4.3. Potential Impact on Soil

4.3.1. Dominant Soil Types

The Cernavoda NPP site was prepared for 5 reactors and for the necessary installations and activities for their construction and operation during a long period.

This site is in a former lime quarry area (called Ilie Barza), on the left side of Danube-Black Sea Canal.

The site preparation works resulted in an almost flat area with an upper layer consisting of limestone. After specific engineering works, most of the prepared land area was used for various constructions and inner roads (Ref. 4.3-1). Some green areas have also been arranged.

The land surface for the Cernavoda NPP Unit 3 is now a built area.

At a larger scale, taking into consideration the zones defined around the NPP (section 4.2.7.4), the Cernavoda site area belongs to the plateau between the Danube branch Dunarea Veche and the Black Sea, known as South Dobrogea Platform. The Cernavoda NPP site is not far from the Danube, but it is not near its floodplain.

On the right bank of the Danube, in the floodplain, there are alluvial soils. They are undeveloped soils, non-homogenous, having sand to clay structure.

Towards east, there are gray soils (Ref. 4.3-1, 4.3-2), characteristic for dry climate areas. Due to the low humidity, alteration and levigation are less intense. These gray soils are poor in humus (2-3%) and nutritive substances. Although the gray soils present good physical characteristics, they do not accumulate water enough because of the low rain quantities and their distribution during the whole year, so that a humidity deficiency in soil is found during most part of the year.

4.3.2. Land Use and Cultivated Plants

Inside the Cernavoda NPP site, beside constructions and roads, there are green areas with small vegetation.

The Cernavoda NPP Units 3 and 4 area is already a built area and the land is not cultivated.

Around the Cernavoda site, at a larger scale, the dominant areas are the agricultural surfaces (Table 4.3.2-1), most of them arranged for irrigation, but large areas are covered by meadows, vineyards and only few are covered by orchards (Ref. 4.3-3).

The agricultural land is mainly in the NE, ENE, E and SE from the site.

There are vineyards around Cernavoda, Cochirleni, Rasova, Aliman, Medgidia, Mircea Voda, Tortomanu.

The most compact orchard areas are in the Mircea Voda and Medgidia zones.

On agricultural areas, there are mainly cereals, oleaginous plants and fodder plants.

Table 4.3.2-2 presents the agricultural crops obtained in a zone around the Cernavoda NPP site, within a distance R = 20 km, in 1998. The main activities in this zone are agriculture, animal breeding, vine culture and fish farming.

Table 4.3.2-1. Land use in the zone with radius R = 20 km

Categories of usage	Surface (ha)	Surface percent (%)
Arable	86084	68.5
Pasturelands	10600	8.4
Vineyards	5019	4
Orchards	1347	1.1
AGRICULTURAL TOTAL	103050	82
Forests	7774	6.1
Water-reed	6084	4.8
Buildings	2296	2
Non-productive	1340	1.1
NON-AGRICULTURAL TOTAL	22550	18
GENERAL TOTAL	125600	100

Table 4.3.2-2. Agricultural surfaces and crops around the Cernavoda NPP site in 1998 (within a distance r = 20 km)

No	LOCALITY	Wheat/Rye		Corn		Sun Flower		Potatoes		Sugar Beet		Vegetables		Grapes		Fruits	
		ha	t	ha	t	ha	t	ha	t	ha	t	ha	t	ha	t	ha	t
I. COUNTY CONSTANTA																	
1	Medgidia	1 639	4 648	667	2 075	1 050	1 510	111	2 255	45	2 317	223	2 897	1 084	6 982	377	2 763
2	Cernavoda	238	581	403	1 194	108	212	6	50	-	-	20	239	733	2 219	120	278
3	Adamclisi	730	1 168	1 286	2 579	985	605	20	250	-	-	29	360	960	726	-	132
4	Aliman	800	1 903	1 343	4 293	540	248	25	315	-	-	68	833	889	2 530	-	67
5	Castelu	2 608	7 930	2 629	8 846	1 322	2 140	219	3 908	60	1 800	194	3 239	42	195	-	27
6	Mircea Voda	1 900	5 211	1 906	5 644	1 268	1 908	48	440	25	685	111	1 381	952	4 863	521	2 385
7	Pestera	3 785	9 984	2 896	6 561	2 830	3 826	10	120	-	-	20	260	266	923	127	1 542
8	Rasova	547	1 415	1 853	4 566	435	320	16	110	-	-	37	259	1 607	3 834	77	291
9	Seimeni	900	2 250	1 747	2 627	750	638	40	400	-	-	44	475	239	1 100	3	14
10	Silistea	2 010	6 484	548	1 537	559	842	58	1 175	-	-	59	511	175	751	-	55
11	Topalu	550	1 540	1 737	3 129	750	600	10	150	-	-	50	1 035	78	83	-	33
12	Tortoman	3 484	12954	1 282	3 787	1 212	2 175	30	340	-	-	43	352	59	232	-	34
	TOTAL I	**19 191**	**56068**	**17 630**	**46 838**	**11 809**	**14 624**	**593**	**9 513**	**130**	**4 802**	**898**	**11 841**	**7 084**	**24 438**	**1 225**	**7 621**
II. COUNTY CALARASI																	
1	Borcea	8 062	13796	6 359	17 169	5 926	7 980	50	280	21	320	104	405	497	820	-	162
	TOTAL II	**8 062**	**13796**	**6 359**	**17 169**	**5 926**	**7 980**	**50**	**280**	**21**	**320**	**104**	**405**	**497**	**820**	**-**	**162**
III. COUNTY IALOMITA																	
1	Fetesti	1 773	5 064	2 336	5 883	966	1 076	30	350	196	6 407	1 519	12 066	585	1 260	367	1 841
2	Bordusani	2 091	7 391	4 162	10 146	2 992	4 680	50	210	-	-	110	766	284	285	36	265
3	Stelnica	3 902	13543	1 767	4 646	1 898	3 152	31	365	-	-	70	752	55	138	-	22
	TOTAL III	**7 766**	**25998**	**8 265**	**20 675**	**5 856**	**8 908**	**111**	**925**	**196**	**6 407**	**1 699**	**13 584**	**924**	**1 683**	**403**	**2 128**
	GENERAL TOTAL	**35 019**	**95862**	**32 254**	**84 682**	**23 591**	**31 512**	**754**	**10 718**	**347**	**11 529**	**2 701**	**25 830**	**8 505**	**26 941**	**1 628**	**9 911**

4.3.3. Results of Chemical Analyses of Soil Samples, Radioactivity

4.3.3.1. Soil Samples Chemical Analyses

In the years 2000, 2001 and 2006, ICIM performed analyses of soil samples (Ref. 4.3-5) taken from the Cernavoda NPP site, from its western part, and also from the area occupied by Units 2, 3 and 4. Water samples from existing drillings were also analyzed in order to determine metal concentrations (taking Order 756/1997 as reference).

The results from the years 2000 and 2001 (Ref. 4.3-5) show concentrations of cadmium, between 0.049 ppm and 0.084 ppm, chrome up to 29.84 ppm, copper, between 9.044 ppm and 111.48 ppm, manganese, between 45.78 ppm and 88.567 ppm, nickel, between 8.94 ppm and 16.12 ppm, lead, between 4.57 ppm and 10.23 ppm, zinc, between 35.28 ppm and 381.07 ppm, in soil samples in an area not far from Unit 3 and 4, within the Cernavoda NPP site.

In the year 2006, soil samples were taken from gate J, at the limit of Units 4 and 5 (point I), near the Turbine Hall at Unit 3 (point II) and from the area between Units 2 and 3 (point III), from depths of 5 cm and 30 cm. The results of the analyses are presented in Table 4.3.3-1, and the maximum allowable concentrations (MAC) are those from Order 756/1997.

The concentrations in the water samples from drillings were between 7.2 ppm and 73.02 ppm chrome, up to 29.57 ppm copper, between 58.29 ppm and 196.43 ppm manganese, up to 31.32 ppm lead, between 75.86 ppm and 240.58 ppm zinc.

The values were below the limits in Order 756/1997.

Table 4.3.3-1. Results of soil samples analyses in the year 2006

Parameter	Unit	I 5 cm	I 30 cm	II 5 cm	II 30 cm	III 5 cm	III 30 cm	Normal	MAC	
									pa*	pi**
pH	-	7.5	7.5	7.6	7.6	7.6	7.7	-	-	-
Conductivity	µS/cm	207	218	215	223	277	224	-	-	-
Cadmium	mg/kg dw	1.36	0.92	1.87	0.92	1.22	0.59	1	5	10
Copper	mg/kg dw	40.1	28.7	17.7	13.1	13.3	10.8	20	250	500
Chromium	mg/kg dw	9.2	8.5	6.2	5.4	10.1	8.7	30	300	600
Manganese	mg/kg dw	343	314	268	259	246	238	900	2000	4000
Nickel	mg/kg dw	31.5	27.1	5.3	3.9	23.5	17.2	20	200	500
Lead	mg/kg dw	11.9	9.6	10.7	8.1	7.7	6.3	20	250	1000
Zinc	mg/kg dw	37.7	23.4	30.4	24.5	57.3	48.9	100	700	1500
Petroleum products	mg/kg dw	164	102	139	122	128	115	100	1000	2000

* less sensible alert thresholds
** less sensible intervention thresholds

4.3.3.2. Radioactivity

For assessing the pollution level of soil and subsoil in the influence zone of Cernavoda CNE PROD, ICIM performed a program in the year 2004 (Ref. 4.3-5), that included taking, preparation and analyses of uncultivated soil samples, spontaneous vegetation eatable vegetation (vegetables and fruits predominating in the specific diet), widely consumed products (milk, meat, eggs). The sampling locations were the Cernavoda CNE – PROD platform, Cernavoda, Seimeni, Dunarea, Faclia, Saligny, Mircea Voda, Satu Nou, Stefan cel Mare, Cochirleni, Capidava, Silistea, Tortomanu, Medgidia, Pestera, Alimanu, Rasova.

The areas for collecting soil samples were selected so that to represent the natural conditions of the region, be not on slopes and be not surrounded by trees or bushes.

The spontaneous vegetations samples consisted of grass and tree leads.

The food samples were obtained from local producers, the samples being selected so that to be representative for the area dietary custom.

Soil samples

Gross beta analyses

For all the soil samples from the Cernavoda CNE – PROD influence zone, the minimum value recorded for gross beta activity was 382.0 ± 15.8 Bq/kg dw, and the maximum value was 581.8 ± 23.9 Bq/kg dw. The average value of gross beta activity of uncultivated soil from the Cernavoda CNE – PROD influence zone was 481.9 ± 19.9 Bq/kg dw.

Figure 4.3.3-1 presents the gross beta radioactivity level in the samples of uncultivated soil from the Cernavoda CNE – PROD influence zone. The gross beta activity values were obtained by averaging the values corresponding to the same zone.

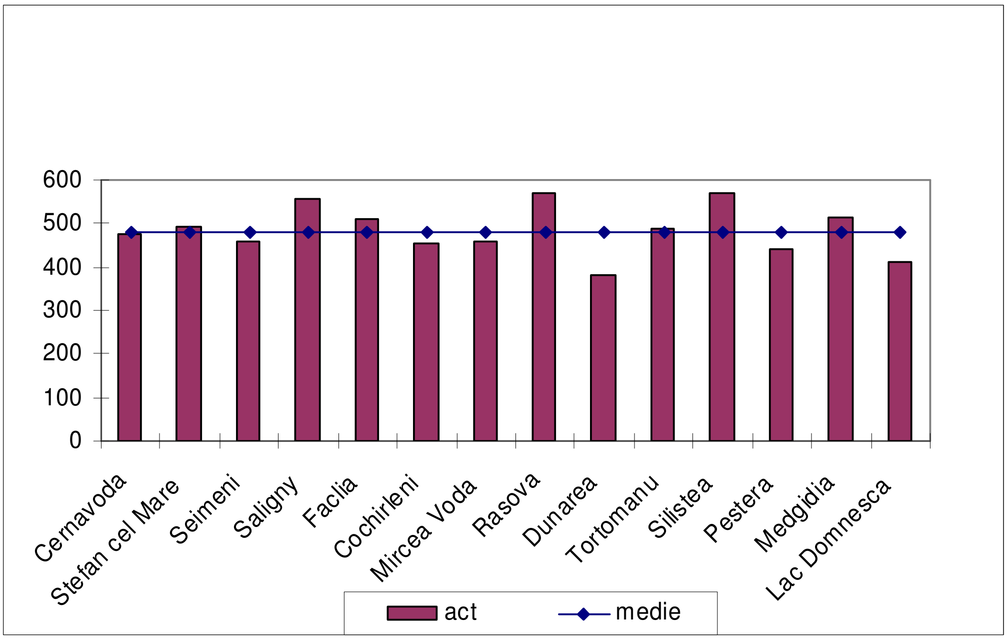

Figure 4.3.3-1. Gross beta activity of the soil samples from the Cernavoda CNE – PROD influence zone

Table 4.3.3-2 presents the minimum, average and maximum values of gross beta activity in uncultivated soil samples, for reference locations

Table 4.3.3-2. Minimum, average and maximum values of gross beta activity in soil samples

Location	Min. val. gross beta activity [Bq/kg]	Average val. gross beta activity [Bq/kg]	Max. val. gross beta activity [Bq/kg]
Cernavoda	477.8 ± 52.2	591.7 ± 56.4	752.6± 62.3
Constanta	310.7 ± 45.6	370.2 ± 47.2	491.9 ± 51.3
Calarasi	238.9 ± 25.5	303.9 ± 26.1	403.2 ± 29.5
Slobozia	189.0 ± 31.1	338.0 ± 35.7	458.4 ± 40.8

The gross beta activity values are within the normal limits for the soil types in the respective zones.

Spectrometric gamma analyses

For the uncultivated soil samples from the Cernavoda CNE – PROD influence zone there were found values above the detection limit for the natural radionuclide K-40 and also for the radionuclides Pb-214 and Bi-212.

Table 4.3.3-3 presents the average values of the natural radionuclide K-40 concentrations, and also of the radionuclides Pb-214 and Bi-212, detected in uncultivated soil samples from the Cernavoda CNE – PROD influence zone.

Table 4.3.3-3. Average concentrations of K-40, Pb-214 and Bi-212 in uncultivated soil samples

Radionuclide	Average concentrations [Bq/kg]	No. samples – detected radionuclide / no. samples analyzed
K-40	417.8 ± 9.4	12 / 20
Pb-214	27.1 ± 1.0	12 / 20
Bi-212	26.0 ± 5.2	13 / 20

Figure 4.3.3-2 presents the level of K-40, Pb-214 and Bi-212 detected uncultivated soil samples.

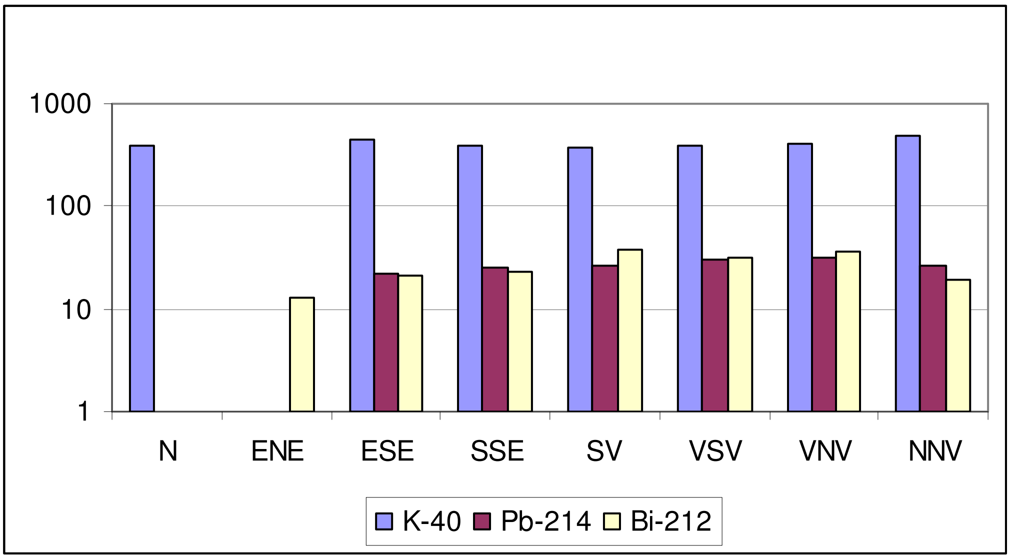

Figure 4.3.3-2. Concentrations of K-40, Pb-214 and Bi-212 in uncultivated soil samples

Determinations of tritium and carbon – 14

For the soil samples, it was recorded an average value of tritium concentration, for the Cernavoda CNE – PROD influence zone, of 27.1 ± 4.5 Bq/kg fw.

Table 4.3.3-4 presents the average values of tritium concentration in soil samples for Cernavoda, in comparison with the other locations from the power plant influence zone and with the reference location - Calarasi.

Table 4.3.3-4. Tritium concentration in soil samples

Sample type	Location	Average value H-3 [Bq/kg fw.]
Uncultivated soil	Cernavoda	30.1 ± 5.1
	Other locations*	24.0 ± 3.8
	Calarasi	4.5 ± 0.8

* locations from the Cernavoda CNE - PROD influence zone

As regards carbon – 14 determinations in soil samples from the Cernavoda CNE - PROD influence zone, it was recorded an average value of 248 ± 17 Bq/kg – carbon fw., and for the reference location – Calarasi it was obtained an average value of 233 ± 8 Bq/kg-carbon fw.

Spontaneous vegetation

Gross beta analyses

For the samples of spontaneous vegetation taken from the Cernavoda CNE - PROD influence zone, there were recorded the lollowing values above the detection limit of gross beta activity: the minimum recordedvalue was 26.0 ± 1.0 Bq/kg fw, and the maximum value was 546.5 ± 22.0 Bq/kg fw. The acerage value of gross beta activity of spontaneous vegetation samples from the Cernavoda CNE - PROD influence zone was 115.5 ± 4.6 Bq/kg fw.

Figure 4.3.3-3 presents the gross beta radioactivity level in spontaneous vegetation samples. The gross beta activity values were obtained by averaging the values corresponding to the same zone, the average value being also presented for the Cernavoda CNE - PROD influence zone.

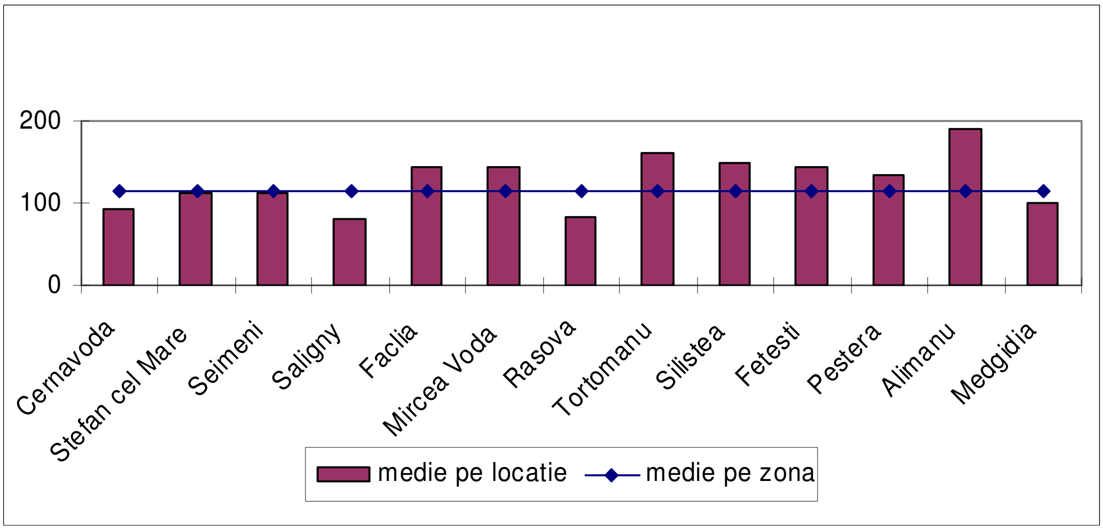

Figure 4.3.3-3. Gross beta activity of spontaneous vegetations samples from the Cernavoda CNE - PROD influence zone

The presented values represent the radioactivity level corresponding to one kilogram of green mass (fw).

Table 4.3.3-5 presents the average value, for each reference locations, of gross beta activity in spontaneous vegetation samples, the minimum recorded value and the maximum recorded value, and also the corresponding locations.

Table 4.3.3-5. Minimum, average and maximum values of gross beta activity in spontaneous vegetation samples

Location	Min. val. gross beta activity [Bq/kg]	Average val. gross beta activity [Bq/kg]	Max. val. gross beta activity [Bq/kg]
Cernavoda	157.8 ± 19.4	222.2 ± 21.4	313.8 ± 24.8
Constanta	142.7 ± 17.8	257.8 ± 22.3	463.9 ± 31.1
Calarasi	80.0 ± 13.5	154.3 ± 14.4	210.6 ± 15.4
Slobozia	110.3 ± 15.5	163.5 ± 17.6	235.4 ± 20.3

Spectrometric gamma analyses

For the samples of spontaneous vegetation from the Cernavoda CNE - PROD influence zone, there were recorded values above the detection limit of the spectrometric gamma activity for the radionuclides K-40 and Be-7.

The K-40 concentration varied in the domain 15.4 ± 0.6 Bq/kg fw – 166.0 ± 6.2 Bq/kg fw and the Be-7 concentration varied in the domain 3.6 ± 0.6 Bq/kg fw – 81.7 ± 5.0 Bq/kg fw.

Figure 4.3.3-4 presents the average values of K-40 and Be-7 concentrations in samples of spontaneous vegetation, for sampling locations.

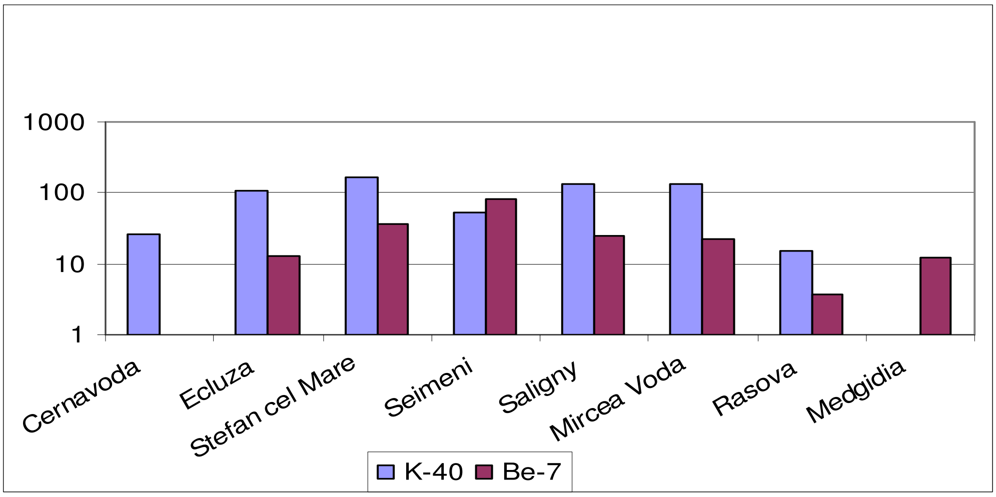

Figure 4.3.3-4. Levels of K-40 and Be-7 in spontaneous vegetation samples from the Cernavoda CNE - PROD influence zone

The presented values represent the radioactivity level corresponding to a kilogram of dry mass (fw).

Determinations of tritium and carbon – 14

For the samples of terrestrial and arbor spontaneous vegetation, it was recorded an average value of tritium concentration (in the Cernavoda CNE - PROD influence zone) of 23.1 ± 3.4 Bq/kg fw.

Table 4.3.3-6 presents the average values of tritium concentration in samples of terrestrial and arbor spontaneous vegetation, from the power plant influence zone.

Table 4.3.3-6. Tritium concentrations in spontaneous vegetation samples

Sample type		Average value H-3 [Bq/kg fw.]
Spontaneous vegetation	terrestrial	25.4 ± 3.7
	arbor	20.7 ± 3.1

As regards the carbon – 14 determinations in spontaneous vegetation samples, it was recorded an average value of 287 ± 30 Bq/kg – carbon fw. Table 4.3.3-7 presents the concentrations of carbon – 14 in spontaneous vegetation samples from the Cernavoda CNE - PROD influence zone.

Table 4.3.3-7. Concentrations of carbon – 14 in spontaneous vegetation samples

Sample type	Average value C-14 [Bq/kg-carbon fw.]
Terrestrial spontaneous vegetation	278 ± 29
Arbor spontaneous vegetation	295 ± 30

Vegetables

Gross beta analyses

For samples of vegetables taken from the Cernavoda CNE – PROD influence zone, there were recorded the following values above the detection limit of the gross beta activity: the minimum value 11.30 ± 0.45 Bq/kg fw, the maximum value 241.48 ± 9.69 Bq/kg fw. The average value of gross beta activity of the vegetables samples from the Cernavoda CNE - PROD influence zone was 79.08 ± 3.18 Bq/kg fw.

Figure 4.3.3-5 presents the gross beta radioactivity level in samples of vegetables samples. The gross beta activity values were obtained by averaging the values corresponding to the same zone, the average value for the Cernavoda CNE - PROD influence zone being also presented.

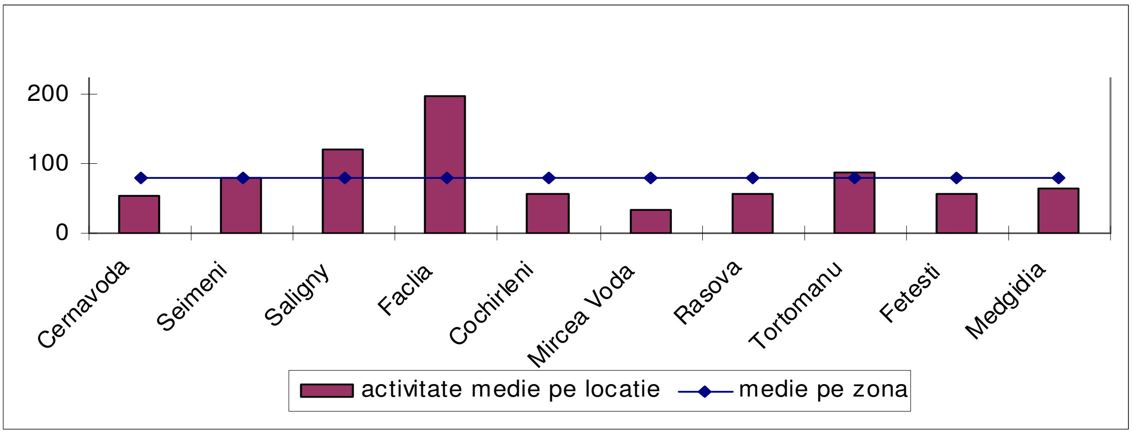

Figure 4.3.3-5. Gross beta activity in samples of vegetables from the Cernavoda CNE - PROD influence zone

The presented values represent the radioactivity level corresponding to a kilogram of green mass (fw).

Spectrometric gamma analyses

For samples of vegetable, there were detected the natural radionuclides K-40 with an average of spectrometric gamma activity of 240.4 ± 13.9 Bq/kg fw and Be-7 with an average value of 34.3 ± 13.6 Bq/kg fw; there were not detected other gamma emitting radionuclides.

Determinations of tritium and carbon – 14

For the samples of vegetables, it was recorded an average value of tritium concentration, for the Cernavoda CNE - PROD influence zone, of 19.2 ± 3.1 Bq/kg fw.

Table 4.3.3-8 presents the average values of tritium concentrations in samples of vegetables from Cernavoda and the power plant influence zone, in comparison with the reference location - Calarasi. There were not observed significant diferences.

Table 4.3.3-8. Tritium concentration in samples of vegetables

Sample type	Location	Average value H-3 [Bq/kg fw.]
Vegetables	Cernavoda	19.8 ± 3.2
	Cernavoda zone*	18.5 ± 2.9
	Calarasi	16.4 ± 2.0

* locations in the Cernavoda CNE - PROD influence zone

Figure 4.3.3-6 presents the average values of tritium concentration in samples of vegetable - for sampling locations in the Cernavoda zone - in comparison with the reference location Calarasi.

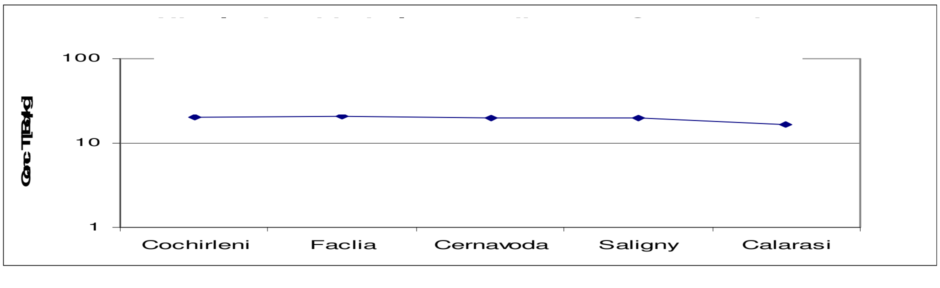

Figure 4.3.3-6. Tritium concentration in samples of vegetables from the Cernavoda CNE - PROD influence zone, in comparison with the reference location Calarasi

As regards the determinations of carbon – 14 in samples of vegetables, it was recorded an average value of 303 ± 38 Bq/kg – carbon fw.. Table 4.3.3-9 presents the concentrations of carbon – 14 in samples of vegetables from the Cernavoda CNE - PROD influence zone in comparison with the reference location Calarasi.

Table 4.3.3-9. Concentrations of carbon – 14 in samples of vegetables

Sample type	Location	Average value C-14 [Bq/kg-carbon fw.]
Vegetables	Cernavoda zone*	303 ± 38
	Calarasi	239 ± 30

* locations from the the Cernavoda CNE - PROD influence zone

Figure 4.3.3-7 presents the average values of carbon – 14 concentrations in samples of vegetables, for sampling loctions from the Cernavoda zone, in comparison with the reference location Calarasi. There were not observed significant differences.

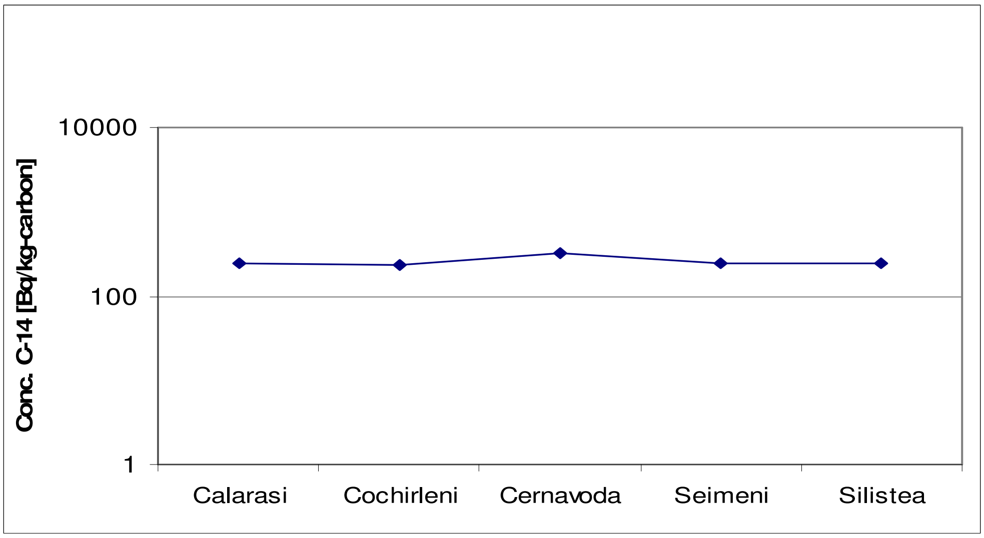

Figure 4.3.3-7. Concentrations of carbon – 14 in samples of vegetables from the Cernavoda CNE - PROD influence zone, in comparison with the reference location Calarasi

Fruits

Gross beta analyses

For the samples of fruits taken from the Cernavoda CNE - PROD influence zone, there were recorded the following values above the detection limit of gross beta activity: the minimum value 17.4 ± 0.7 Bq/kg fw, the maximum value 177.4 ± 7.1

Bq/kg fw. The average value of gross beta activity of the samples of fruits from the Cernavoda CNE - PROD influence was 58.9 ± 2.3 Bq/kg fw.

Figure 4.3.3-8 presents the gross beta radioactivity level in the samples of fruits. The gross beta activity values in the graph were obtained by averaging the values corresponding to the same zone, the average value for the Cernavoda CNE - PROD influence zone being also present.

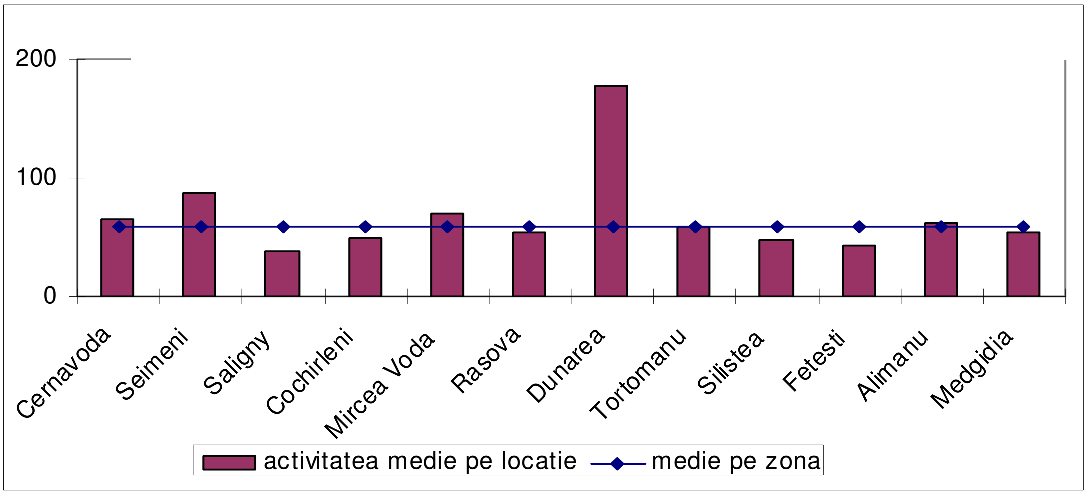

Figure 4.3.3-8. Gross beta activity of the samples of fruits from the Cernavoda CNE - PROD influence zone

The presented values represent the radioactivity level corresponding to a kilogram of green mass (fw).

Spectrometric gamma analyses

For the samples of fruits, there were recorded values above the detection limit for the natural radionuclides K-40 with the average spectrometric gamma activity of 74.4 ± 2.7 Bq/kg fw and Be-7 with the average value of 10.8 ± 2.3 Bq/kg fw.

Determinations of tritium and carbon – 14

For the samples of fruits, i twas recorded an average value of tritium concentration, for the Cernavoda CNE - PROD influence zone, of 50.0 ± 6.8 Bq/kg fw., observing relatively small variations from a location to another and between different types of samples.

Table 4.3.3-10 presents the average values of tritium concentration in samples of fruits from Cernavoda and the power plant influence zone, in comparison with the reference location Calarasi.

Table 4.3.3-10. Tritium concentration in samples of fruits

Sample type	Location	Average value H-3 [Bq/kg fw.]
Fruits	Cernavoda	62.8 ± 7.8
	Cernavoda zone*	37.1 ± 5.8
	Calarasi	15.2 ± 2.5

* locations in the Cernavoda CNE PROD influence zone

Figure 4.3.3-9 presents the average values of tritium concentration in samples of fruits for sampling location in the Cernavoda zone, in comparison with the reference location Calarasi.

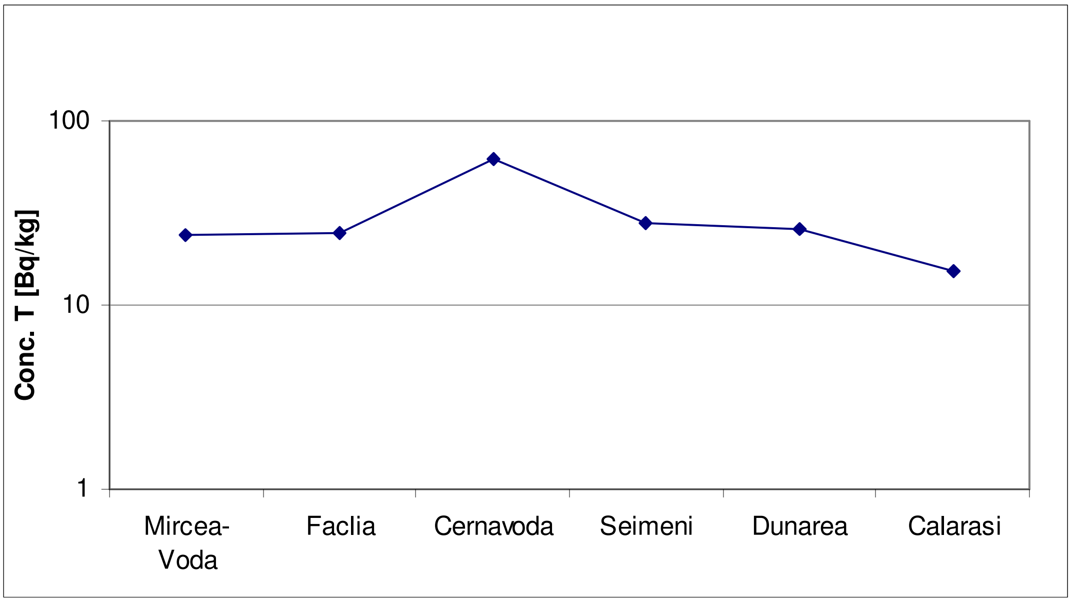

Figure 4.3.3-9. Tritium concentration in samples of fruits from the Cernavoda CNE - PROD influence zone, in comparison with the reference location Calarasi

As regards the determinations of carbon – 14 in samples of fruits, it was recorded an average value of 263 ± 29 Bq/kg – carbon fw. Table 4.3.3-11 presents the concentrations of carbon – 14 in samples of fruits from the Cernavoda CNE - PROD influence zone in comparison with the reference location Calarasi.

Table 4.3.3-11. Concentrations of carbon – 14 in samples of fruits

Sample type	Location	Average value C-14 [Bq/kg-carbon fw.]
Fruits	Cernavoda zone*	263 ± 29
	Calarasi	238 ± 28

* locations in the Cernavoda CNE PROD

Milk

Gross beta analyses

For the samples of milk from the Cernavoda zone, the minimum recorded value of gross beta activity was 20.9 ± 0.8 Bq/l, and the maximum value was 66.7 ± 2.7 Bq/l. The average value of gross beta activity of milk samples from the Cernavoda zone was 45.9 ± 1.8 Bq/l.

Figure 4.3.3-10 presents the gross beta radioactivity level in the samples of milk from the Cernavoda zone and the average value for the measurements which recorded values above the detection limit.

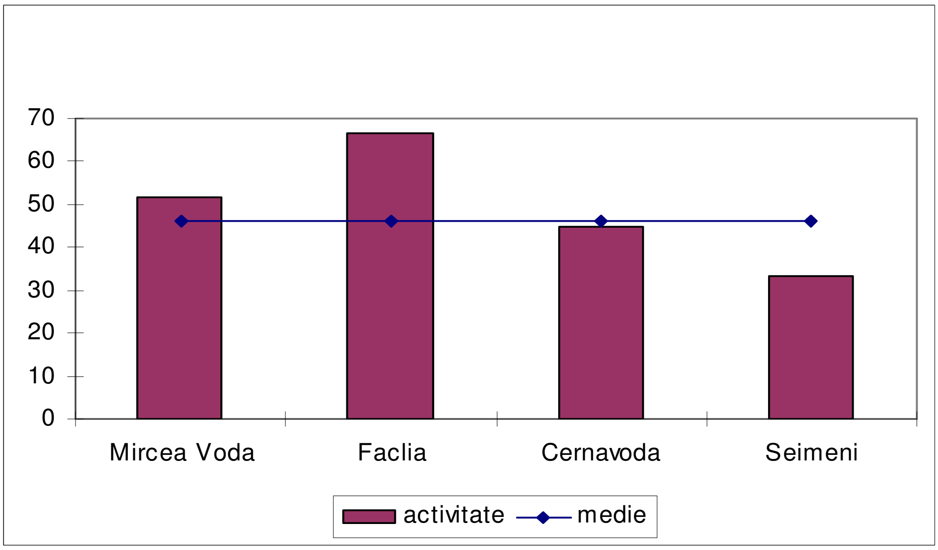

Figure 4.3.3-10. Gross beta activity of the samples of milk from the Cernavoda CNE - PROD influence zone

Spectrometric gamma analyses

For the samples of milk, values above the detection limit were recorded for the natural radionuclides K-40, with an average of spectrometric gamma activity of 91.9 ± 13.4 Bq/l; there were not detected other gamma emitting radionuclides.

Determinations of tritium and carbon – 14

For the samples of milk, it was obtained an average value of tritium concentration, for the Cernavoda CNE - PROD influence zone, of 21.0 ± 3.4 Bq/L, observing relatively s,mall variations from a location to another and between different types of samples.

Table 4.3.3-12 prezents the average values of tritium concentrsations in samples of milk from Cernavoda and the power plant influence one, in comparison with the reference location Calarasi.

Table 4.3.3-12. Tritium concentration in samples of milk

Sample type	Location	Average value H-3 [Bq/L]
Milk	Cernavoda	22.6 ± 3.6
	Cernavoda zone*	19.4 ± 3.1
	Calarasi	9.2 ± 1.3

* locations in the Cernavoda CNE PROD influence zone

As regards the determinations of carbon – 14 in samples of milk, it was recorded an average value of 260 ± 28 Bq/kg – carbon. Table 4.3.3-13 presents the concentrations of carbon – 14 in samples of milk from the Cernavoda CNE - PROD influence zone in comparison with the reference location Calarasi.

Table 4.3.3-13. Concentrations of carbon – 14 in samples of milk

Sample type	Location	Average value C-14 [Bq/kg-carbon]
Milk	Cernavoda zone*	260 ± 28
	Calarasi	239 ± 27

* locations in the Cernavoda CNE PROD influence zone

Meat

Spectrometric gamma analyses

For the samples of meat for which spectrometric gamma analyses were performed, there were not detected gamma emitting radionuclides.

Determinations of tritium and carbon – 14

For the samples of meat, it was obtained an average value of tritium concentration, for the Cernavoda CNE - PROD influence zone, of 5.4 ± 0.9 Bq/kg fw.

After performing the analyses of carbon – 14 in samples of meat, taken from the Cernavoda CNE - PROD influence zone, it was obtained an average value of 266 ± 27 Bq/kg – carbon fw., and for the reference location Calarasi it was obtained an average value of 260 ± 28 Bq/kg – carbon fw.

Egs

Gross beta analyses

In the samples of egg taken from the locations Cernavoda, Stefan cel Mare, Saligny and Faclia for the determination of the gross beta activity, there were not recorded values above the detection limit.

Spectrometric gamma analyses

For the analized samples of egg, there were not detected gamma emitting radionuclides, except the natural radionuclides K-40 having an average concentration of 137.7 ± 20.0 Bq/kg fw and Be-7 with an average concentration of 73.1 ± 24.2 Bq/kg fw.

Determinations of tritium and carbon – 14

For the samples of eggs, it was obtained an average value of tritium concentration, for the Cernavoda CNE - PROD influence zone, of 17.2 ± 2.8 Bq/kg fw., observing relatively small variations from a location to another.

After performing the analyses of carbon – 14 in samples of egg, taken from the Cernavoda CNE - PROD influence zone, it was obtained an average value of 285 ± 29 Bq/kg – carbon fw.

Figure 4.3.3-11 presents the average values of carbon – 14 concentrations in samples of hen eggs, for sampling locations.

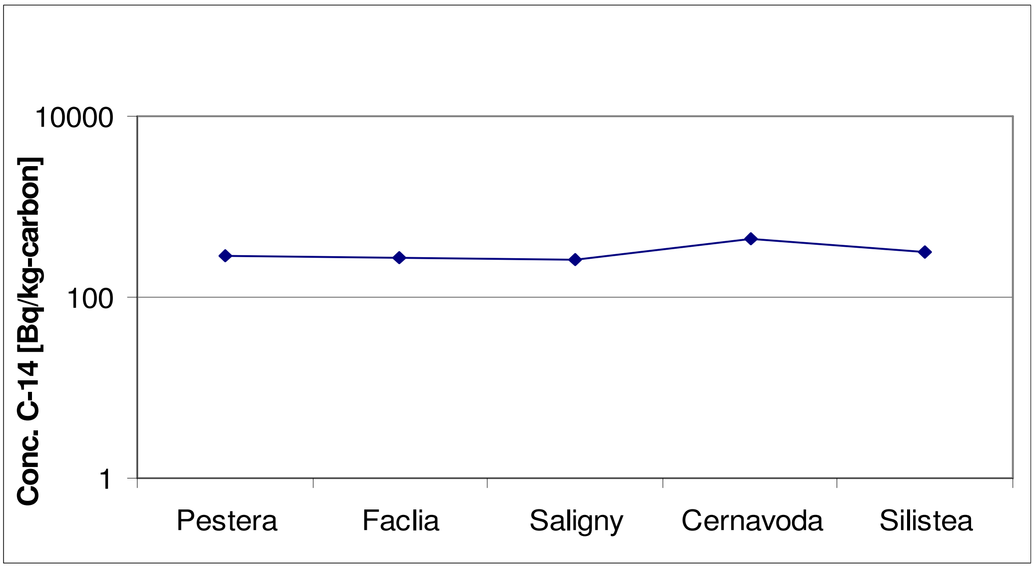

Figure 4.3.3-11. Concentrations of carbon – 14 in samples of eggs from the Cernavoda CNE - PROD influence zone

4.3.4. Sources of Soil Pollution during the Construction Period

The soil potential pollution sources during the Unit 3 construction period are the following (Ref. 4.3-6):

- handling and disposal of the construction materials;
- handling and storage of toxic and hazardous substances;
- waste management;
- leaks from transportation activities.

4.3.5. Sources of Soil Pollution during the Operation Period

The potential impact of the Unit 3 operation on soil and subsoil can be mainly due to the substances and materials use and handling, to the waste management or to leaks that appear in normal and abnormal operation regime of some technological systems (Ref. 4.3-6).

Indirect potential impact can also be due to using the receptor water for crop irrigation, or to atmospheric deposition of radioactive materials.

4.3.6. Estimated Impact on Soil during the Units 3 and 4 Completion Period

Taking into consideration that the main buildings of Units 3 and 4 are already constructed and further work outside will be done for finalizing some exterior surfaces and for finishing them, the impact on soil will be less than in other construction sites.

As regards the building site organizations, they belong to the companies that carry out the works.

The leaks of oil, fuel, chemicals will be reduced to minimum by the proper maintenance of equipment and vehicles.

The leaks resulted during handling and storage will be prevented and reduced by strict application of the procedures, as well as by adequate training of the personnel, and by specifying the environmental protection responsibilities.

Proper management of toxic substances (paints) and care during operations using them, will prevent their potential impact on soil.

The waste generated during the execution period are common wastes similar to those resulted from building-installing works for industrial objectives. The wastes management will be carried out inside the building site, according to the existing legal provisions and practices in the NPP Site. In these conditions, the waste management activities will not have a significant adverse effect on soil.

4.3.7. Estimated Impact on Soil during the Units 3 and 4 Operation

The non-radiological impact of Units 3 and 4 operation on soil and subsoil can be mainly generated by the substances and materials use and handling, by the waste management or by leaks and infiltration in soil.

In order to avoid the soil and subsoil pollution by substances or materials used or by wastes, the following are provided: installations, devices, correspondingly arranged spaces, detailed measures and procedures on material type and category, regarding their transport, handling, storage, collecting and management. Also, the impact will be reduced to minimum by the specific regulation application.

The main chemicals used are stocked in the supplier package or in cisterns. The cisterns are grouped on a anti-acid plated platform that contains the chemicals accidental leaks and allows their transfer to the waste water reservoirs. The discharging platform of chemicals from the railway tanks is anti-acid plated and equipped with transfer facilities of waste water to neutralization.

The reagents used in the chemical laboratory are stocked in rooms (in the laboratory) with special destination, in safety conditions: freezer for potentially explosive substances, metallic locker with double walls for flammable substances, metallic locker for toxic substances, and their use is strictly regulated.

Substances of PCB type are not used at Units 3 and 4.

The liquid non-radioactive waste (for example: solvents, oils) will be collected in barrels for their storage, analyses (for identification and contamination degree determination), conditioning and transfer outside of the power plant. The disposal procedures take into account authorized contractors or are established conforming to environmental protection regulations.

The leaks that appear in normal and abnormal operation regime of some technological systems (the turbine building, the NSP - BOP interface building and the chiller building) are collected by the inactive drainage system and discharged in the rainwater sewage. The system ensures also the possibility to collect the water-oil mixture from the turbine main bearing and to separate the oil from water.

The rainwater from the black oil husbandry and discharging platform, after their purification in the black oil separator, is collected by the rainwater sewage system.

The drainage system and sewage network efficiency is ensured by their proper maintenance. Care will be taken to avoid their deterioration during Units 3 and 4 completion.

Therefore, the non-radiological impact of the Units 3 and 4 activity on soil is expected to be insignificant during normal operation conditions.

The radiological impact on soil is analyzed in Chapter 4.9.

4.3.8. Impact Mitigation Measures for Soil

In addition to the impact prevention measures taken in the Units 3 and 4 design, the operation procedures comprise impact mitigation measures by limiting and collecting leaks, collecting wastes, and also procedures for equipments proper maintenance.

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