EMERGENCIES AND EMERGENCY PLANNING IN FRANCE

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PLANNING FOR RADIATION EMERGENCIES

The organization for dealing with radiation emergencies in France is complex and centralized. It consists of the Radiation Security Council with participants from the Premier Ministre and the Ministers of Interior, Industry, Health, and Defense. A permanent general secretary for radiation security coordinates the work of the various departments.

Planning for nuclear power emergencies is divided between on-site, in which organization and intervention are the responsibilities of the manager of the plant, and off-site, in which organization and intervention are the responsibilities of the regional governor. Both on-site and off-site planning have models integrated into a special code of practice called the radiation emergency organization.

For intervention, two types of action are considered: technical and medical. On-site technical intervention is the responsibility of the plant's safety department and radiological health physics protection department, with coordinated assistance among the different nuclear plants in France. Off-site technical intervention is the responsibility of two national services: the nuclear safety service in industry department and the radiation protection service in the Department of Health, with assistance from the nuclear plants within the regions.

Medical intervention for workers and the public is the general responsibility of the Ministry of Health. Regional organization and action are the responsibilities of the regional governor aided by a special council, the national committee of radiation medical experts. For each nuclear plant there are written agreements with local hospitals for the emergency treatment of the workers; the public has a special organization with regional hospitals for nonradiation injuries and a national organization (based on the International Center of Radiopathology) for radiation injuries. The name, International Center of Radiopathology, was chosen because the Center is a collaborating center of the World Health Organization for radiopathology and has regional offices in Europe, Africa, and Western Asia. It is also recommended as a competent center by the International Atomic Energy Agency.

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DETERMINATION OF RADIATION INJURIES

The first step of medical emergency planning is to know the extent of exposure to external irradiation or radioactive contamination. In both cases we have to consider (1) if the number of persons is small, as in small incidents (loss of sources), or (2) if the number is very high (many hundreds or thousands, as in the Chernobyl explosion). If the number of persons is small, a count of lymphocytes and granulocytes is utilized to estimate whole body mean dose, for there is good correlation between a decrease in lymphocytes and an increase in dose. Analysis of chromosomal aberrations is good for estimation too but is time consuming and impractical if large numbers of people are exposed.

If a small number of persons have been externally exposed, during the latent period we decide on the medical or surgical intervention according to best knowledge of the dose distribution in the body. For that, good reconstruction of the spatial and temporal conditions of exposure is necessary. For example, an acute whole body external exposure with a phantom tissue equivalent shows very nonhomogeneous distribution of doses between 5 and 32 gray, in which case a bone marrow transplantation is contraindicated. On the other hand, a relatively homogeneous chronic exposure of 14 days over a period of five weeks by a source of Ir-192 may point to the need for a bone marrow transplantation.

In the event of partial irradiation with radiation burns, the dosimetric reconstitution of the accident also is of interest in order to present a precise basis for amputation. I will cite three examples. If a patient's hand is burned by a source of cobalt 60, this might involve a dosimetric result calling for amputation of the whole hand. In a second case, that of a hand burned by a source of Ir-192, the distribution of the dose is localized and indicates amputation of the fifth finger only. In a third case, also that of a hand burned by a source of Ir-192, the dose distribution is 80 gray in the vessels and the bone; the probability of necrosis is 100% and indicates that a complete amputation is needed.

When a large number of people are involved, it is impossible to obtain dosimetric data by reconstitution of the accident, because the method is too complex and takes too long. It is necessary to use triage to determine those who are most highly contaminated.

For whole body exposure, clinical observations are the best means of triage. For partial body irradiation with radiation burn, two biophysical methods can be utilized to determine those really overexposed: (1) thermography by infrared camera during the latent asymptomatic period clearly indicates the intensity and distribution of the partial irradiation; or (2) determination of local circulation as in nuclear medicine. The latter method is less practical than thermography for large numbers of persons.

For radioactive contamination involving large numbers of people, our center has two options: We have small cars with four seats and a large detector for the whole body measurement of cobalt and a small detector for measurement of iodine in the thyroid. One car can assess up to 200 persons per day. For situations involving thousands of people, we have railroad cars with 32 seats and the same types of gamma ray detectors. These can accommodate 5,000 persons per day and obtain computerized results.