INTERVENTION LEVELS FOR CASES FOLLOWING NUCLEAR ACCIDENTS

Bruno, H. A; Palacios, E; Kunst, J.J.
Comisión Nacional de Energía Atómica (CNEA)
República Argentina.

To accomplishing with the safety criteria applied in Argentina, nuclear accidents with severe consequences in the public should have very low probability of occurrence. However, if one of these very improbable accident occurs, significant quantities of radioactive material could be released in the environment and, therefore, significant doses in the public would be incurred.

Radiological consequences from these accidents could be minimized if efficacious countermeasures are taken. Intervention levels are then an essential tool for decision making in each emergency.

The criteria used in Argentina in establishing intervention levels are in accordance with ICRP, publication #40 [1] and IAEA, Safety Series 72 [2]:a) Serious non-stochastic effects should be avoided; b) The risk from stochastic effects should be limited by introducing countermeasures which achieve a positive net benefit to the individual involved, and c) The overall incidence of stochastic effects should be reduced as low as reasonably achievable by reducing the collective dose commitment.

INTERVENTION LEVELS FOR EVACUATION

Based on the first criteria, the Argentine authority has established intervention levels for evacuation, as a courtermeasure to limit the dose due to the external irradiation from the material deposited on the ground. These intervention levels are 0.1 Sv integrated during the first six hours after the accident, for irrestricted evacuation, and 0.1 Sv integrated in the first twenty-four hours after the accident as a value below which no countermeasures are needed.[3]. In the middle, a case by case analysis is required, taking into acount the risk that could be avoided, and the risk introduced by the countermaesure itself.

Later on, when the ground deposit has sufficiently decayed, a decision is required about areas where reentry would be allowed for permanent occupancy. The optimized rate of dose for reentry of evacuated people should be such as to minimize the sum of the remanent detriment cost and the cost to maintain the countemeasure.

For purposes of emmergency planning, cost-benefit techniques for optimizing protection have been used for relocation decisions (4). As result of this analysis, the optimized time for reentry of evacuated people should be such that the dose rate at that time, $H(\theta)$, is equal to the ratio of the cost rate, C, for keeping evacuated an average person and the monetary value, α, assigned by the regulatory authority to the unit of collective dose.

$$H_\theta = \frac{C}{\alpha}$$

The Argentine authorities have selected a value of α equivalent to US$ 10,000 per man sievert for purposes of optimization on radiation protection. The cost (additional to the usual cost of living) of maintaining evacuated an average person is estimated in order of US$ 100 per month and per person. Therefore, the optimum dose rate for deciding reentry in Argentina will be in the order of 10^{-2} Sv/month.

INTERVENTION LEVELS FOR FOODS

Ground contamination also implies to take some decision concerning contaminated foods. A lower intervetion level was selected, below which no actions are necessary, using a cost-benefit analysis similar to that used in case of reentry. The cost of imposing a countermeasure such as the introduction of a ban on the consumption of a foodstuff, is taken as a first approximation, as the cost, C_f, of replacing that foodstuff at market-price. With this approximation, C_f = K.V. where K is the foodsstuff cost per unit mass or volume and V is the average consumption per person and per unit time. The optimum solution becomes:

$$H_{op} = \frac{K.V}{\alpha}$$

In practices the intervention levels of dose are more readily compared with the results environmental measures if derived intervention levels in terms of concentration are determined. The above method can be used to calculate the derived intervention levels, since: $DIL_l = \frac{H_{op}}{Fd.V}$;where Fd is the dose per unit intake.

$$DIL_l = \frac{K}{\alpha.Fd}$$

On the other hand, an upper derived intervention level that if overpast the consumption is authomaticaly prohibit, was derived from an individual dose limit of 50 $mSv.a^{-1}$.

$$DIL_u = \frac{50\ mSv.a^{-1}}{Fd.Vm}$$

Where Vm is the consumption rate representative of a hyphotetical critical group.

A list of DIL_l and DIL_u for Cs^{137} for the principal foodstuffs consumed in Argentina are shown in Table I.

Intermediate situations are resolved by a case by case analysis, taking into consideration social and economic aspects.

Table I

Derived intervention levels for different tipes of foodstuff (Bq/kg)

Foodstuff	Cs^{137}	
	DIL_u	DIL_l
Milk	15000	1800
Milk products	130000	16000
Meat	20000	8500
Green vegetables	50000	1300
Root vegetables	15000	950
Fruits	20000	1500
Cereals	15000	900

REFERENCES

(1) ICRP "Protection of the public in the Event of Major Radiation Accidents: Principles for Planning". The International Commission on Radiological Protection". Pergamon Press (1984)

(2) "Principles for Establishing Intervention Levels for the Protection of the Public in the Event of a Nuclear Accident or Radiological Emergency". IAEA. Safety Series N° 72 - International Atomic Energy Agency. Viena (1985)

(3) Migliori de Beninson, et al. "Evacuation and Reentry Policy for cases of Ground Deposition Following Nuclear Accidents". International Radiation Protection Association. 6th International Congress. Radiation-Risk Protection (728). Berlin (West) May 7-12, 1984. Radiation-Risk Protection.

(4) Beninson, D. and Gonzalez, A.J. "Optimization in relocation decisions". International Symposium on Optimization of Radiation Protection. IAEA-SM-287/37 - Vienna,Austria, March 10 14, 1986.