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FAST EVALUATION OF THE RADIOLOGICAL CONSEQUENCES OF POSSIBLE NUCLEAR ACCIDENTS

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The radiological consequences of a possible accident at the Paks Nuclear Power Station can be evaluated extremely rapidly by the use of tables and isodose curves prepared in advance for typical meteorological conditions.

Introduction

In the case of an accident at the Paks Nuclear Power Station, methods are needed for urgently estimating the consequences of atmospheric releases. Doses around the station are calculated from data of the telemetric environmental monitoring system. Additional data can be obtained from on-site measurements carried out by a specially instrumented cross-country vehicle. In the present paper the rapid methods developed and utilized for dose estimation based on the telemetric measurements are discussed.

Rapid, preliminary estimation

Representative tables and figures have been prepared for 16 wind directions and 24 typical meteorological conditions: 6 Pasquill categories, 2 wind speeds, dry and rainy weathers. For these in-advance computations the ACRA-II code /developed at Oak Ridge National Laboratory, USA [1]/ was used to calculate the ^{131}I inhalation dose, as the major component in the exposure of the population. ACRA-II is a Gaussian-diffusion code that handles the 6 Pasquill categories with user specified dispersion parameters and takes into account both dry-outs and wash-outs. In the calculations carried out for the Paks power station, the dispersion parameters are taken from [2], the deposition velocities are set to 0.3 and 1.2 $m \cdot min^{-1}$ for particles and halogens, respectively, while a wash-out coefficient of 0.012 min^{-1} is used. A thyroid dose conversion factor, limit for 95 % of the adolescent population, of 3.75 $Sv \cdot MBq^{-1}$ is derived from recommendations of the ICRP [3] and the data of Dunning and Schwarz [4].

There are three charts available in the control room. The first gives the ratios of the ^{131}I inhalation thyroid doses in the surrounding villages to the iodine doses measured in the downwind environmental control station. A part of this chart is illustrated in Table I.

The ratios of the maximum iodine doses at 3 km from the emission to the values measured at the downwind station are shown on another chart in the control room.

Table I

Ratios of the ^{131}I inhalation thyroid doses in the surrounding villages to the iodine doses measured in the reference station A8

	village	**dry weather**											
		wind speed ≤ 2 m/s						wind speed > 2 m/s					
		A	B	C	**D**	E	F	A	B	C	D	E	F
wind direction W ⟶ E	USZÓD	0.034	0.096	0.130	0.170	0.360	2.500	0.071	0.081	0.130	0.270	3.3	130
	KIS-FOKTŐ	0.002	0.015	0.025	0.031	0.083	0.840	0.005	0.014	0.033	0.085	2.5	250
	rainy weather												
reference station A8	USZÓD	0.021	0.057	0.074	0.098	0.210	1.500	0.065	0.073	0.120	0.240	3.0	120
	KIS-FOKTŐ	0.001	0.003	0.005	0.006	0.015	0.160	0.003	0.010	0.024	0.061	1.8	180

Note. The conditions written in bold type relate to the thyroid iso-dose curves in Fig. 1.

Iso-thyroid-dose curves for the 24 representative meteorological conditions are plotted on transparent lucite sheets. A fast estimation of the distribution of doses can be made just by superimposing the appropriate sheet on the map /the third chart/ - in the actual direction. However, the isodose curves on the map are suitable only for qualitative estimates.

The iso-thyroid-dose curves given in Fig. 1 relate to the conditions written in bold type in Table I.

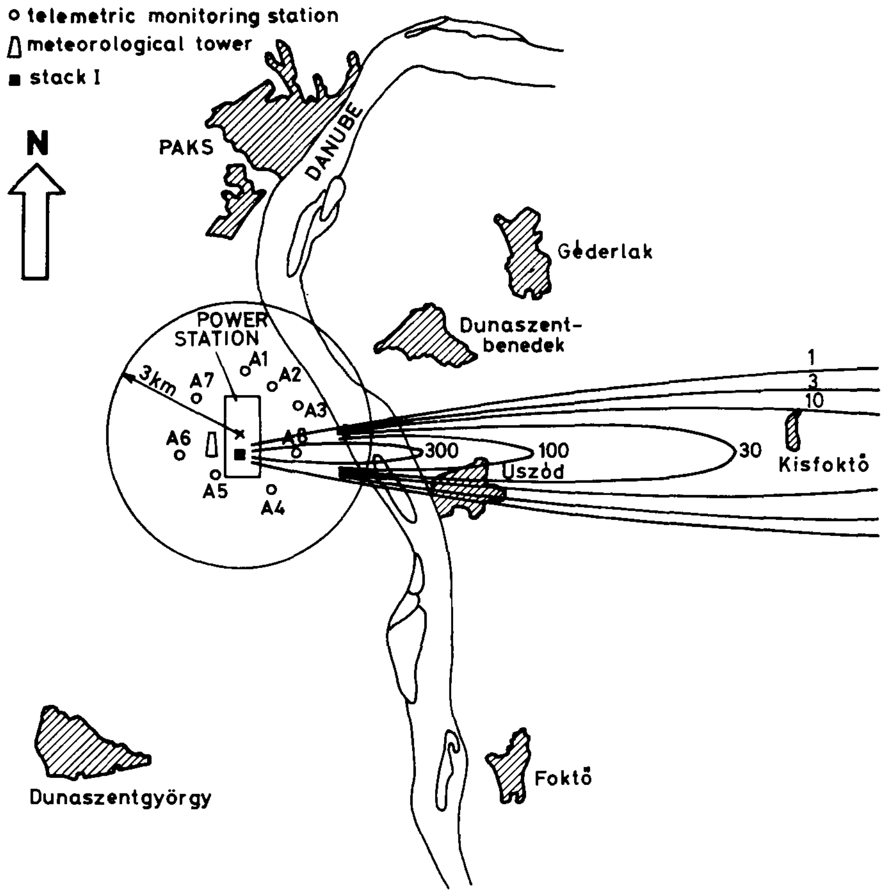

Fig. 1. Thyroid iso-dose curves

Off-line computations

More accurate data can be obtained by computations with the actual meteorological data which are telexed from Paks to the Central Research Institute for Physics, Budapest. Runs with these in-site measured input parameters can be done by a new, Paks oriented version of the ACRA code. In this case, external gamma doses, dry and wet depositions, as well as inhalation doses are computed and summed up for the whole accident time and for all surrounding villages.

Real-time computing

Real-time computing of doses using the data of the telemetric environmental monitoring system is under development [5].

References

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