD AND AGRICULTURE

1. INTRODUCTION

The requirements are set out in *Preparedness and Response for a Nuclear or Radiological Emergency* (GS-R-2, IAEA, 2002), especially paragraphs 4.85–4.93, and guidance is given in *Guidelines for Agricultural Countermeasures following an Accidental Release of Radionuclides* (Technical Reports Series No. 363 IAEA, Vienna 1994) and Doc Master. This annex gives an indication of the elements necessary for a minimum emergency response capability. As in any case of severe accidental contamination of the environment, all levels of government, from central down to local, will be involved.

The main considerations in preparing an agricultural countermeasures strategy are to:

- protect human health by reducing radioactive contamination of agricultural products;
- return the land to normal usage as far as possible; and
- balance health protection measures, cost and the disruption to daily life.

2. INFORMATION REQUIREMENTS

A comprehensive countermeasures plan requires an extensive base of information as indicated in the following table:

TABLE 1. PRINCIPAL ELEMENTS OF PRIOR INFORMATION NEEDED FOR COUNTERMEASURES PLANNING

Topic	**Information**
Environment	Maps showing topography, soil characteristics, land utilization, hydrology, deposition of radionuclides, climate data
Agriculture	Production systems, yields, quantities and prices of products sold, materials inputs, economic importance
Infrastructure	Availability and costs of transport, communications, fuel, water, medical services
Social factors	Population size and distribution, employment patterns, health profiles, recreational uses of rural areas
Catalogue of suitable countermeasures	Effectiveness, resource requirements, costs (of collective dose reduction), compatibility with other countermeasures, possible side effects
Radioecology	Relevant transfer factors, accumulation and biological half-lives in livestock, retention factors by main local vegetation canopies, factors for reduction of radionuclide contamination by processing operations

On the basis of the relevant information, Intervention Levels for food, animal feedstuffs and soil should be set in advance ready for immediate application in the case of an emergency (see Annex III).

3. TIMING

The timing and nature of countermeasures depend on the season of the year, site-specific factors, the quantity and composition of the radionuclides in the release. Those most likely to be of concern are ^{131}I (half-life 8d), ^{134}Cs (half-life 2.3y), ^{137}Cs (half life 23 y) and ^{90}Sr (half life 25y). The post-accident period can be conveniently divided into three phases, but these overlap so that distinct divisions cannot be made.

3.1. Early Phase (General Emergency Class)

This may begin before the fallout arrives since warning may be obtained several hours and sometimes days beforehand. The period should be used to estimate the severity and consequences of the expected deposition. Naturally, protection of the population will be the first priority, but then consideration should be given to protection of food and water supplies. This phase ends when the 'cloud' has passed and acute deposition has finished. Countermeasures for this phase must be applied rapidly but as they will be based on incomplete data there is a high degree of uncertainty so they should be inexpensive.

3.1.1. Early Phase Actions

Activate arrangements for managing the accident response;

Activate and test emergency communication networks, including those with international links;

Consider appropriate early and short-term countermeasures[12] including:

- House Animals (5.2.2.1, 6.2.1.1)
- Cover feed/food stores and open water (5.2.2.2)
- Harvest ripe crops (5.2.2.2)
- Delay harvest of forage and other crops (6.2.1.3)
- Cover high value crops (5.2.2.2)
- Apply specific countermeasures against ^{131}I contamination of milk. (6.2.2)

Keep the general public, and farmers in particular, fully informed of the expected course of events, and of the steps that may be taken to protect the food chain;

Begin to develop intermediate and late phase countermeasure plans appropriate to the expected contamination;

Use any information available, for example, from the site, from analysis of the plume and meteorological data to predict the likely consequences for the country, and in particular for agriculture;

Share data with other national and international scientific organizations;

Mobilise emergency staff and monitoring teams, clear laboratories of other work;

Begin to monitor radioactive contamination of food and the environment.

All actions at this and subsequent phases should be made known to neighbouring countries, FAO, IAEA and other international organizations to ensure adequate co-ordination.

3.2. Short-Term Phase

The duration of the short-term response depends on the half-life of short-lived radionuclides deposited (normally ^{131}I, half-life of 8 d). A period of a few weeks is sufficient for such radionuclides to decay to negligible amounts.

Initial decisions to identify areas and products that should have the highest priority in the early monitoring programme have to be based largely on model calculations. It is important that the responsible authorities receive data rapidly so that calculated figures can progressively be supplemented by measured values and that the public is kept as fully informed as possible.

3.2.1. Short- Term Phase Actions

Introduce temporary permissible levels, immediately for ^{131}I, as soon as possible for radio-caesium and –strontium;

Prevent harvesting, movement and distribution of agricultural produce contaminated at unacceptable levels (see Appendix for suggested values);

Identify alternative sources of food available through domestic or international trade;

Predict contamination levels at harvest of currently growing crops as soon as possible;

Identify main scientific tasks to assist decision making;

Consider provisional medium to long-term countermeasures and initiate any necessary pilot investigations;

Maintain intensive programme of monitoring, dose assessment and countermeasures;

Prepare detailed and comprehensive maps of contamination of the agricultural environment, preferably including data from pre-fallout or pre-accident periods;

Replace calculated data in decision models with actual data as they become available;

Review agricultural countermeasures taken during the early-warning and consider additional short-term actions such as:

- store harvested fodder to allow ^{131}I to decay (6.10);
- process milk contaminated with ^{131}I and store products (6.2.2.1);
- harvest and dispose of vegetation that has protected soil (6.2.2.1);
- identify crops that may be decontaminated by food processing or used in a non-food application (Section 8);
- assess desirability of distributing Prussian Blue (7.5.3.5); and
- assess need to change cultural operations (e.g. cultivation) to: 1) reduce residence time of workers in contaminated fields; 2) reduce dust formation and secondary contamination.

3.3. Medium-Term Phase

If it is judged that the problem in the affected areas will persist, long-term countermeasures to reduce contamination of the food chain must be considered. It may also be appropriate to review intervention levels. Consideration should also be given to worker exposure, including that derived from nuclides such as ^{239}Pu that are not generally taken into food chains.

The main long-term problems are caused by contamination with long lived radionuclides, especially ^{137}Cs and ^{90}Sr. The extent of this contamination would have been identified by the radiological surveys made during the short-term phase. An adequate response to long-term contamination needs a more extensive and systematic approach than is necessary for short-term action. Hence, ongoing countermeasures will require revision.

3.3.1. Medium-Term Actions

The main tasks will be to prepare for long-term programmes. This involves:

- review intervention levels for foodstuffs and revise as necessary;
- continue monitoring to control foodstuffs to reassure public and assess the effectiveness of countermeasures;
- ensure farmers are applying the most important and effective countermeasures;
- further develop databases to facilitate future decisions including contamination maps down to individual farm scale;
- prepare a long-term radiological forecast (contamination of the environment and crops, dose commitment, etc.);
- prepare long-term programmes based on intervention levels (Annex III) and inventories of countermeasures (TRS 363 sections 7 and 8, DocMaster);
- continue/initiate scientific/technological studies needed to implement future countermeasures; and
- initiate educational programmes for specialists and the general public.

The use of model farms or demonstration projects might be an effective way to train farmers in countermeasure techniques, and to demonstrate both to them and to the public the effectiveness of the countermeasures. An ongoing research and development programme may be needed to improve the countermeasures.

3.4. Late-phase

In the late-phase the radioactive contamination is mainly due to long lived radionuclides and contamination of foodstuffs occurs primarily through root uptake of radionuclides by plants. The need for long-term agricultural countermeasures can be assessed and suitable countermeasures applied consistent with the availability of uncontaminated foods through trade. This may include using land for non-food crops. This phase may last for several years so it is beyond the scope of 'Emergency Response'.

4. PUBLIC INFORMATION

It is essential that spokespersons are fully aware of the actions and statements of all departments; rapid communication among all departments and the central government press team is therefore vital. This is another area where regular drill exercises are extremely important. In some cases authorities may wish to ensure that official statements appear unaltered in newspapers, perhaps by paying for advertisements.

In addition to general information released to the media, authoritative information should be issued directly to the farmers in a clear and concise form. The following topics may be relevant to them:

- the scale and distribution of contamination of farmland in an easily understandable form (maps);
- the main hazards and possible consequences;
- the identity of the central and local authorities to be contacted for information and advice;
- the actions being introduced or planned, including the observance of intervention levels and contamination limits;
- financial aspects of the countermeasures.

ANNEX III

INTERVENTION LEVELS

1. INTRODUCTION

The Safety Requirements for Preparedness and Response for a Nuclear or Radiological Emergency (GS-R-2) set out requirements on the establishment of intervention levels (paragraph 4.88). The competent management authority should specify intervention levels for use in abnormal situations in advance. If the value of the quantity of interest exceeds or is predicted to exceed a particular intervention level, the appropriate remedial action should be taken.

2. INTERVENTION LEVELS FOR FOOD

No two accidents will ever be alike - the proportions of the various radio-isotopes released, the meteorological conditions, the transfer rates to different food products, and factors such as the season of the year will affect the doses that could be received by members of the public through the food chain. Theoretically, the intervention levels for different nuclides and different foodstuffs will depend on the particular accident and prevailing conditions. However, intervention levels must be specified in advance of an accident to avoid confusion within food control authorities, and must be consistent with existing food legislation. There is considerable advantage in using internationally recognized values for the intervention levels; this will help in maintaining credibility, confidence and trust in the authorities. The use of such values will also help to prevent the anomalies that otherwise might exist along the borders of neighbouring countries. Since the difference between a theoretically more specific set of levels and a simple generic set is relatively small, the added complexity of more sophisticated schemes of intervention levels is not warranted in a simple basic response plan. Discussions of how to calculate more specific intervention levels may be found in Radionuclide Contamination of Foods: FAO Recommended Limits[13] and the USFDA Accidental Radiation Contamination of Human Food and Animal Feeds: Recommendations for State and Local Agencies[14]. These publications illustrate the complexity of such calculations.

The *Codex Alimentarius* Commission of the FAO and WHO has addressed the situation of international standards in order to maintain widespread international trading in food. Guideline levels for radionuclides in international trade following accidental nuclear contamination have been agreed. It should be recognized that these levels are a compromise between what is appropriate on radiological protection grounds (which would give rise to higher values) and the natural wish of countries unaffected by an accident to avoid importing produce with any contamination at all, no matter how small, even compared with natural radiation. On the basis of the arguments described above, they are appropriate on a generic basis as intervention levels. They are reproduced in Table 1.

These levels apply to national control where alternative food supplies are available; if this is not the case, higher levels may be justified. As the proposed levels were derived using extensive conservative assumptions, there is no need to add contributions from each of the three groups; each group should be treated independently. However, if more than one radionuclide is present, the activities of the different accidentally contaminating radionuclides within a group should be added together. For example, following a reactor accident, ^{134}Cs and ^{137}Cs could be contaminants of food and the 1000 Bq/kg refers to the summed activity of both these radionuclides.

These levels are intended to be applied to food prepared for consumption, and would be unnecessarily restrictive if applied to dried or concentrated food prior to dilution or reconstitution.

The intervention levels are specified as activity concentrations for a particular radionuclide (or group of radionuclides) in the foodstuff (e.g. Bq/kg, Bq/L), and countermeasures must be taken to achieve values lower than these; otherwise the food must be withdrawn from consumption. Note that diluting contaminated food with uncontaminated food to meet these levels would not reduce the collective dose to the whole population.

TABLE 1. GENERIC INTERVENTION LEVELS FOR WITHDRAWAL OF FOODSTUFFS WHERE ALTERNATIVE SUPPLIES ARE READILY AVAILABLE

Dose per unit intake (Sv/Bq)	Representative	Level (Bq/kg)
Foods destined for general consumption		
10^{-6}	Am-241, Pu-239	10
10^{-7}	Sr-90	100
10^{-8}	1-131, Cs-134, Cs-l37	1000
Milk and infant foods		
10^{-6}	Am-241, Pu-239	1
10^{-7}	Sr-90, 1-131	100
10^{-8}	Cs-l34, Cs-137	1000

3. INTERVENTION LEVELS FOR ANIMAL FEEDSTUFFS

There will also be a need for authorities to develop secondary reference levels (so-called 'operational intervention levels') for other quantities such as animal feeds and levels of contamination on pasture at which animals should be withdrawn. The issue is complicated by the difference between the early phase after an accident when the contamination of forage is by both uptake from the soil and direct aerial deposition and the longer term when only contamination by root uptake is important. Further, intakes of radioactivity by livestock depend on the composition of the diet, the time of year deposition occurred and the activity concentration in each feedstuff. Thus, again, a simple if conservative set of values is appropriate for a simple basic response. The Council of the European Communities (CEC) has specified Maximum Permitted Levels (MPLs) of radiocaesium contamination in marketed animal feedstuffs[15], which are suitable for this purpose (Table 2). It was not considered necessary to develop MPLs for other radionuclides. A detailed discussion of the issues involved, including the calculation of working levels, is given by Woodman and Nisbet[16].

TABLE 2. CEC MAXIMUM PERMITTED LEVELS OF RADIOCAESIUM ($^{134}Cs+^{137}Cs$) IN ANIMAL FEEDSTUFFS

Animal	**MPL** (Bq/kg as fed)
Dairy cattle	5 000
Beef cattle	5 000
Lambs	2 500
Pigs	1 250
Broiler chickens	2 500
Laying hens	2 500

4. INTERVENTION LEVELS FOR SOIL

There are no internationally agreed levels for soil.

The following tables show ranges of transfer factors for Cs and Sr into cereals and leafy green vegetables. They are derived from the Report of the 2nd FAO/IAEA Research Co-ordination Meeting of the Co-ordinated Research Programme 'The Classification of Soil Systems on the Basis of Transfer of Radionuclides from Soil to Reference Plants'. The data were derived from references[17,18,19].

These tables are included for two purposes:

1) Tables 3 and 4 can be used to judge local data; if they fall outside these ranges, which are wide, the methodology and calculations need careful evaluation;

2) If local data are not available, values can be calculated from the summary data in Table 5 to give some guidance.

TABLE 3. REFERENCE TRANSFER FACTORS OF Cs FROM ACCIDENTAL RELEASES (Non-equilibrium conditions) FOR CEREALS AND LEAFY GREEN VEGETABLES. REFERENCE VALUES ARE EXPRESSED AS (BQ/KG DRY CROP)/(BQ/KG SOIL IN THE UPPER 20 CM OF SOIL).

Nutrient status	Soil type	Reference TF's for cereals		Reference TFs for leafy green vegetables	
		Expected value	Range	Expected value	Range
High nutrient status, pH > 4.8	All soils	0.05	0.02 - 0.1	0.5	0.2 -1
Medium nutrient status, pH > 4.	Clay and loam soils	0.1	0.05 – 0.5	1	0.5 –5
	Sand, peat and other soils	0.2	0.1 – 0.5	2	1 – 5
pH < 4.8	Clay soils	0.5	0.2 – 1	5	2 – 10
	Sand and other mineral soils	0.7	0.2 – 2	6	2 – 20
	Wet, gleyic peat soils	8	2 – 20	70	20 – 200

In Table 3, the highest transfer factors for Cs are 20 for cereals and 200 for green vegetables in wet, gleyic peat soils. Thus soil concentrations in the top 20 cm of 50 Bq/kg for cereals and 5 Bq/kg for green vegetables would produce levels of 1000 Bq/kg (the *Codex Alimentarius* limit) in the crops. Assuming a soil bulk density of 1, 1 m^2 of soil to a depth of 20 cm weighs 200 kg so these soil concentrations convert to 10 kBq/m^2 and 1 kBq/m^2 respectively. Thus these figures represent the highest levels of contamination at which countermeasures are almost certainly unnecessary so any higher levels should trigger consideration of the introduction of countermeasures for food crops.

(A bulk density of 1 is assumed here for convenience. However, most soils do not have a bulk density of 1 and if necessary the calculation could use the actual bulk density of the soil under consideration).

TABLE 4. EXPECTED TRANSFER FACTORS FOLLOWING ACCIDENTAL RELEASES (Non equilibrium conditions) OF Sr FOR CEREALS AND LEAFY GREEN VEGETABLES. REFERENCE VALUES EXPRESSED AS (BQ/KG DRY CROP)/(BQ/KG SOIL IN THE UPPER 20 CM OF SOIL).

Soil type	Reference TFs of Sr for cereals		Reference TFs of Sr for Vegetables	
	Expected value	Range	Expected value	Range
CLAY AND LOAM				
Ca, pH or OM not specified	0.15	0.015-1.8	1.5	0.15-18
SAND				
Ca, pH or OM not specified	0.3	0.03-3	3	0.3-30
ORGANIC (PEAT, OM > 18)				
No further specification	0.035	0.01-0.1	0.35	0.1-1

In Table 4 the highest TFs for Sr are 3 for cereals and 30 for green vegetables in sandy soils so that soil concentrations of 33 Bq/kg (or 11 6.6 kBq/m^2) and 3.3 Bq/kg (or 660 Bq/m^2) respectively would produce crops at the Codex limit of 100 Bq/kg so any higher levels should be taken as the trigger for the consideration of the introduction of countermeasures.

Table 5 summarises the relevant calculations.

TABLE 5. RECOMMENDED SOIL LEVELS ABOVE WHICH COUNTERMEASURES MAY BE NECESSARY.

	Radionuclide contamination			
	Cereals		Leafy vegetables	
	Bq/kg soil	kBq/m^2	Bq/kg soil	kBq/m^2
$^{134+137}$Cs	50	10	5	1
^{90}Sr	55	11	3.3	0.66

These figures apply to food crops; higher values are for MPLs appropriate for fodder crops and can be calculated calculated for radiocaesium using the levels in Table 2. Levels for Sr for dairy cows and laying hens will be similar to those of Cs but some 100 times greater for meat animals[14].

NOTES

[1] European Commission, Food and Agriculture Organization of the United Nations, International Atomic Energy Agency, International Civil Aviation Organization, OECD Nuclear Energy Agency, Pan American Health Organization, United Nations Office for the Co-Ordination of Humanitarian Affairs, United Nations Office for Outer Space Affairs, World Health Organization, World Meteorological Organization, Joint Radiation Emergency Management Plan of the International Organizations, EPR-JPLAN (2002), IAEA, Vienna (2002).

[2] Food and Agriculture Organization of the United Nations, International Atomic Energy Agency, International Labour Organization, OECD Nuclear Energy Agency, Pan American Health Organization, United Nations Office for the Co-Ordination of Humanitarian Affairs, World Health Organization, Preparedness and Response for a Nuclear or Radiological Emergency, Safety Standards Series No. GS-R-2, IAEA, Vienna (2002).

[3] The Joint FAO/IAEA Division will maintain a register of experts who can be mobilized at short notice.

[4] The IAEA is deemed to meet its obligations to notify FAO when it contacts AGE (by telephone/fax).

[5] It is envisaged that FAO would have a desk in the ERC and an e-mail account for FAO (Vienna). All messages would be copied to a list of pre-agreed contacts in NAFA, ERC and TCES.

[6] A preliminary assessment is only prepared for a 'general emergency' or 'other radiation emergency or threat'.

[7] http://www.unisdr.org/unisdr/safer.htm

[8] ECG co-ordinates disaster management strategies with other UN agencies as disasters may be both humanmade and natural and/or a combination of both.

[9]FAO Director-General's bulletin dated 23 August 1999 No. 99/16
(http://internal.fao.org/ois/afsintranet/dgb/dgb99_16.htm)

[10] FAO medium term plan 2002-2007

[11] DocMaster (http://www-infocris.iaea.org/EN/w3.exe$DocMaster) requires a valid user name and password to access.

[12] Numbers in parenthesis refer to sections of paragraphs of TRS 363 and DocMaster.

[13] http://www.fao.org/docrep/u5900t/u5900t08.htm

[14] http://www.fda.gov/cdrh

[15] Off. J. Eur. Commun. L83/78 (1990).

[16] Woodman, R.F.M., Nisbet, A.F., Health Physics 77(4), 383-391 (1999).

[17] International Union of Radioecologists, VIth Report Working Group Soil to Plant Transfer Factors, Balen, Belgium, 1992.

[18] Nisbet, A.F., Woodman, R.F.M., Haylock, R.G., National Radiation Protection Board, Chilton, UK, Report NRPB-B304 (1999).

[19] Transfer of Radionuclides from Air, Soil and Freshwater to the Foodchain of Man in Tropical and Subtropical Environments, IAEA TECDOC.