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NUCLEAR POWER PROGRAMME

REPORT TO THE GOVERNMENT OF TURKEY

NUCLEAR POWER PROGRAMME
Pre-operational Environmental Radiological Monitoring

(TUR/9/005)

Report to the Government of Turkey

by

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I. INTRODUCTION

1. The purpose of the expert's mission to Turkey, undertaken from December 14, 1981 to January 13, 1982 within the framework of the Agency's co-operation programme, was to advise the Turkish Electricity Authority (TEK), Ankara, on a pre-operational environmental radiological monitoring programme for the planned Akkuyu Nuclear Power Plant (NPP). This report summarizes the results of the expert's work in Turkey along with recommendations for the programme.

2. The site selected for Turkey's first nuclear power plant is on the sea-shore in the southern part of the country, in the middle Mediterranean region, about 43 km southwest of the town Silifke. Population in the immediate vicinity of the site is at present very sparse. There are only a few villages with some 1000 inhabitants within 10 km radius of the planned power plant. The nearest town with more than 25 000 inhabitants is Silifke. The plant will have a generating capacity of 600-1000 MWe. It will be of the BWR, BHWR or CANDU type, with sea-water cooling.

II. ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAMME

3. The environmental radiological monitoring programme for the plant should consist of:

(a) A pre-operational radiological monitoring programme

(b) An operational radiological monitoring programme, and

(c) An emergency radiological monitoring programme.

This report covers only the first programme above. The operational and emergency programme can be drawn up in future, once the results of the pre-operational programme are obtained.

III. PRE-OPERATIONAL ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAMME

A. Objectives

4. The objectives of this programme are as follows (2):

(a) To obtain information on the critical nuclides, pathways and groups, thus leading to the design of the operational survey and to the establishment of a quantitative basis for interpreting the results in terms of actual or potential human exposure,

(b) To provide information on the pre-operational level of radiation and radioactivity in the environment in cases where this information is helpful in interpreting operational surveys, and

(c) To test operational survey methods and procedures.

B. Selection of sampling measurement locations

5. The sampling and measurement locations around the planned site have been selected taking into account the following factors:

(a) Population distribution and density,

(b) Dominant wind directions, and

(c) Road access to the sites (for transportation of equipment), and

(d) The availability of electricity (for continuously operated fixed sampling/ measurement stations).

6. Three fixed stations (FSs) were selected for the continuous sampling of air particulates and iodine, as well as the measurement of direct radiation. These are as follows (see also Figure 1):

- FS1: In the vicinity of Ovacik village (Büyükeceli), at the second-most prevalent downwind direction, about 3 km (areal distance) to the north-east of the NPP site,
- FS2: At the planned operators' village, about 3 km (areal distance) to the south-east of the NPP site, and
- FS3: On the proposed pier, at the most prevalent downwind

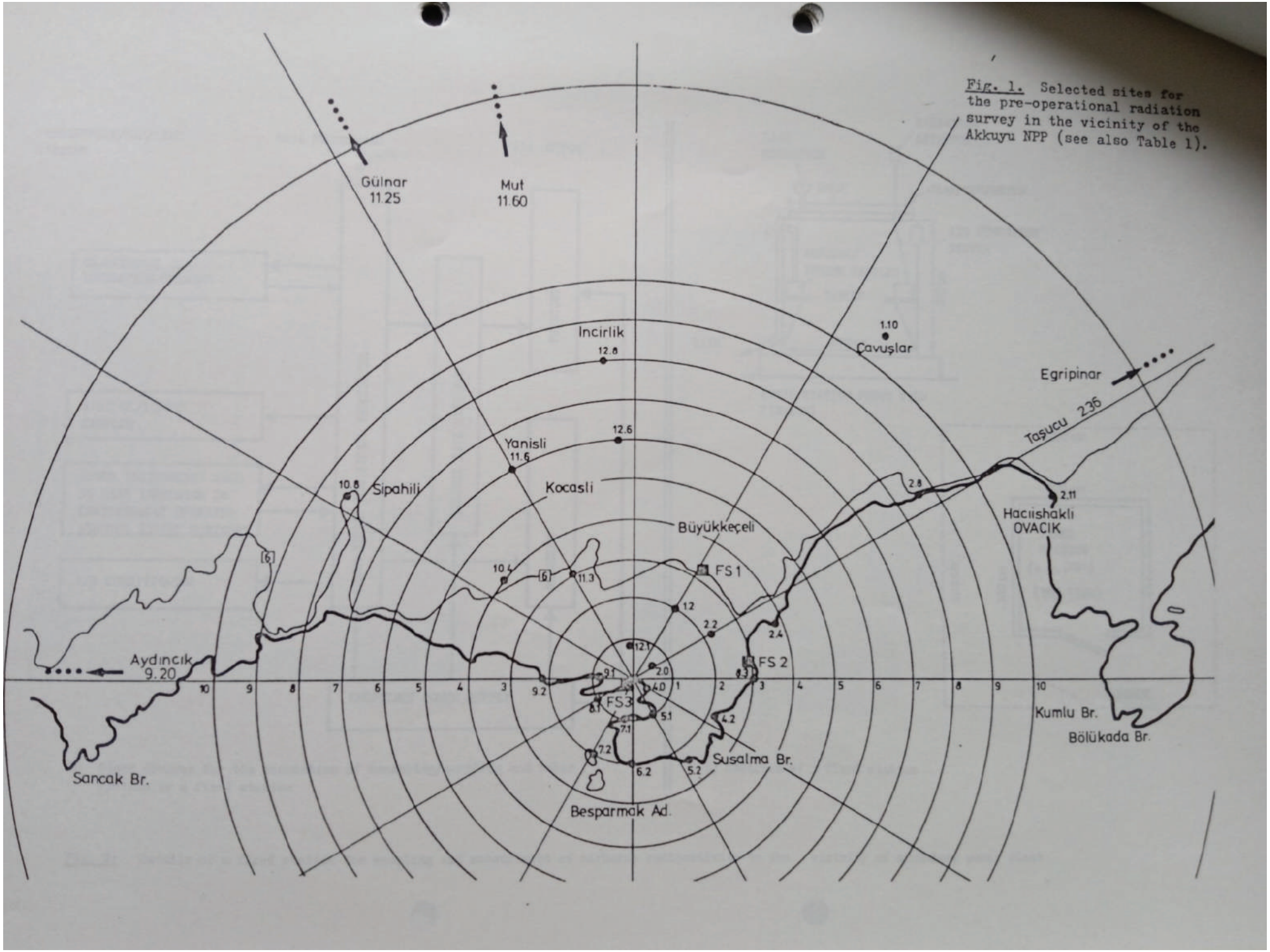
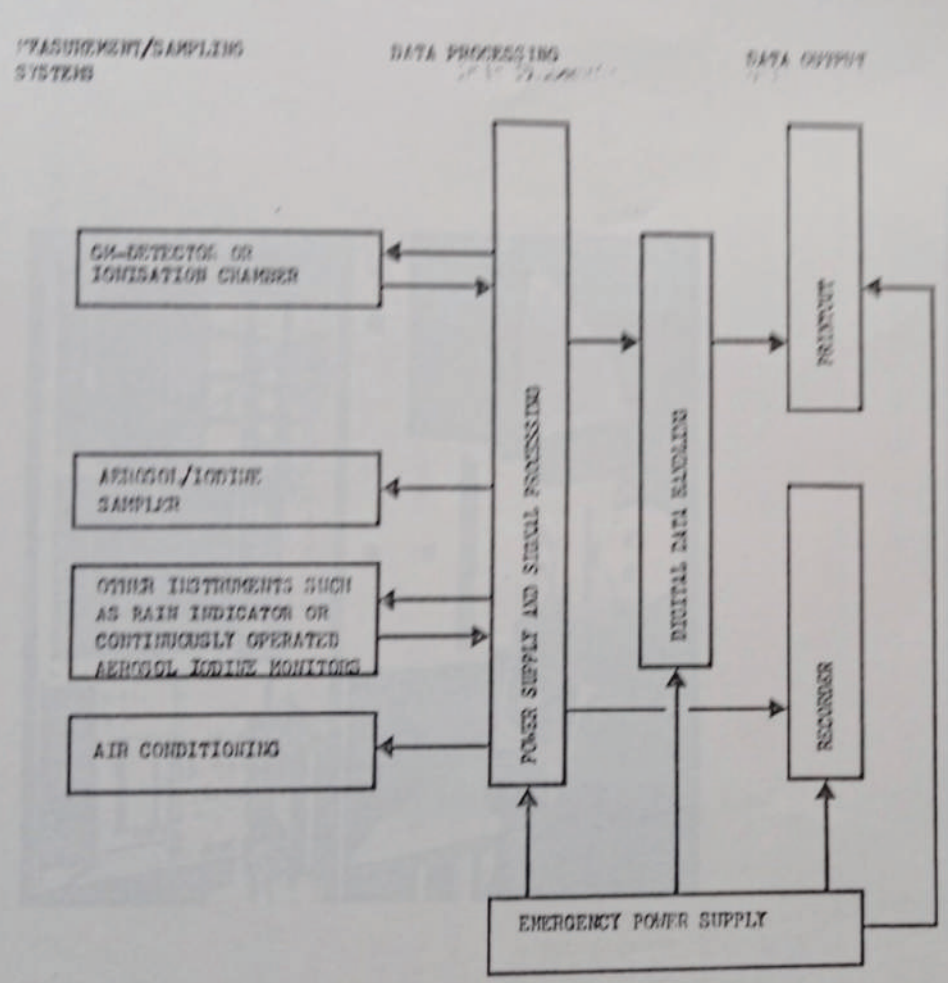
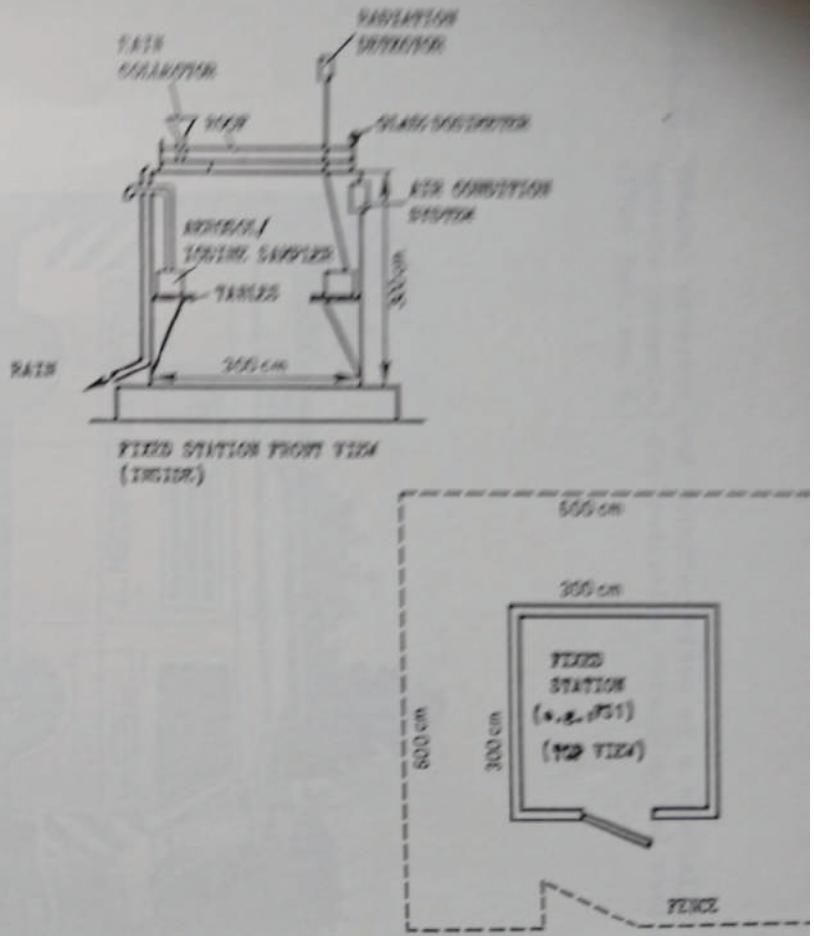


Fig. 1. Selected sites for the pre-operational radiation survey in the vicinity of the Akkuyu NPP (see also Table 1).



a) Block diagram for the connection of measuring/sampling and other systems in a fixed station



b) Sketches of a fixed station

Fig. 2: Details of a fixed station for sampling and measurement of airborne radioactivity in the vicinity of a nuclear power plant

Table 1. Radiation survey sites selected in the vicinity of the Akkuyu NPP

Number	Station code	Location (from Akkuyu NPP)	Areal distance from NPP (km)	Estimated number of In-habitants in 1985 *)	Typical plant cover in vicinity
(1)	(2)	(3)	(4)	(5)	(6)
1	FS1	1 o'clock (NNE); Road N.6, Ovacik (Büyükeceli) village at Gendarmerie Station	3.2	1111	Tomato, cucumber, pine trees etc.
2	FS2	3 o'clock (E); at planned operators' village	2.7	1000	Small trees and bushes
3	FS3	7 o'clock (SSW); on planned pier adjacent to NPP	0.2	500	Small trees and bushes
4	1.2	1 o'clock (NNE) at main gate for NPP	2.0	500	Small trees and bushes
5	1.10	1 o'clock (NNE); Çavuşlar (exact location will be specified by TEK)	10.0	536	Small trees and bushes
6	2.0	2 o'clock (ENE); adjacent to meteorological tower at NPP site	0.5	500	Small trees and bushes
7	2.2	2 o'clock (ENE); in immediate vicinity of operators' village	2.2	1000	Small trees and bushes
8	2.4	2 o'clock (ENE); at Hayat Motel beach	3.75	50	Pine and olive trees, bushes
9	2.8	2 o'clock (ENE); at the junction of Road No. 6 and Boğsak Motel	8.4	100	Pine and olive trees, bushes
10	2.11	2 o'clock (ENE); Road No. 6, Haciishakli village next to the cemetery	11.0	1342	Orange trees, bushes
11	2.36	2 o'clock (ENE); m			

Table 2. Proposed pre-operational environmental radiological monitoring programme for the planned Akkuyu Nuclear Power Plant

Exposure pathway and/or sample (1)	Sampling and/or measurement sites (see Fig.1 and Table 1) (2)	Sampling and collection frequency (3)	Type and frequency of analysis (4)	Instrument lowest detection limit required (5)	Typical detection system (6)
1. Airborne 1.1 Particulates (at fixed stations)	FS1, FS2, FS3 (fixed stations)	Continuous sampling operation with weekly sample collection or as required by dust loading, which ever is more frequent	Total beta radioactivity (long-lived) 3 days after filter change; composite (by site) for gamma isotopic and composite ^{89}Sr, ^{90}Sr, 90 analyses quarterly	Total beta: 50 fCi/m^3 (*) (^{90}Sr/90y) Gamma isotopic: 10 fCi/m^3 (^{60}Co) ^{89}Sr/^{90}y) Radiochemical separation of strontium and measurement 50 fCi/m^3	Total beta: Argon-methane flow counter or beta plastic scintillation counter Gamma isotopic: Gamma spectrometer with Ge(Li) detector (Multichannel analyser) ^{89}Sr/^{90}y: Argon-methane flow counter
1.2. Particulates (at sampling sites)	1.2/1.10/2.1/2.2/2.4 2.8/2.11/2.36/3.3 4.0/4.2/5.1/5.2/6.2 7.1/7.2/8.1/9.1/9.2 9.20/10.4/10.8/11.3 11.6/11.25/11.60/12.1 12.3/12.4/12.6/12.8 Total number of sampling sites = 31	100 m^3 sampling (quarterly)	A. Total beta radioactivity measurement (a) 5 minutes after sample collection in the vehicle with contamination monitor		(a) Portable contamination monitor
			(b) 3 days after sample collection in the laboratory	(b) See above	(b) See above
			B. Total alpha activity measurement 3 days after sample collection	Total alpha: 0.1 fCi/m^3 (^{239}Pu)	Total alpha: Argon-methane flow counter
	See above	Minimum 300 m^3 sampling (yearly)	C. Gamma isotopic analysis		

(*) 1 fCi = 1 femtocurie or 1 x 10^{-15} Ci.

(1)	(2)	(3)	(4)	(5)	(6)
1.3 Radioiodine	See 1.1 and 1.2 above		Analyse for ^{131}I weekly for fixed stations, quarterly for other sampling sites	100 fCi/m^3	Gamma spectrometer with Ge(Li) detector
1.4 Soil	34 sites: See 1.1 and 1.2 above	-	Direct gamma and beta contamination-measurement (100 cm and 10 cm above soil surface respectively) (quarterly)		Portable contamination monitor
	5 sites FS1,FS2 2,36,11.25,11.60 (0-10 cm depth)	yearly	Gamma isotopic	10 p Ci/kg(^{60}Co) (dry substance)	See above 1.1
. Direct .1 Gamma dose	FS1,FS2,FS3 2.36, 11.25,11.60 and 10 sites around the NPP at fence (total: 16)		Gamma dose (mrem) (Yearly)	50 mrem/year	Calcium sulphate dosimeter or glass dosimeter (Thermoluminescence dosimeter) Lithium fluoride
2 Gamma dose rate	FS1,FS2,FS3	-	Continuous monitoring or gamma dose rate with monthly evaluation of half-hour values	4 mrem/h	Analogue digital dose rate meter with ionization chamber or GM Counter