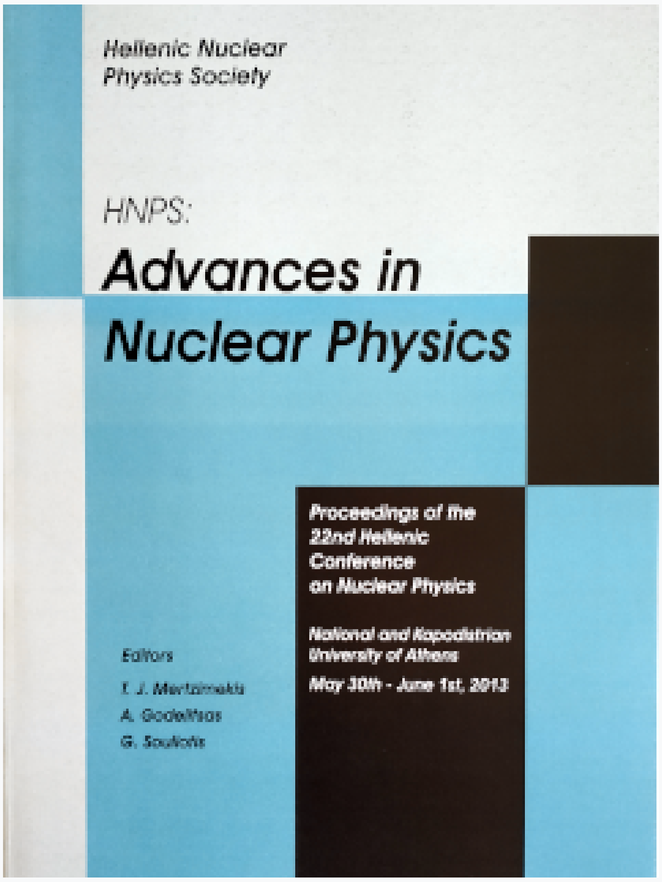
HNPS Advances in Nuclear Physics

Vol 21 (2013)

HNPS2013



Chernobyl still affects the environment of Greece: Recent measurements of 137Cs in soil cores from Grevena–Trikala area

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doi: 10.12681/hnps.2030

Chernobyl still affects the environment of Greece: Recent measurements of ^{137}Cs in soil cores from Grevena–Trikala area

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Abstract

Cores to a depth of 20 cm from surface were collected from Central Greece to study the ^{137}Cs concentration and mobility in soils from the most afflicted areas by the Chernobyl Accident. As we are approaching a time almost equal to one halflife of radiocesium from the Chernobyl accident, new data can be proven extremely useful for assessing the present status.

Keywords:

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1. Introduction & Motivation

The accident at Chernobyl nuclear reactor in 1986 resulted in the contamination of a large portion of European grounds, including Greece, with long-lived radioisotopes such as ^{137}Cs ($t_{1/2}$ = 30.07 a). Early works [1, 2] have reported on the extent of contamination in surface areas, as well as migration in depth, showing that radiocesium remains within the first ≈ 30 cm from surface in Greece soils [3]. Highly affected areas were located in Central Greece, where contamination due to ^{137}Cs seemed to persist a decade later [4].

Almost a ^{137}Cs halflife later (27 years), it is interesting to investigate potential changes from earlier reports and determine the amount of radiocesium that is still present in soils of Central Greece. Moreover, depth profiles can provide evidence of the level of migration in those soils.

^{137}Cs depth profiles and concentrations can be combined with measurements of natural radioactivity levels (U-series, ^{40}K) to allow for contamination evolution studies. Soil particle fractions and geological characterization are also necessary to explain the behavior of ^{137}Cs, which is known to be strongly bound in clays.

2. Experimental Method

Four different locations, very close to those reported in Ref. [4] have been chosen as sampling locations. These locations (see Fig. 1) differed in elevation, soil composition and soil disturbance (Fig. 2). Cores were collected to depths down to ≈ 20 cm from the surface. Vertical, 2 cm–thick sections were further produced from each core, starting from the surface level. All samples were dried by staying in an oven at T=45 °C for 24 hrs. Any remaining gravel content was removed and the samples were further sieved to a 2–mm size.

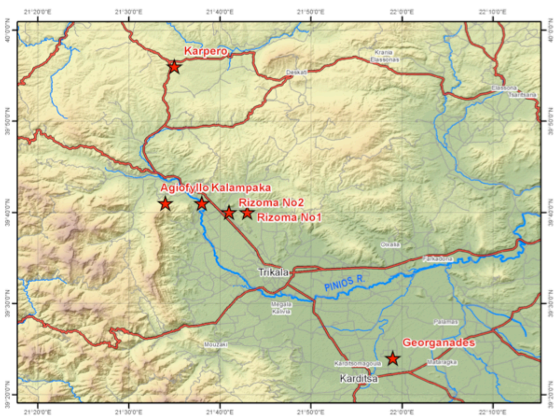

Figure 1: A map of sampling locations

^{137}Cs levels, as well as natural radioactivity ones (U–series and ^{40}K) were determined by gamma–spectrometry measurements carried out at the Environmental Assessments Laboratory of the University of Ioannina.

Each core sample (> 50 in total) was measured for a period of 24 hr using a HPGe detector (1.9 keV resolution at 661.65 keV), calibrated by means of an IAEA soil standard. A typical spectrum is depicted in Fig. 3. Spectra were analyzed using the Fitzpeaks software suite [5].

Figure 2: A photo of a sampling site with undisturbed soils near Karpero

3. Results and Conclusions

In 4 out of 5 cores, ^{137}Cs activity was found to be higher near soil surface, especially in samples from grounds considered totally undisturbed (e.g. Karpero, Agiofyllo). We speculate this result is strongly correlated to the geological character of those grounds, therefore future work has been planned towards that direction. Migration of ^{137}Cs deeper in the ground was observed in only one case (Kalambaka), most likely due to the fact that ground can not be considered entirely undisturbed. An important conclusion is that ^{137}Cs concentration is found significantly smaller with respect to Ref. [4] (at least a factor of 5), signifying an overall reduction of contamination.

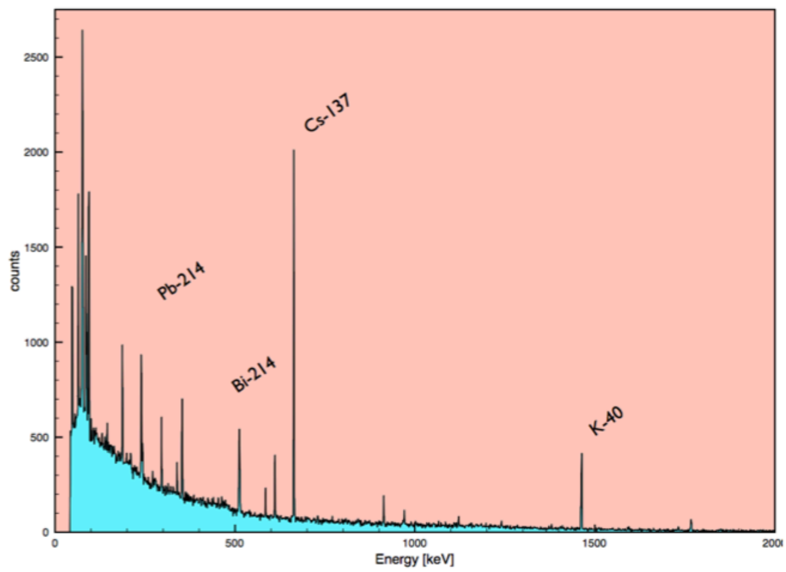

Figure 3: A typical -spectrum. Spectrum corresponding to the 0–2 cm slice from the Agiofyllo core

References

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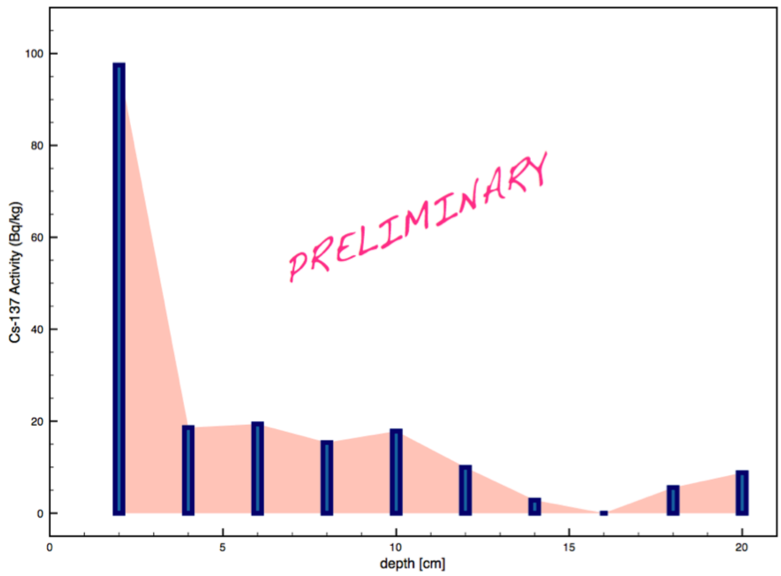

Figure 4: Core Depth Profile for the sample collected at Agiofyllo