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Education in the radioactivity field: a project for the Italian schools

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Introduction

Environmental topics are today at the centre of the public attention, but people mostly doesn't have cultural tools for an adequate knowledge. The radioactivity, in particular, is generally misunderstood and this had negatively influence debate about the energy. To fill this gap science subjects need to be study in school with a more efficient approach. Many efforts have spent to obtain this goal: in this framework the Envirad project was developed with the aim to make students of high schools of Campania Region (south-Italy) able to practice experimental method involving directly them in a real environmental physics experiment [1]. The aim of this project, developed by the grant of the Istituto Nazionale di Fisica Nucleare, is that the effective experimental activity is the best way to provide for an adequate scientific background.

The structure of the project

Envirad project concerns environmental radioactivity, principally the radon measurement. The reasons of this choice are mainly three: i) the specific knowledge of the project team; ii) the relevance of these subjects and the chance to present them correctly; iii) the possibility to investigate and apply many basic physical concepts and to carry out in the school effectively interesting measurements.

The project was planned on three years: the first one was spent to set up a strategy with a pilot school; in the following two years students developed their work on two topics showing the double aspects of the radioactivity, as an health problem and as a for geophysics research. The first line was about to plane, carry out and analyse measurements of the indoor radon concentration in schools and in other public buildings, using passive detectors. Because the most sensitive target of radon exposure are the children of primary schools, students where invited to include them into their surveys. The second topic of this work was the measurement of radon concentration into soil, using a method based on the electrostatic collection of ionised radon daughters, to find correlations between radon level fluctuations and the variation of parameters interesting the seismic and volcanic activity. These correlation is well studied in geophysics field, and this study is very important in the Campania region, where seismic and volcanic activity are well known, as well the its high levels of radioactivity [2] [3].

The method and the results

The preliminary work in the first year was very important because it allowed to find and verify in a small scale the strategy successfully adopted in the schools. Initially, the effort of this preliminary activity, was dedicated to select the study topics and the best way to propose them to students. In this stage the first problem to solve was the link between this relatively new subjects and the ordinary activity. On this plane, the role of the teachers is of great relevance: their mediation between ordinary and extraordinary activity is fundamental. Consequently, on the basis of the experience made in this first year, the two years activity has been organised and carried out with 20 schools. In the following we will report on this second phase.

Initially the participants learned the basic concepts of the radioactivity and the properties of the ionising radiations, the characteristics of the radon, the role of the monitoring and measurement techniques. To better understand last topics, students carried out preliminary measurements, to become with experimental techniques and with the radon properties. This objective was reached with the planning and the realization of series of short term (one/two weeks) measurements and the discussion of the results. After that, students where able to organize the long-term measurements suited to estimate the annual mean effective dose. LR115 track etch detectors were exposed on two consecutive semesters. Preliminary results are presented in ref [5]. The data, comprising radon concentrations and building information as well, are stored in a data base which can be inquired on line, so each group of students can make the data analysis on the whole set of data. Accepting our invitation, some participants extended their observations to other schools or to other public buildings, producing many data regarding the exposition in the workplaces. In some cases students exported in other schools the "Envirad method": they not only carried out radon measurements, but set up also a popular program to teach to other students the knowledge they reached in the first part of the project.

Students were invited also to extend their activities towards other themes. For example students of a school of Ischia island carried out indoor measurements in a district characterised by houses built green tuff bricks, typical of the volcanic island and studied the geologic characteristic of this area.

Moreover another group, analysed the cytogenetic effect of ionising radiations, using human cells exposed to different doses of X rays. The exposition has been done by a RX generator of the University; students learned and used a specific staining technique (GIEMSA) to paint and observe some chromosomal aberrations (dicentrics and rings). The scoring of chromosomal aberrations was realised using an optical microscope.

In the second year started the monitoring of the radon levels in soil using the RaMonA equipment [4], a system based on a silicon α -detector coupled with an electrostatic collection chamber. Devices, installed in the participant schools, are wase connected via Ethernet to a network and they will be managed completely by the students. They will be able, using the peculiarities of the system, to distinguish in the spectra acquired the ^{222}Rn from the ^{220}Rn and they will try to compare the variations of the long living isotope with the seismograms provided by geophysics. Another interesting aspect of the second year is that, for each school, new groups of students will begin the same activity in order to start a virtuous cycle that will

guarantee the activity in the following years: teachers and "expert" students will organise the training sessions for the new groups.

To expand the activity field of the students, some links have been established with two other Italian projects which involve students of other Italian regions in the study and the measurement of the radioactivity. The project web page (www.envirad.it) plays an important role from which was possible to reach the various information and documents needed.

Also the meetings organised each year in May with the participation of all schools have been interesting moments. In these meetings students presented with various works and oral presentations the activity developed and had the opportunity to meet some experts on various fields linked to radioactivity.

Conclusions

Beside the project education aspect, we want to underline the results from the scientific point of view: the results of the indoor measurements, carried out using standard protocols are the first data about radon exposition in the schools of south Italy. Moreover the monitoring of the soil radon gas provides to geophysics one tool which could be result very useful. Nevertheless, the original aspects of the project consist on its duality, scientific and educational.

Future perspectives

The project has been planned as an usual experiment, with its financial plan, its beginning, its developing and its conclusion. Consequently it would be finished at the end of 2005. But considering the very high interest of the schools, we decided to search a new financial support and a work planning saving a lot of time for us. So we obtained to continue the project in the 2006. The conditions to realise this goal are the use of appropriate scientific and educational materials and strict selection of the topics to investigate. In the planning of this new project we want to involve other researchers implied in similar fields to share our different experiences.

References

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