

Responses to Questions about The Management of Workers Exceeding Dose Limits in Accident Situations

Question 1: Overall Summary

All those responding said yes, there are nationally-established dose criteria for emergency situations. In general these are expressed as reference levels. While some responses did not explicitly call their criteria reference levels, the criteria were presented as numbers they did not want to exceed, and as such could functionally be considered as reference levels.

However, in two cases (France and Finland) firm upper-value limits were established.

Q1: Do you have dose criteria, beyond normal-situation dose limits, that workers can be allowed to receive in emergency situations?

All those responding said yes.

Q1: If so, what are the nature (e.g. Limit? Constraint? Reference Level?) and value of your criteria?

There are 2 categories of workers that are likely to be exposed in emergency situations:

Category 1 – special teams which are likely to run into occupational exposures during emergency, involving the risk of exceeding one of the normal dose limits for the exposed staff. The selected personnel are to be classified in advance by the licensed physician based on the age and health parameters. The special teams include technical, medical and health (sanitary) experts for radiological emergency, and they have to attend a special training.

- From 50 mSv (*Switzerland, Romania*) up to 100 mSv total effective dose (*France, Italy, UK, Slovenia, Russia*) for the duration of their mission – for protecting major property, preventing serious health detriment, preventing large collective dose, restoring safety system of a nuclear reactor, dose rate monitoring and where lower dose limit is not practicable;
- 300 mSv equivalent dose to the eye lens (*Italy, UK*);
- 1 Sv equivalent dose to the hands, forearms, feet and ankles (*Italy*);
- 1 Sv equivalent dose to the skin (*Italy, UK*).

Exposure **above** the aforementioned limits is permitted, in exceptional circumstances, but only for the purpose of saving human lives, for volunteers (usually older than 30 years, *Russia*) from the special teams that are fully aware of the risks involved:

- from 200 (*Russia*) up to 750 (*Netherlands*) mSv effective dose (for *Korea* – non-applicable) – reference level for lifesaving, protection of large populations, and, in some cases, preventing reactor core melting, preventing large release;
- 500 mGy (*UK*) – whole body dose upper value;
- from 2000 mSv per annum (*Russia*) to 5000 mGy (*UK*) or 5000 mSv (*Slovakia, Korea*) – dose to skin upper value.

Category 2 – other workers classified as professionally exposed to ionizing radiation that, in an emergency situation, are subject to exposures exceeding the normal dose limits for exposed workers, when no other techniques are available to avoid it, and after special authorization by the supervisory authority.

- from 10 (*France*) to 50 (*Spain*) mSv effective dose – reference level;
- 300 mSv equivalent dose to the lens (*Italy*);
- 1 Sv equivalent dose to the hands, forearms, feet and ankles (*Italy*);
- 1 Sv equivalent dose to the skin (*Italy*).

Reference levels above may be exceeded exceptionally, in order to save human life, but in any case the effective dose integrated over the lifetime must not exceed **1 Sv** (*France*), or the equivalent dose at any point on the skin shall not exceed **5 Sv** (*Finland*).

Question 2: Overall Summary

All those who responded said: either that medical examination and permission to continue work in areas where radiation exposure could occur; or that dose restrictions for further work were imposed.

The only specific requirement regarding the managing of exposure exceeding limits came from the US NRC, which specifies that:

Doses received in excess of the annual limits, including doses received during accidents, emergencies, and planned special exposures, must be subtracted from the limits for planned special exposures that the individual may receive during the current year (see § 20.1206(e)(1)) and during the individual's lifetime (see § 20.1206(e)(2)).

It was also noted by all that specific dose limitations applied to pregnant women, and some mentioned that once a women declared herself to be pregnant then specific limits applied.

Finally, no differences in requirements or limitations were reported for men and women of child-bearing-age.

Q: Following an accident situation where workers have been exposed beyond your normal-situation occupational exposure dose limit, do you impose any work restrictions for further work by over-exposed workers, e.g.

- *No further work in radiation areas for some defined time frame?*
- *Further work in radiation areas allowed but with strict dose restrictions?*
- *Different restrictions for men and child-bearing-age-women?*
- *Other?*

In *Slovenia*, if the annual dose limit was exceeded, worker is not allowed to work with ionizing radiation for 12 months from the event.

In emergency situations, persons exposed with the effective dose of 100 mSv should not incur exposure above 10 mSv (*Italy*) or 20 mSv/year (*Russia, Armenia*) dose in a year further on, or their employer must request medical advisory previously to authorize any other additional radiation exposure (*Brazil*).

Exposure above the effective dose of 200 mSv a year should be considered as a potentially harmful and the persons incurring such overexposure should be immediately removed from the exposed area and sent for the medical examination. Further work of these persons with sources may be permitted only by the Regulatory Authority empowered with responsibilities for health issued with prior consent of these people (*Armenia, Canada*).

In *Australia, Czech Republic, Finland, Korea, Netherlands, Romania, Slovakia, the UK, the USA*, there are no requirements for work restrictions on workers who have been exposed beyond normal dose limits following accidents. However it is expected if such an accident were to occur, the federal regulatory authority would deal with each situation on a case-by-case basis, depending on the nature of the exposures e.g. magnitude of exposure, exposure type (external versus internal etc), exposure groups (child-bearing age women etc), and if deemed necessary impose restrictions to prevent further exposure.

There are no different restrictions for men and child-bearing-age-women as defined for post-accident situation (*Brazil, Czech Republic, Korea, Romania*). In *Canada, Switzerland, the USA*, however, pregnant women have specific dose limits (emergency dose limits do not apply to them; in *Switzerland* - 2 mSv per year external and 1 mSv by incorporation; in *the USA* - the equivalent dose is 5 mSv); otherwise, women of child bearing age have the same dose restrictions as other workers. In *France, the UK*, pregnant or breast-feeding women and persons less than eighteen years old cannot be included in the teams of Category 1: when the risk of exposure to ionising radiation is established, pregnant or breast-feeding women and persons less than eighteen years old in the second group are excluded from the radiological danger zone.

Question 3: Overall Summary

All those responding reported that workers exceeding emergency dose criteria shall be medically examined. A few specified the type of medical testing that was required, but most responses were general and suggested that requirements would be determined on a case-by-case basis by examining physicians.

There were no specifications as to how long such medical surveillance should be undertaken.

Q: Following an accident situation where workers have been exposed beyond your normal-situation occupational exposure dose limit, do you impose any special medical surveillance requirements? If so, what type of requirements and for what time period?

The *French* regulation does not impose any peculiar requirement for the medical surveillance of the workers after an accident situation. The occupational doctor takes any decision that he considered useful for the health of the worker. During the period when the dose remains above the limit, the medical surveillance relevant to category 1 of workers including at least one medical visit per year remains applicable.

For most of the countries, in summary, the medical management of over-exposed workers following an accident should be consulted with the appropriate regulatory authority as soon as possible, including psychological counselling. According the level of exposure, it may vary from a simple medical follow up to a specialized treatment in a reference hospital for ionizing radiation treatment. In the instructions for the potentially involved medical personnel the need of considering the latency period of possible effects is adequately pointed out. Clinical controls, specific examinations and the time period of further medical surveillance depend on specific situation (received dose, type of exposure, etc.) and they fall under the competence of the licensed physician.

Employers must also arrange for health records to be kept in respect of employees who are subject to medical surveillance. Such records are not essential for non-classified persons who receive emergency exposures, but employers may find it is useful to keep a record of the medical surveillance that has

been conducted using a health record. If so, such a health record would normally be kept until the person to whom it relates has or would have attained the age of 75 years, but in any event for at least 50 years from the date of the last entry made in it.

In *Romania*, the occupational health physician must perform at least the following medical surveillance: general clinical exam; complete hematological exam; cytogenesis analysis (chromosome aberrations); whole body counting; radiological toxicology investigations; other specialty examinations necessary to specify the diagnosis.

In *Finland*, if there is reason to suspect that the dose exceeds 0,5 Sv, a blood sample shall be taken as soon as possible after the exposure and follow-up sample 24 hours after the exposure. Further follow-up is decided case-by case.

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The Management of Workers
Exceeding Dose Limits in Accident Situations**

Q1: Do you have dose criteria, beyond normal-situation dose limits, that workers can be allowed to receive in emergency situations? If so, what are the nature (e.g. Limit? Constraint? Reference Level?) and value of your criteria? (See some national approaches that are documented in the NEA ISOE Report on OCCUPATIONAL RADIATION PROTECTION IN SEVERE ACCIDENT MANAGEMENT, NEA/CRPPH/R(2014)5)

Australia

In Australia, ARPANSA has produced recommendations for intervention in emergency situations involving radiation exposure (RPS 7) which can be downloaded from the ARPANSA website at

<http://www.arpansa.gov.au/pubs/rps/rps7.pdf>

The table below indicates the recommended allowable exposures for different categories of workers:

**IAEA TOTAL EFFECTIVE DOSE GUIDANCE FOR EMERGENCY
WORKERS
(IAEA 2000)**

Tasks	Total effective dose guidance [mSv]
Type 1: Life saving actions	<500 ^a
Type 2: Prevent serious injury Avert a large collection dose Prevent the development of catastrophic conditions	<100
Type 3: Short term recovery operations Implement urgent protective actions Monitoring and sampling	<50
Type 4: Longer term recovery operations Work not directly connected with an accident	Occupational exposure guidance, as given in Table 9.

- a. This dose can be exceeded if justified BUT every effort shall be made to keep dose below this level and certainly below the thresholds for deterministic effects. The workers should be trained on radiation protection and understand the risk they face. They must be instructed on the potential consequences of exposure. The benefits to others must clearly outweigh the risks to the workers.

Canada, CNSC	Yes. Effective dose shall not exceed 500 mSv and the equivalent dose received by skin shall not exceed 5000 mSv in emergency situations. Currently, Section 15 of Canada's Radiation Protection Regulations (RPRs) permit the "normal situation" dose limits for effective and equivalent doses (defined in Sections 13 and 14 of the RPRs) to be exceeded during the control of an emergency; however, the effective dose shall not exceed 500 mSv and the equivalent dose received by skin shall not exceed 5000 mSv. The CNSC has proposed amendments to Section 15 of the RPRs. The proposed amendments identify dose limits for persons during an emergency as well as reference levels for dose which would apply to rare situations in which persons may be required to undertake specific actions during the emergency response. It is expected that these amendments will come into effect, in 2015.
France, ASN	Workers (exposure limits or reference levels) The Labour Code in the French regulation defines "exposed workers" as workers, including self-employed workers, who are subject to occupational exposures which may exceed dose limits set for members of the public. Articles R. 4451-12 and 13 of the Labour code set the dose limits for workers : - the sum of the effective doses received by external and internal exposure must not exceed 20 mSv over twelve consecutive months ; - the equivalent dose limits for different exposed body parts are the following : - o for hands, forearms, feet and ankles, the exposure received during twelve consecutive months must not exceed 500 mSv; - o for skin, the exposure received during twelve consecutive months must not exceed 500 mSv; this limit applies to the average dose on any area of 1 cm², whatever the exposed area; - o for the crystalline lens, the exposure received during twelve consecutive months must not exceed 150 mSv (20 mSv in the new European Directive). In the case of pregnancy, arrangements are made so that the occupational exposure of the pregnant woman is such that the exposure of the unborn child during the time elapsing between the notification of the pregnancy and the time of birth is as low as

reasonably achievable, and in any case less than 1 mSv.

Breast-feeding women must not be assigned to or kept at work stations giving a risk of internal exposure.

Persons aged from sixteen to eighteen years authorised during their training to carry out work exposing them to ionising radiation cannot receive an effective dose greater than 6 mSv or equivalent doses greater than the following values over twelve consecutive months:

- 150 mSv for hands, forearms, feet and ankles;
- 150 mSv of skin; this limit applies to the average dose on any area of 1 cm², whatever the exposed area;
- 50 mSv for the crystalline lens.

Article R. 4451-15 of the Labour code provides that derogations may be made to the exposure limits during occupational exposure of individuals intervening in a radiological emergency based on the reference exposure levels set pursuant to the aforementioned provisions of the Public Health Code (see below). It may be permitted, in exceptional circumstances, to exceed these reference levels within the context of emergency operations aimed at saving human lives, for voluntary personnel informed of the risk involved with their intervention.

Intervention personnel (reference levels)

Article R. 1333-83 of the Public health code defines as intervention personnel the various categories of personnel likely to be involved in the management of a radiological emergency, as well as any person acting either within the context of agreements with public authorities or within the context of the requisitions provided for by Article 17 of Act No. 2004-811 of 13 August 2004 on modernisation of civil security, under the authority of the director of emergency operations, in particular with regard to the emergency plans provided for by this act.

In Article R. 1333-84 of the Public health code, with a view to determining the conditions for their selection, training and medical and radiological surveillance, intervention personnel are divided into two groups:

- the first group is made up of the personnel in the special technical, medical or sanitary intervention teams;
- the second group is made up of individuals who do not belong to special response teams but who are involved for the purpose of missions within their jurisdiction, such as policemen, fire fighters, people in charge of radioactivity measurements, medical teams in hospitals, physicians,...

Article R. 1333-86 of the Public health code sets that the individual effective dose likely to be received by group 1 personnel, for the duration of their missions, is 100 mSv. It is set at 300 mSv when the intervention is intended to protect people. The individual effective dose likely to be received by group 2 personnel is 10 mSv.

	It may be permitted, in exceptional circumstances, to exceed those reference levels in order to save human life, for voluntary personnel informed of the risk involved with their intervention. Under no circumstances may the total effective dose over the lifetime of a member of intervention personnel exceed 1 Sv.
France, IRSN	There are two groups of emergency workers in the French regulation: - Group 1 consists of the personnel composing special teams of technical, health or medical intervention previously readied in advance to cover an emergency situation. - Group 2 consists of people not belonging to special teams but intervening for missions according to their competence. Group 1 of emergency workers can be allowed to receive doses above the ‘normal-situation’ dose limits. The reference level is 100 mSv during their missions. The reference level is 300 mSv if their intervention is aimed at protecting people. The reference level for Group 2 is 10 mSv. Reference levels may be exceeded exceptionally, for saving people, by emergency workers who are volunteers and well informed of the risk of their intervention. In any case the effective dose integrated over the lifetime must not exceed 1 Sv.
Korea, KNHP	Answer Q1~3) KHNP do not have dose criteria, beyond normal-situation dose limits in emergency situation. But KRHI(KHNP Radiation Health Institute) will conduct R&D Project titled “Study on Improvement of Emergency Worker’s Emergency Medical System in NPP’s emergency”. The results of project will contain answers about your 3 questions and will start next march. * In Notice of the Nuclear Safety and Security Commission, “Standards for Radiation Protection, etc.”, dose limit in emergency situation is described as following; The workers doing the emergency work or inevitably taking part in such works as dealing with accidents to prevent the spread of damage may be exposed up to 0.5 Sv of effective dose and 5 Sv of skin equivalent dose. This limitation shall not apply to life saving emergency works.
Korea, KINS	Yes RL: effective dose: 500 mSv, skin equivalent dose: 5 Sv Life Saving: NA

Russia	In accordance with the current Russian Sanitary Norms and rules to the work to mitigate the radiation accident and its consequences first of all, the radiation facility workers, rescue units and members of the specialized emergency teams should be involved. The planned exposure of the personnel (PEP) can be authorized only in case of life saving actions towards the people and (or) prevention of their exposure. PEP is permitted for men, usually older than 30 years with their voluntary written consent, after informing about possible radiation doses and health risks. Persons, who are not related to the personnel engaged in carrying out of emergency and rescue operations, should be prepared and allowed to work as a staff group A. Attracting women to the operations in these conditions is not permitted. The assignment of an employee to the staff of group A is performed on the conclusion of the medical commission of the absence of medical contraindications to work with sources of ionizing radiation. This means that staff rescue teams should have early in the prescribed manner designed as a staff group A. The Table below shows a summary of the restriction limiting personnel exposure to group A for PEP conditions in accordance with para. 3.2.2. NRB-99/2009 (Norms of Radiation Safety-99/2009) <table><tr><th>Criteria</th><th>Dose limits</th><th>The mechanism of restrictions</th></tr><tr><td>Effective dose</td><td>up to 100 mSv per annum</td><td rowspan="4">Permitted by sanitary supervision organizations at the level of the Russian Federation entities (regional level).</td></tr><tr><td>Equivalent dose per annum</td><td></td></tr><tr><td>lens</td><td>300 mSv</td></tr><tr><td>skin</td><td>1000 mSv</td></tr><tr><td>hand and foot</td><td>1000 mSv</td><td></td></tr><tr><td>Effective dose</td><td>Up to 200 mSv per annum</td><td rowspan="4">Permitted only by the federal bodies of sanitary supervision (federal level).</td></tr><tr><td>Equivalent dose per annum</td><td></td></tr><tr><td>lens</td><td>600 mSv</td></tr><tr><td>skin</td><td>2000 mSv</td></tr><tr><td>hand and foot</td><td>2000 mSv</td><td></td></tr></table>	Criteria	Dose limits	The mechanism of restrictions	Effective dose	up to 100 mSv per annum	Permitted by sanitary supervision organizations at the level of the Russian Federation entities (regional level).	Equivalent dose per annum		lens	300 mSv	skin	1000 mSv	hand and foot	1000 mSv		Effective dose	Up to 200 mSv per annum	Permitted only by the federal bodies of sanitary supervision (federal level).	Equivalent dose per annum		lens	600 mSv	skin	2000 mSv	hand and foot	2000 mSv	
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UK	Yes. However such emergency doses may only be incurred under carefully specified and regulated conditions. For example, the employer must first develop an emergency plan, identify those employees who may be subject to emergency exposures, provide them with appropriate training in the field of radiation protection, provide equipment necessary to restrict their exposure and make arrangements for medical surveillance and dose assessment in the event that an emergency exposure is incurred. The duty holder must also notify the regulator, in advance, of the emergency dose levels which he has determined to be appropriate and provide justification for this. The following represent upper values which may be accepted for this purpose by the regulator: Effective dose: 100 mSv Equivalent dose to skin: 1000 mSv Equivalent dose to the eye lens 300 mSv Specific arrangements may be made for lifesaving over and above these upper limits. For life saving, planning should normally ensure that the following levels are not exceeded: Whole body dose: 500 mGy Dose to skin: 5000 mGy These figures are expressed in mGy, rather than mSv, because this is the appropriate dose quantity in relation to dose effects. It is stressed that these are upper values and lower values should be proposed if this is reasonable.
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USA, DoE	Title 10, Code of Federal Regulations, Part 835 (10 CFR 835), “Occupational Radiation Protection,” establishes occupational radiation protection requirements for Department of Energy (DOE) activities and includes requirements for controlling individual exposures to ionizing radiation. The basic DOE standards for occupational radiation protection include radiation dose limits (total effective dose) that establish maximum permissible doses to workers. In addition to the requirement that radiation doses not exceed these limits, contractors and subcontractors are required to maintain exposures at ALARA levels. For the purpose of monitoring individual exposures to internal radiation, internal dose evaluation programs (including routine bioassay) are conducted for radiological workers who, under typical conditions, are likely to receive 100 mrem (0.001 Sv) or more committed effective dose, and/or 5rem (0.05 Sv) or more committed equivalent dose to any organ or tissue, from all occupational radionuclide intakes in a year. The guidelines for control of emergency exposures are: 1) Up to 100 mSv (10 rem) for protecting major property and where lower dose limit is not practicable. 2) Up to 250 mSv (25 rem) for lifesaving or protection of large populations where lower dose limit is not practicable. 3) Above 250 mSv (25 rem) for lifesaving or protection of large populations. Only on a voluntary basis to personnel fully aware of the risks involved.
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USA, NRC	Yes. NRC regulation in Part 20 standards for protection against ionizing radiation resulting from activities conducted under licenses issued by the Nuclear Regulatory Commission. The purpose of the regulations in that part to control the receipt, possession, use, transfer, and disposal of licensed material by any licensee in such a manner that the total dose to an individual (including doses resulting from licensed and unlicensed radioactive material and from radiation sources other than background radiation) does not exceed the standards for protection against radiation prescribed in the regulations in this part. That said, 10 CFR 20.1001 specifies: However, nothing in this part shall be construed as limiting actions that may be necessary to protect health and safety. NRC regulations at 10 CFR 50.47(b) requires: (11) Means for controlling radiological exposures, in an emergency, are established for emergency workers. The means for controlling radiological exposures shall include exposure guidelines consistent with EPA Emergency Worker and Lifesaving Activity Protective Action Guides. (12) Arrangements are made for medical services for contaminated injured individuals. The Environmental Protection Agency (EPA) “Manual of Protective Action Guides and Protective Actions for Nuclear Incidents,” provides guidance for controlling doses to workers under emergency conditions. <table><tr><th colspan="3">Table 2-2 Guidance on Dose Limits for Workers Performing Emergency Services</th></tr><tr><th>Rem*</th><th>Activity</th><th>Condition</th></tr><tr><td>5</td><td>all</td><td></td></tr><tr><td>10</td><td>protecting valuable property</td><td>lower dose not practicable</td></tr><tr><td>25</td><td>lifesaving or protection of large populations</td><td>lower dose not practicable</td></tr></table>	Table 2-2 Guidance on Dose Limits for Workers Performing Emergency Services			Rem*	Activity	Condition	5	all		10	protecting valuable property	lower dose not practicable	25	lifesaving or protection of large populations	lower dose not practicable
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	>25	lifesaving or protection of large populations	only on a voluntary basis to persons fully aware of the risks involved (See Tables 2-3 and 2-4)	
	*Sum of external effective dose equivalent and committed effective dose equivalent to non-pregnant adults from exposure and intake during an emergency situation. Workers performing services during emergencies should limit dose to the lens of the eye to three times the listed value and doses to any other organ (including skin and body extremities) to ten times the listed value. These limits apply to all doses from an incident, except those received in unrestricted areas as members of the public during the intermediate phase of the incident (see Chapters 3 and 4).			

	Q2: Following an accident situation where workers have been exposed beyond your normal-situation occupational exposure dose limit, do you impose any work restrictions for further work by over-exposed workers, e.g. - o No further work in radiation areas for some defined time frame? - o Further work in radiation areas allowed but with strict dose restrictions? - o Different restrictions for men and child-bearing-age-women? - o Other?
Australia	ARPANSA has no requirements for work restrictions on workers who have been exposed beyond normal dose limits following accidents. However it is expected if such an accident were to occur, ARPANSA would deal with each situation on a case-by-case basis, depending on the nature of the exposures eg magnitude of exposure, exposure type (external versus internal etc), exposure groups (child-bearing age women etc), and if deemed necessary impose restrictions to prevent further exposure. Note that ARPANSA is the regulatory authority only for Federal Government radiation workers and State and Territory regulatory authorities may impose their own restrictions.
Canada, CNSC	- o No further work in radiation areas for some defined time frame? Further work in radiation areas allowed but with strict dose restrictions? Workers would only be removed from work if dose limits were exceeded. If this occurred, the CNSC would decide whether to authorize the worker to return to work and may specify conditions and prorated dose limits with this authorization. - o Different restrictions for men and child-bearing-age-women? Pregnant women have specific dose limits. Otherwise, women of child bearing age have the same dose restrictions as other workers. Emergency dose limits in Section 15 of the RPRs do not apply to pregnant Nuclear Energy Workers. - o Other?
France, ASN	Workers In the case where one of the exposure limits for workers has been exceeded, the head of establishment informs the health, safety and working conditions committee or, failing this, the personnel delegates, and the labour inspector of the exceeded limit, giving the presumed causes, the circumstances and the measures planned to avoid a recurrence. The occupational health physician takes any measures that he or she considers useful. Any subsequent exposure of the worker concerned requires the opinion of the occupational health physician. During the period when the received dose remains above the limit values, the worker benefits from the measures applicable to

	workers in category A. During this period, the worker concerned cannot be assigned to work exposing him or her to ionising radiation, except in the case of a radiological emergency situation. Intervention personnel Article R1333-87 of the Public health code defines that after any intervention involving an established radiological risk, individual dosimetric assessment and medical monitoring of the intervening personnel is carried out (for both groups of intervention personnel). The results are communicated to each person and recorded in their medical file. Previous exposures are taken into account when deciding on the fitness of a person to carry out the tasks within his or her competence in application of the regulations specific to each category of intervening personnel. Pregnant or breast-feeding women and persons less than eighteen years old cannot be included in the teams of the first group. When the risk of exposure to ionising radiation is established, pregnant or breast-feeding women and persons less than eighteen years old in the second group are excluded from the radiological danger zone.
France IRSN	After any intervention in emergency situation, dosimetric results of the emergency worker must be reviewed. The medical fitness of the worker must take his previous exposures into account. Following an accident situation where workers have been exposed beyond the normal-situation occupational exposure dose limit, the worker is in principle not allowed to have further work in radiation areas for one year. Any further radiation exposure of the worker need the advice of his occupational doctor. Strictly speaking, the French regulation does not impose any other restriction. However, it is often considered that the limit of 100 mSv over 5 years which was fixed by the Directive 96/29/EURATOM should also apply.
Korea, KNHP	Answer) KIRAMS(Korea Institute of Radiological and Medical Science) takes care of over-exposed workers. KIRAMS does not have any documented procedures about medical cares. KIRAMS treats over-exposed workers according to clinical situations.
KINS, Korea	No further work in radiation area or reduction of the working hours or change of work duties with no and/or less exposure; no specified timeframe No difference between men and child-bearing-age-women
Russia	2. The Increased exposure is not allowed: - For workers who have previously been overexposed during the year as a result of an accident or PEP with an effective dose of 200 mSv or an equivalent dose exceeding of the relevant dose limits; - For those who have medical contraindications to work with sources of ionizing radiation. Under the dose the PES for a year should be understood dose over a period of time equal to one year, counted from the start of

	the PES. Persons, overexposed at a dose exceeding 100 mSv per annum, with further work should not be overexposed at a dose of more than 20 mSv per annum. Practically, this means prohibition of admission of work in PEP conditions, persons overexposed with effective dose of more than 100 mSv per annum. Federal Law "On radiation safety of population" allows attracting persons to the work to mitigate the radiation accident and its consequences 1 times in a lifetime.
Slovakia	If the annual effective dose limits were exceeded, dosimetric results of the workers must be reviewed. Any further radiation exposure of the workers need the advice of their occupational doctor.
Slovenia	If the annual dose limit was exceeded, worker is not allowed to work with ionizing radiation for 12 months from the event.
Switzerland	In case of violation of a dose limit, the worker is banned from any work in a controlled area for the rest of the year. In this context, there is no difference between male and females. Women have a lower "every day dose limit" during pregnancy (2 mSv per year external and 1 mSv by incorporation).
UK	Employees who receive emergency exposures of any magnitude are not automatically precluded from further occupational exposure following an emergency exposure situation.. However employers must apply pro-rata dose limits to employees following overexposures subject to the outcome of medical surveillance (see below). No female employee whom is pregnant or breast-feeding is permitted to be subject to an emergency exposure. IRR99, Regulation 24, Medical surveillance, regulation 24(6). This. Advice is provided as guidance, L121, paragraphs 462-465.
USA, DoE	• No further work in radiation areas for some defined time frame? Workers may be permitted to return to work in radiological areas during the current year, provided that all of the following conditions are met: 1. Approval is obtained from the contractor management and the Head of the responsible DOE field organization. 2. The individual receives counseling from radiological protection and medical personnel regarding the consequences of receiving additional occupational exposure during the year. 3. The doses exceeding the individual's occupational dose limit. 4. The affected employee agrees to return to radiological work. • Further work in radiation areas allowed but with strict dose restrictions? Yes.

	• Different restrictions for men and child-bearing-age-women? Yes. The total effective dose limit for members of the public, from all routine DOE activities, is 100mrem in a year. The ALARA process shall be used to reduce doses to the public as far below this limit as is reasonably achievable. For embryo/fetus of declared pregnant worker, the equivalent dose is 5 mSv (0.05 rem). The dose limit for occupational exposure to radiation is 50 mSv/year (5 rem/year), while the exposure limit to minors and the general public is set at 1 mSv/year (100 mrem/year), as specified in 10 C.F.R. 835.
USA, NRC	The licensee would have to restrict the worker from additional radiation exposure during the monitoring calendar year. The gender dose limit differences between men and women only occur if the female declares her pregnancy to the licensee (5 rem (50 mSv) per yr and 500 (5 mSv) mrem per gestation period). Specifically in NRC regulations: § 20.1201 Occupational dose limits for adults. (b) Doses received in excess of the annual limits, including doses received during accidents, emergencies, and planned special exposures, must be subtracted from the limits for planned special exposures that the individual may receive during the current year (see § 20.1206(e)(1)) and during the individual's lifetime (see § 20.1206(e)(2)).

Q3: Following an accident situation where workers have been exposed beyond your normal-situation occupational exposure dose limit, do you impose any special medical surveillance requirements? If so, what type of requirements and for what time period?	
Australia	ARPANSA has provided guidance on health surveillance following accidents in its recommendations for limiting exposure to ionising radiation (RPS 1) which can be downloaded from the ARPANSA website at: http://www.arpansa.gov.au/pubs/rps/rps1.pdf In summary, the medical management of over-exposed workers following an accident should be consulted with the appropriate regulatory authority as soon as possible, including psychological counselling.
Canada, CNSC	In the case that a dose limit has been exceeded (either the “normal situation” occupational exposure dose limits, or emergency dose limits), the CNSC may specify conditions with an authorization to return to work. Part of these conditions may include medical surveillance; however, there are no Canadian regulatory requirements related to this.
France, ASN	Workers Workers classified in category A or B are subject to special medical monitoring. They are given a medical examination at least once per year, comprising a general clinical examination and, depending on the nature of the exposure, one or more additional specialist examinations carried out or prescribed by the occupational health physician. Within the framework of the medical monitoring of employees, the occupational health physician receives the results of all the measurements or checks that he or she judges pertinent in order to assess the state of health of the workers. After any internal or external exposure occurring in a radiological emergency situation, the occupational health physician draws up a dosimetric assessment of the exposure and an assessment of its effects on each exposed worker. The occupational health physician compiles and updates an individual file for each exposed worker. This file must be kept for at least fifty years after the end of the period of exposure. Intervention personnel An intervening personnel of group 1 can be assigned to a mission exposing him or her to ionising radiation only after having undergone a medical examination by the occupational health physician and on condition that the fitness data sheet certifies that the worker has no medical contraindication for such work. This medical examination is renewed each year.
France, IRSN	The French regulation does not impose any peculiar requirement for the medical surveillance of the workers after an accident situation. The occupational doctor takes any decision that he considered useful for the health of the worker. During the period when the dose remains above the limit, the medical surveillance relevant to category A of workers including at least one medical visit per year remains applicable.

Korea, KINS	Yes, medical surveillance shall be done immediately
Russia	3. Overexposure of an effective dose of more than 200 mSv for a year is regarded as potentially dangerous. Persons who have such exposure should be immediately taken out of the irradiation zone and sent for medical examination. Subsequent work with radiation sources for such persons might be allowed only in an individual order, taking into account the permission by the competent medical commission. It should be emphasized that the existing regulatory framework needs to be harmonized with international approaches. In particular, it seems necessary to revise the Dose limits for the the lens of the eye toward reducing them. Add-ons. During the mitigation of radiation accident consequences in 1986 at the 4 Unit of Chernobyl NPP the permitted dose levels were clearly defined temporary and decreases as the improvement of radiation situation. Immediately after the accident, the Government Commission had decided to establish the limit of the whole individual external dose for the workers 25 rem (250 mSv) for the duration of the work. This level has been approved by the Ministry of Health of the USSR and in force until the end of 1986.
UK	Employers are required to to ensure that all employees only engage in work with ionising radiation as specified in their health records as certified by appointed doctors or employment medical advisers. All employees who receive emergency exposures receive medical surveillance. Employers are required to make arrangements (in advance) for medical surveillance by an appointed doctor or employment medical adviser to be carried out without delay in the event of a radiation emergency in respect of those employees who receive emergency exposures. Medical surveillance should be carried out by appointed doctors or employment medical advisers and should take account of the nature of the emergency exposure and that individual's state of health. Any individual who has received an effective dose of ionising radiation in excess of 100 millisieverts in a year, or an equivalent dose of at least twice any relevant dose limit should undergo a special medical examination. This should also be done if considered to be necessary by the appointed doctor (or employment medical adviser). The special medical examination may involve counselling the individual and detailing possible restrictions on further exposure. Employers must also arrange for health records to be kept in respect of employees who are subject to medical surveillance. Such records are not essential for non-classified persons who receive emergency exposures, but employers may find it is useful to keep a record of the medical surveillance that has been conducted using a health record. If so, such a health record would normally be kept until the person to whom it relates has or would have attained the age of 75 years, but in any event for at least 50 years from the date of the last entry made in it.

USA, DoE	Yes. The monitoring is tailored to specific events and identity of radionuclides to demonstrate compliance with the dose limits. 10 CFR 835 requires monitoring of employees likely to receive intakes of radionuclides that would result in committed effective doses at or above 100 mrem in a year. DOE considers bioassay to be a more reliable method to assess internal dose.
USA, NRC	Additional medical surveillance would have to be determined by the licensee, worker, and/or their medical practitioner.