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Public Health Response To Radiation Emergencies And The Role Of The Helsinki Project Office

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Introduction

The aims and objectives of the Helsinki Project Office are concerned with the protection of public health through effective response to nuclear emergencies Effective response cannot take place without effective contingency planning for such events Thus the activities of the Project Office fall into two categories, namely contingency planning or preparedness, and response.

The European region faces unique problems in connection with nuclear emergencies. It houses the largest concentration of nuclear facilities in the world, combined with, in parts, very high population densities relying, often heavily, on fresh dairy produce as a staple in the diet. Two out of the three accidents to nuclear reactors (2 civil and one military) have occurred in the region as well as a number of other accidents and past practices involving exposure to radioactivity through environmental routes to the population.

Added to this regional dimension is the global dimension of climate change driven by the build-up of "greenhouse" gases. As the transition from theory to reality is made (and that is happening now) pressure to exploit non-carbon burning sources of energy will increase. In some cases this may mean the construction of "rough and ready" nuclear reactors but more likely it will mean the extension of the operating lifetime of existing facilities. The probability of accidents will therefore increase as equipment ages and becomes more prone to failure

While prevention of accidents will remain a high priority for the future through better engineering, safe procedures etc. preparedness and response to accidents will require greater attention in the future Already, on the basis of past practical experience of accidents, the probability of another accident in the next decade is about 0 67. This I stress is based on past experience, the last accident was in 1986. we should have leaned from that so reducing the future risk but equally the age of the generating stock is that much greater - little of it has been replaced and already the operating life of some stations has been extended beyond their originally anticipated lifetime. We therefore already face a new and unknown situation. If we are confident that the lessons of Chernobyl have been learned and that risks of future accidents have been dramatically reduced I guess we share much in common with the ostrich

In this paper I will be concentrating on only one aspect of nuclear emergency preparedness; the public health element

The public health element of nuclear emergency response is defined as.
Mitigation of the long-term effects of radiation on exposed populations, as opposed to dealing with the health consequences of an exposure in an individual (termed medical aspects). The consequent narrow definition of the term "medical" is only to make the distinction between these two important aspect of preparedness and response clearer; it is acknowledged that there are many important medical aspects to the public health aspect

It has to be recognised that there is a potential conflict between public health objectives and medical objectives; what is best for the population as a whole may seemingly put some individuals at greater risk than otherwise or the converse that too much attention to the perceived needs of the individual puts the population at risk The balance between risk and benefit is, as in other aspects of radiological protection, of critical importance

Therefore, public health actions should reduce the risk that would otherwise have been incurred and so a good practical criterion is the averted dose (assumes risk is in some way proportional to dose) but it has its limitations.

The psychosocial dimension

Experience has shown that the psychosocial effect has been at least as, if not more, damaging to public health than the physiopathological effects of the exposure after the Chernobyl accident. The psychosocial effect is not dose related Thus it follows that dose averted cannot necessarily be regarded as the sole criterion for intervention.

The psychosocial effects seen after the Chernobyl accident were examined by a WHO expert group in 1991; they identified five dimensions of the psychosocial effect but of particular importance is the medical sociological dimension, which concerns the illness behaviour of those who perceive themselves to have been exposed and the diagnostic behaviour of doctors faced with such patients Illness tends to be attributed by both patient and doctor to the supposed exposure, regardless of the nature of the symptoms.

Some have questioned the reality of the psychosocial effect. In fact it has been frequently referred to as "radiophobia" in the past and is often equated with "hysteria". It derives, in my view, from a genuine "gap" in communications And this gap in itself derives from fundamental differences in the perception of risk. When, as scientists, we assess the risk of an exposure to radiation we include only the established health effects and then only those regarded as "serious" Recall it was only in 1990 that ICRP made an attempt to include more than "fatal cancer and serious hereditary disease in the first two generations". It is a general perception that cancer is a serious disease whether fatal or not, and notwithstanding the importance of those descendants you may live to meet, most people do not see their lineage as ending there As was noted by the expert group

meeting in Kiev the general public perception of a radiation accident takes in many aspects besides the immediate health consequences. As with the archetypal Englishman abroad, more than simply shouting the same message more and more loudly is required for effective communication. I will return to this important issue later. Suffice to say here that there is real health detriment from the psychosocial effect; much of it can be prevented, once initiated it seems to be refractory to treatment.

Another important feature is that psychosocial and physiopathological effects are not independent of one another The increase in childhood thyroid cancer in Belarus caused attention to be focused on other aspects of thyroid disease. Goitre is prevalent in the region due to a deficiency in dietary iodine content and operations for goitre have dramatically increased, leading to the impression that exposure to radiation has also increased goitre incidence. This is the medical sociological dimension in action. Other diseases not known to be related to radiation from past studies, have been claimed to attributable to exposure to low doses of radiation, for example osteoporosis. This may be due in part to the medical social dimension of the psychosocial effect in so far as the diagnostic behaviour of doctors is concerned It may also be due to the use of biased registries.

What, at the time of the Chernobyl accident was the stimulus for the induction of the psychosocial effect? It seems clear now that a major factor was distrust of authorities responsible for the protection of public health because of:

1.Provision of wrong information at the outset
2.Differing responses to similar situations by different authorities
3.Confused and conflicting information about the levels of exposure and likely health consequences

As for item 1 this does not have to be repeated in future accidents; honesty in information given to the public is an absolute requirement for trust, as is good communication However, if either is not present trust will be lost Once an authority is shown to have been, or is suspected of having been, misleading it will not readily be trusted again.

Item 2 is a key aspect about which much still needs to be done. Lack of harmony in response to a given situation may arise from three sources:

differences in legislation
differences in philosophy and the decision making process
differences in the administrative base from which interventions are implemented

Item 3 is probably unavoidable without some form of censorship which would lose credibility for the reason stated under item 1.

The above, therefore, should act to focus our attention on the one aspect in which effective action (number 2) can be taken and that is to ensure as far as possible that there is harmony in all decisions regarding interventions.

This can only be achieved if the philosophies of intervention and the methodological basis for decision making and action are similar in all countries and this implies that harmony of action will be greatly facilitated by all countries sharing a common administrative basis for the preparedness for accidents.

Philosophies for intervention.

The ICRP says:

a) The proposed intervention should do more good than harm, i e. the reduction in detriment resulting from the reduction in dose should be sufficient to justify the harm and the costs, including social costs, if the intervention (Justification principle)

b) The form, scale and duration of the intervention should be optimised so that the net benefit of the reduction in dose, i.e. the benefit of the reduction in detriment, less the detriment associated with the intervention, should be maximised (Optimisation principle)

Recall also that in the wider context of radiological protection the ICRP philosophy is based on JUSTIFICATION, OPTIMIZATION and LIMITATION, in that order Thus, optimisation takes precedence over limitation

Note that here detriment is linked only to dose, the ICRP recognises no other detriment than that associated with the physiopathological effects of the exposure This makes for a clean and manageable system but not one that necessarily commands the confidence of the general public.

For whatever reason the public do not measure the severity of an accident and its consequences just in terms of the health effects that derive from the interaction of radiation with DNA To them it seems contamination of the environment with radioactivity is in itself a source of harm, that it may affect health in certain rather restricted ways is part, but only part, of their concern Take for example the Chernobyl accident 28 deaths out of 237 persons heavily irradiated and some 1000 cancers of the thyroid and a few deaths as a consequence, hardly rates as a catastrophe against the numbers killed on the roads in many European countries each week, against the ravages of hunger, respiratory and other disease in Africa, against the consequences of the Kobe earthquake and many other natural disasters. Yet to most people it is a catastrophe and the three most heavily affected countries have treated it as such and spend

large fractions of the GNP on ameliorating its effects. It has remained over a decade one of the most discussed and reported events of the past 50 years.

It is tempting to put this apparent over-reaction down to hysteria, and there have been hysterical episodes in our history but I guess few have been as expensive as this one We should, I think, assume that radioactive contamination of the environment regardless of the health implications is a matter for public concern even though few would be able to put their concerns into words. It is perhaps that life is so dependent on a benign and supportive environment that apparently irrational fears readily surface when the integrity of the environment seems to be under threat. Whatever the explanation let us at least question the apparent dependence of detriment solely on dose in the existing generally accepted philosophy for intervention

Decision making processes

There are two distinct phases to be considered here. The first is the early or acute phase in which reactor condition will determine the need for intervention The second phase occurs after the release has occurred and information about the extent of release, its travel direction and likely consequences to populations becomes available.

As far as the acute phase is concerned, depending on the severity and type of accident anticipated a number of intervention measures may be taken, such as sheltering, evacuation, distribution of iodine tablets etc.. These will be pre-emptive in the sense that they will anticipate a release and consequent exposure These will, however, only apply to persons living in the close proximity of the accident site.

After the release has taken place populations at much greater distances will be at risk depending on the prevailing meteorological conditions. Since the Chernobyl accident models for predicting the transport of radioactive clouds have been developed and remote monitoring stations, as well as monitoring activities activated as a result of the accident, will confirm or refine these predictions.

On what basis will decisions be taken at this stage of the accident?

Generic intervention levels are published by IAEA and ICRP; they are broadly comparable but not identical and they are justified on the principal of averted individual dose. But the question arises,

Can better optimisation of intervention be achieved using intervention advice based upon the circumstances of the actual accident situation as it evolves rather than using generic intervention levels ?

Before I give you an example I should point out that according to the ICRP principles this is exactly what should be done Generic intervention levels are part of limitation - optimisation takes precedence. The only justification for generic intervention levels is that there has not been time to assess the optimal intervention policy.

Let us take the advice regarding the distribution of iodine tablets as a case in point. The risk of a serious consequence, cancer, of exposure of the thyroid of a young person to ^{131}I is of the order of 1%/Gy (absorbed dose in the thyroid). The risk of a serious side effect of taking a single iodine tablet is of the order of 10^{-6} to 10^{-7} Thus the dose at which it becomes beneficial to avert the risk of thyroid cancer in children is:

10^{6} - $10^{-7}/1 \times 10^{-2}$ Gy-1 = 10^{-4} - 10^{-5} Gy or 0.1 to 0.01 mGy

These values are so low as to be unusable but the recommended values from the IAEA and ICRP (up to 100 mSv) are, in fact, based on comparing mild side effects of stable iodine, such as nausea, with thyroid cancer, a far from mild condition It is true that some adults who suffer from iodine deficiency conditions may have a rather high chance of serious side effects but since children are overwhelmingly more susceptible to thyroid cancer from exposure to ^{131}I it is possible, indeed seems to me to make the case for, tailoring the countermeasure to the situation - distribution of I tablets to children at risk of exposure to doses above say 10 mSv or more

The point to be made here is that the decision making process - use of generic or tailored levels of intervention - could lead to markedly different actions by different countries where essentially the same level of exposure applied. Of course the situations could be justified in operational terms (values recommended by IAEA and the ICRP had been used) but in health terms, the difference between accepting an increase of 1 case of thyroid cancer in 1000 compared to 1 case in 10,000, the justification becomes more difficult

A common administrative basis

If harmony in response is to be achieved it is surely best ensured on the basis of a common infrastructure and this infrastructure has to be in place well before it is needed in the event of an emergency. The emergency has to be assessed and actions decided upon very rapidly, each component of the response system has to know his/her role and who to communicate what to. If it is decided that specific communities should shelter, the mechanism for informing them of this, reassuring them and answering to their concerns has to be in place and rehearsed. This may involve the use of broadcast media, the police or fire-brigade etc ; it may involve deciding whether children in school should shelter there or be taken

home etc Those who make these decisions have to have thought through the implications and have taken any necessary other measures. This is part of preparedness or contingency planning

A practical case in point is the use of iodine tablets For greatest effectiveness these tablets need to be taken before or as soon after exposure commences as possible Some countries make the tablets available in pharmacies, others have predistributed the tablets to households and others have them stored in places convenient for distribution when needed. Still other countries do not advocate their use and have no means of distribution. Clearly this situation could give rise to markedly different rates of distribution of iodine tablets, including not at all.

Perhaps this last example illustrates as well as any other that preparedness to deal with a nuclear emergency is thus an ongoing and resource consuming activity; if it is not going to be continually updated and reviewed it will fail when it is needed. That there is as much uniformity as possible in the approaches between neighbouring countries will help to ensure harmony of response This is especially true when it comes to communication. In Europe we have to deal with different national languages and this fact alone puts up an immediate barrier to effective communication But different professionals have different "jargons". The exchange of information on a topic between a policeman and a doctor will not be as effective as it would be between two policemen for example This point is not as far fetched as it might at first sound. Nuclear emergencies are dealt with in different countries by different organisations, e.g Ministries of Health, Ministries of Environment, Ministries of Energy Production, Civil Defence and electricity producer organisations etc. may have responsibilities in one way or another with different organisations taking the lead in different countries The professional mix is therefore very diverse. The frameworks within which these different organisations see the emergency can be very different, leaving plenty of room for misunderstanding.

We are therefore presently faced with a serious impediment to achieving harmony in response because firstly there is a lack of consistency in the way in which decisions regarding intervention are reached and a diversity of structures within which they are implemented. Partly these are legal issues which cannot be overcome by re-organisation. But there are aspects which can and should be addressed.

The INEX-2-FIN Exercise

In April this year, under the auspices of the OECD, an exercise was held in Finland in which a serious reactor failure was simulated. The exercise was primarily designed to test the "acute" phase of

an accident scenario with a special emphasis on decision making based on reactor condition, rather than the actual release WHO sent a staff member to Helsinki to participate on the basis that WHO was a participant with the same status as other international organisations such as IAEA, EU etc.

WHO did not concern itself with the acute phase decision making and advice,- this has to be a matter for the local and national authorities and decision making based on highly technical engineering aspects of nuclear reactors. But once a release had taken place WHO made estimates, on the basis of the information provided about weather conditions and estimated the time of arrival of a cloud containing iodine at the Estonian coast, with reasonable accuracy This indicates that useful predictions can be made in real time The exercise lasted less than a day and so was not suitable for testing out the more extended needs for advice that a real situation would have demanded WHO's capability in this respect was, however, demonstrated in the case of the Chernobyl accident.

INEX-2-FIN demonstrated the need for much better co-ordination of actions. There were many examples where advice emanating from different sources was in conflict e.g. Norway advised its nationals not to travel to Helsinki some 50 km distant to the west of the accident site, where as the Finnish authorities made no special provisions for the capital. SAS cancelled services to Helsinki whereas other airlines continued as normal It is easy to see that such differences can arise - possibly for legal reasons - possibly as early caution when the situation is unclear to those outside the immediately affected area. Never-the-less, unless there are rational explanations for these different actions they have the potential to lead to psychosocial consequences.

Perhaps the greatest lesson from INEX-2- FIN was that there is inherent in the existing system a deep division of responsibilities and outlook to be accommodated. INEX - 2 FIN was essentially an exercise on the acute pre-release phase of an accident. As such it was the responsibility of the nuclear safety side to the emergency preparedness and response organisation . At the international level national authorities are ably assisted by IAEA. In this phase of an emergency there is essentially no public health dimension as there has been no release and no exposure and no tangible public health threat.

Once a release has occurred the situation is transformed dramatically While there remain nuclear safety issues, the general public far and wide, at home and abroad, become potentially at risk al beit to different degrees This new dimension, the public health dimension, should not be solely in the hands of the nuclear safety experts· in practice there has to be a transfer of responsibility from nuclear safety to public health protection. At the international level this involves a transition from support to national authorities from IAEA to support from WHO.

How can this transfer be seen to take place? Three phases of an emergency can be envisaged instead of two, namely

1.acute, pre-release,

2.acute, post release and

3.protracted

Phase 1 belongs solely to nuclear safety (IAEA) and phase 3 solely to public health protection (WHO). Phase 2 is the transition phase in which responsibility is passed from one organisation to the other at the international level and the emphasis of the national responses changes in the same direction

Intervention in the three phases will then be based on the following:

1.pre-emptive action

2.generic intervention levels

3.tailored intervention levels

The above are my conclusions derived from the INEX exercise earlier this year and as such are not of course "WHO policy" However, I believe if we are to learn the lessons of Chernobyl this is the direction in which we have to be working.

Where do we go from here?

WHO advocates a two pronged approach for dealing with nuclear emergencies; relying on a pre-planned infrastructure for support in each member country and using focal points as points of contact in each country In collaboration with the WHO collaborating centre in STUK the WHO proposes act as a source of advice to countries wishing to receive it, both on preparedness and in the event of an accident, and as a clearing house for the actions taken or anticipated in other countries.

Within the European region we have countries with among the most advanced nuclear power systems in the world and those with no expertise and experience at all, and everything in between. If radioactivity could be contained within national borders those with the facilities would look after themselves and those without would not be bothered But this is not the case and those without the facilities and expertise, and presently with few if any resources to devote to the problem, never-the-less have to protect the health of their populations.

WHO can assist in bringing them training and in helping them set up contingency plans. Advocating and building the capacity to respond is an important part of WHO's role in this field. These will be the ongoing activities executed from the Helsinki Project Office However, the best preparations are of no value if there is no mechanism to activate them at the appropriate time. For effective response the timing, nature and magnitude of the threat have to be known with some precision. For countries with well developed nuclear industries national response centres have sophisticated communications equipment, access to on-line weather forecasting and tried and tested modelling programmes from which to predict the course of the plume and anticipate exposure. These are not available in the less well developed countries In

collaboration with STUK in Helsinki, a WHO Collaborating Centre, WHO will seek to provide advice to countries requesting it on the nature of any threat they may face and what would be the most effective measures to mitigate the effects of the predicted exposure on public health.

As mentioned above, the importance of harmonised response cannot be underestimated After Chernobyl the psychosocial response was not confined to the three most heavily affected countries. There was for example a marked reduction in live births in Italy nine months after the accident attributed to a reduction in conceptions. In Sweden for more than a year after the accident Chernobyl issues occupied the press more than any other event that year. Also for many months after the accident WHO received requests for advice on issues relating to the accident

While most European countries with nuclear industries were well prepared to respond to an incident in their own countries few had thought much about what they would do in the event of radioactivity coming from another country. This was a rather surprising oversight in view of the consciousness regarding global fallout from nuclear weapons testing only two to three decades earlier. Never-the-less considerable confusion and dispute arose over several issues such as trading in contaminated foodstuffs etc. Also several unanticipated routes of possible exposure were raised by members of the public Although these issues have been addressed now and therefore should not cause a problem in the next accident it seems likely that there will be other issues not raised in the context of the Chernobyl accident because of the different circumstances WHO, though its network of collaborating centres is able to bring the appropriate expertise in the Region to bear on these problems