Impact of Nuclear Information on Young People's Knowledge and Attitudes

WP1

Methods/participatory tools in an educational program

CHK-3

Cowam

FP6 - COWAM2
WP1 "Implementing Local Democracy-Participatory Assessment Methods"

Theme CHK-3
"Impact of Nuclear Information on Young People"

FINAL REPORT

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INR Romania

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I. INTRODUCTION

Despite in Romania nuclear research activities were started in early 50s, the nuclear power is very young. First NPP, Cernavoda Unit 1, about 600 MWe, was in operation since 1996. Next unit (Cernavoda Unit2) will be in operation at the end of 2007. Therefore, a relative low amount of high level waste was produced. However, some problems already exists in Romania, mainly related to historical radioactive wastes released by nuclear industry and research.

Although the radioactive waste (RW) problem is not critical in Romania [COWAM2, Berlin-Romanian case study], in the next future important changes are expected, mainly caused by spent fuel accumulation in Cernavoda and the society trends. Nowadays, in Romania, the public acceptance is based on a relatively low level of information and participation [1]. We appreciate RW problem should be critical in 10-15 years.

In this context the research theme CHK-3 is intended to investigate the methods needed to prepare young generation for a future participation in the decision making process (DMP). This is the first motivation to work with young people in this research. The second motivation is strongly connected with the knowledge transfer aspects. Three years ago, we saw in COWAM2 project the main support for our understanding for public participation in the DMP. A real transfer of knowledge (both positive and negative aspects) from European experience to the Romanian actors is possible only if the theoretical facts will be transferred into practice. CHK-3 theme is an experimental study for qualitative and quantitative evaluation of different methods used to inform and involve people in the DMP.

II. GENERAL DESCRIPTION

The general objective of CHK-3 is to investigate the impact of nuclear information on young people's knowledge & attitudes, by using different Methods/Participatory Tools in the Educational Programme.

The specific objectives of CHK-3 are:
-to assess the actual level of nuclear information for school children of 12-14
-to assess the impact of new information on their attitudes including the use of different methods/ Participatory Tools
-finally, to make recommendations to the Government in order to improve the Educational Programme related to Nuclear Power and RW.

In figure 1 a general scheme of the CHK-3 is presented.

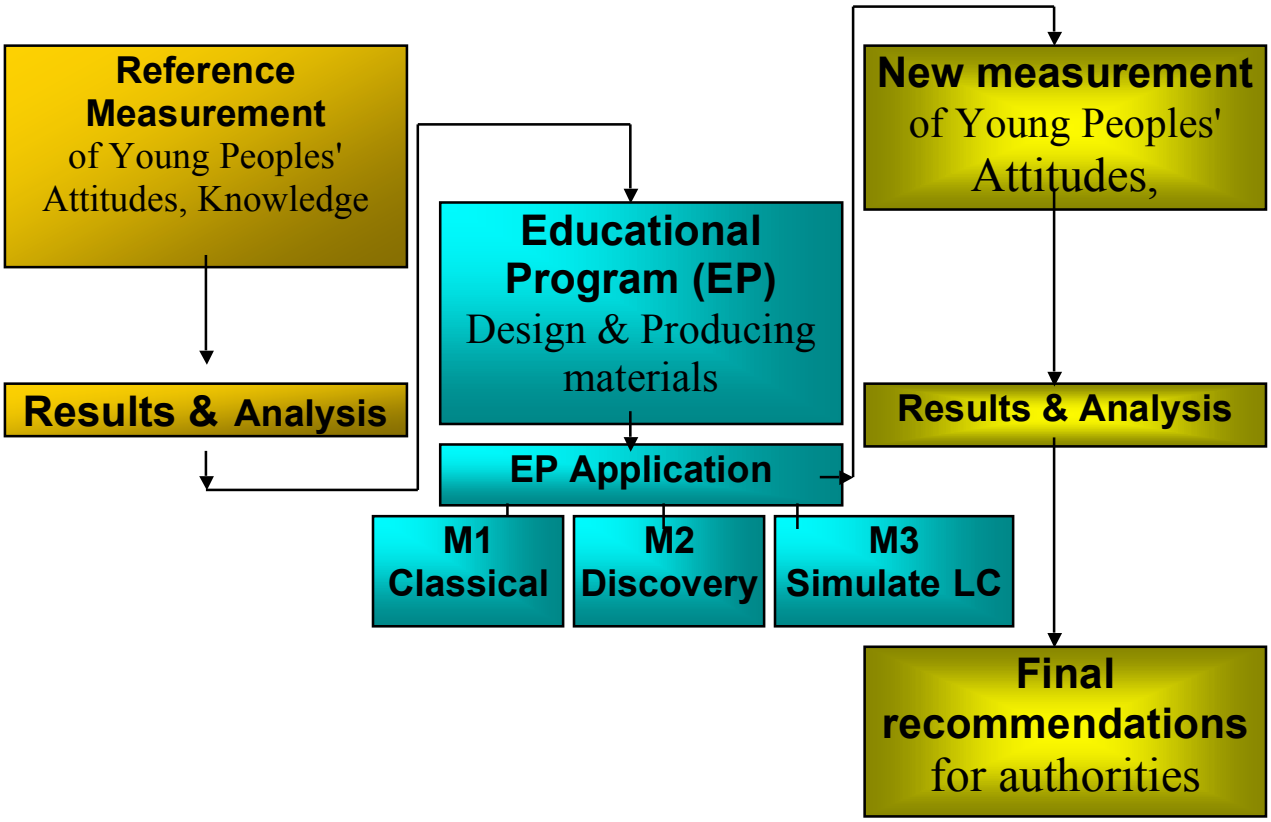


Fig.1 CHK-3 General Scheme

(1) The investigation has started in 2004 with a baseline survey intended to measure the reference state for knowledge and attitudes. The measurements were performed at the end of 2004 and beginning of 2005. Six groups of youngsters (3 from Pitesti and 3 from Cernavoda) were involved. In march 2005 a complete analyse for the basic measurement was released and discussed by the COWAM2 WP1 community.
(2) After the analyse an educational program (EP) was proposed and discussed in the COWAM2 Annual Seminar- Liubliana 2005. The EP design was completed in september 2005 and the materials for EP was collected and produced until November 2005. Three methods were selected for EP applying: the classical methods ussualy used for teaching in the schools-M1, the discovery method-M2 and the LC simulation-

M3. Seven groups (3 from Pitesti and 4 from Cernavoda) were involved during Ianuary 2006-April 2006 in the EP.

(3) A new questionnaire based measurement was performed after EP (May 2006). A first discussion of the result and analyse was achieved in 3rd Annual Seminar, Antwerpen, July 2006.

(4) A final document containing reccomendations for authorities was released in September 2006 and sent to the main Romanian institutions involved in the education and nuclear management.

III. RESULTS AND DISCUSSION

3.1 Reference Measurement

The first stage of the project consists of the measurement of the present level - knowledge and attitudes – of the children. Two towns from Romania were selected for the study: Cernavoda (the location of the Romanian NPP) an Pitesti as a non-nuclear place. In each town three schools were involved in the project (Table 3.1.1). A short comparison between the two towns is presented in Table 3.1.2.

Table3.1.1 Structure of the groups involved in the Baseline Survey

Pitesti		Ceravoda	
School	No. of pupils in the selected class	School	No. of pupils in the selected class
School no.5	21	School no.3	22
School no.11	24	School no.4	24
School no. 13	28	School no. 2	27
	Total=73		Total=73

The data were collected from Pitesti in November 2004, and from Cernavoda in January 2005. At the time of the measurement, the children are, with small exceptions, 13 years old. The used approach was ‘face to face’.

Table 3.1.2 A short comparison between Pitesti and Cernavoda

	Pitesti	Cernavoda
Population	200.000	20.000
Nuclear facilities	-	NPP Location
Universities	2	-
Economy	Very dynamic, diverse	Strong Dependence on NPP

Taking into account the measurement purposes the questionnaire was structured into four parts: A-Sources of information; B-Energy alternatives; C-NPP/Radioactivity/RW; D-Demographics. A number of 5 scales and 11 lists were used.
The main results are presented briefly in the following.

(A)-Sources of information
Our investigation was focused on:
(A1)-sources of information used for technical issues (From where do you usually find out about technical/industrial topics?)
(A2)-frequency of using (Among the previous information sources, which are, for you, the most frequently used?)
(A3)-trust in different sources (Which of them are more trustful for you?)
(A4)-frequency of Internet using (How often are you using the internet?)
The main results are presented in figures 3.1.1 (A1), 3.1.2 (A2), 3.1.3 (A3) and 3.1.4 (A4).

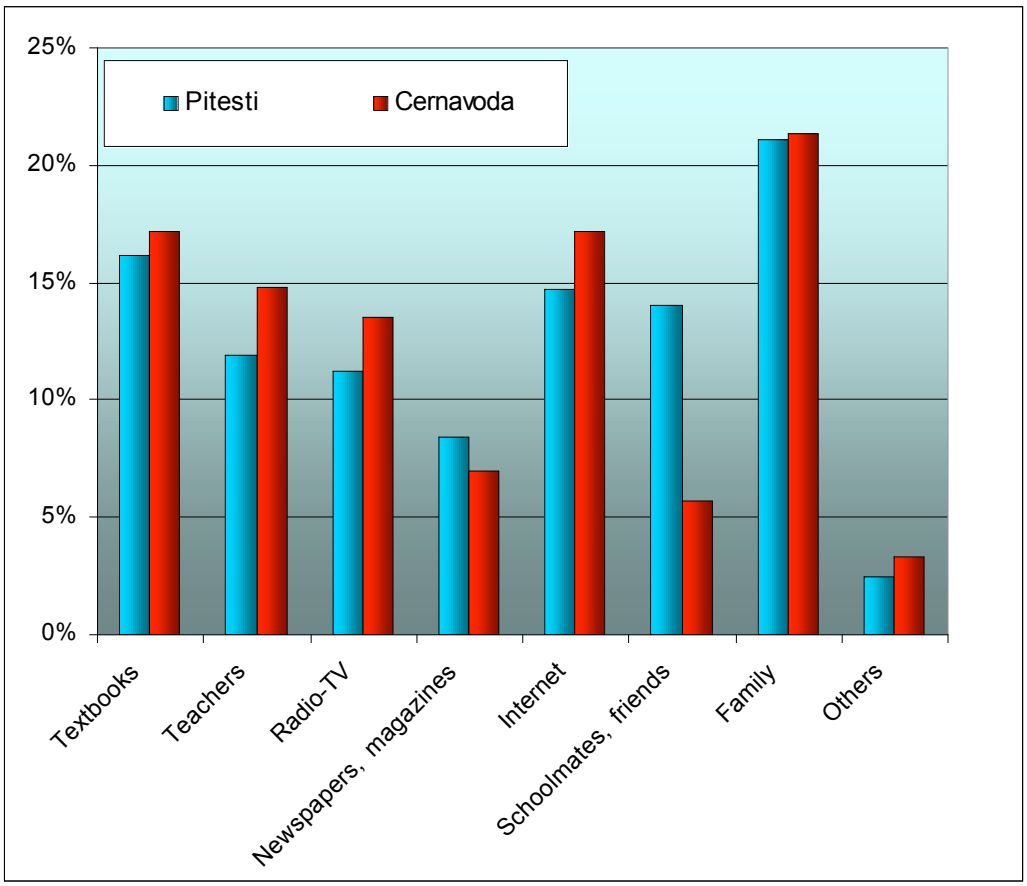


Fig.3.1.1 Tehnical sources used by youngsters

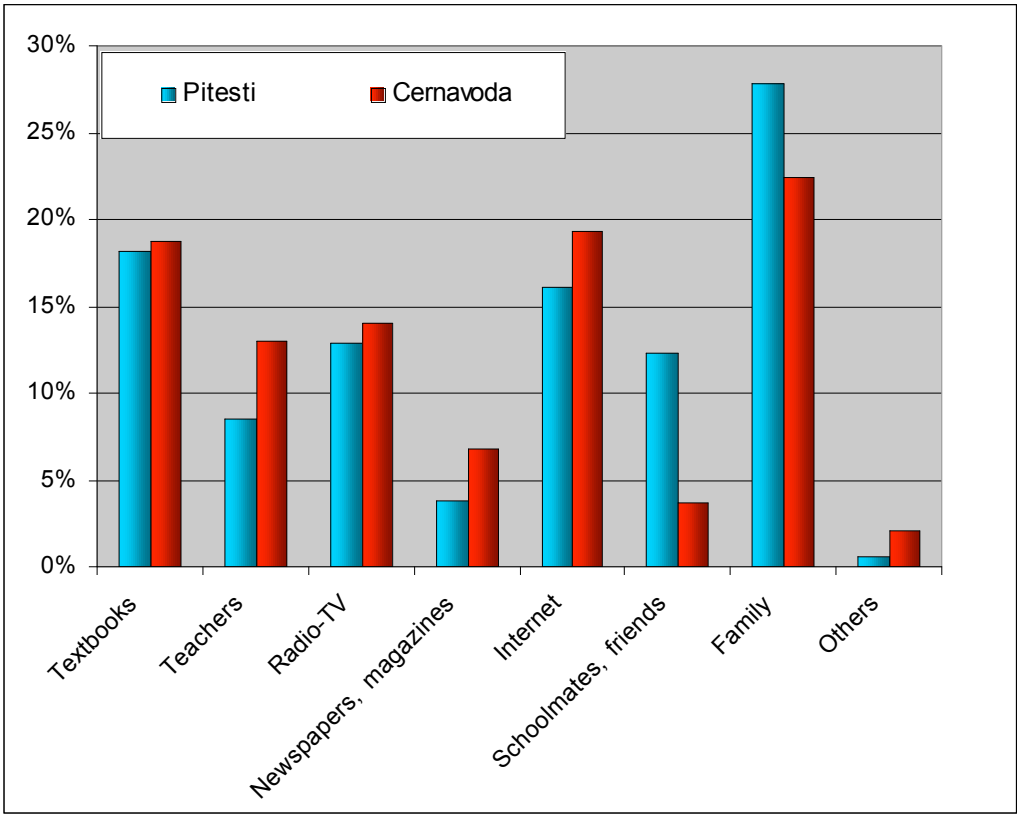


Fig.3.1.2 The most frequently used sources

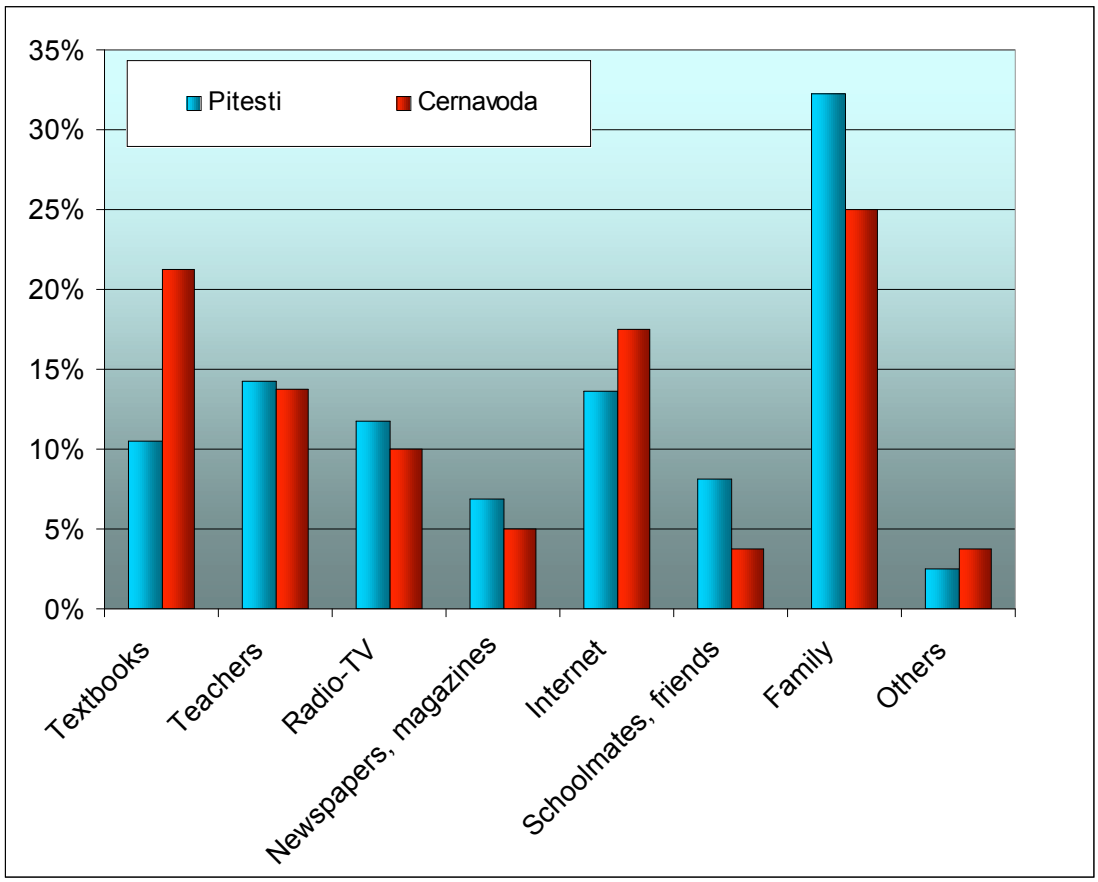


Fig.3.1.3 Trust in sources

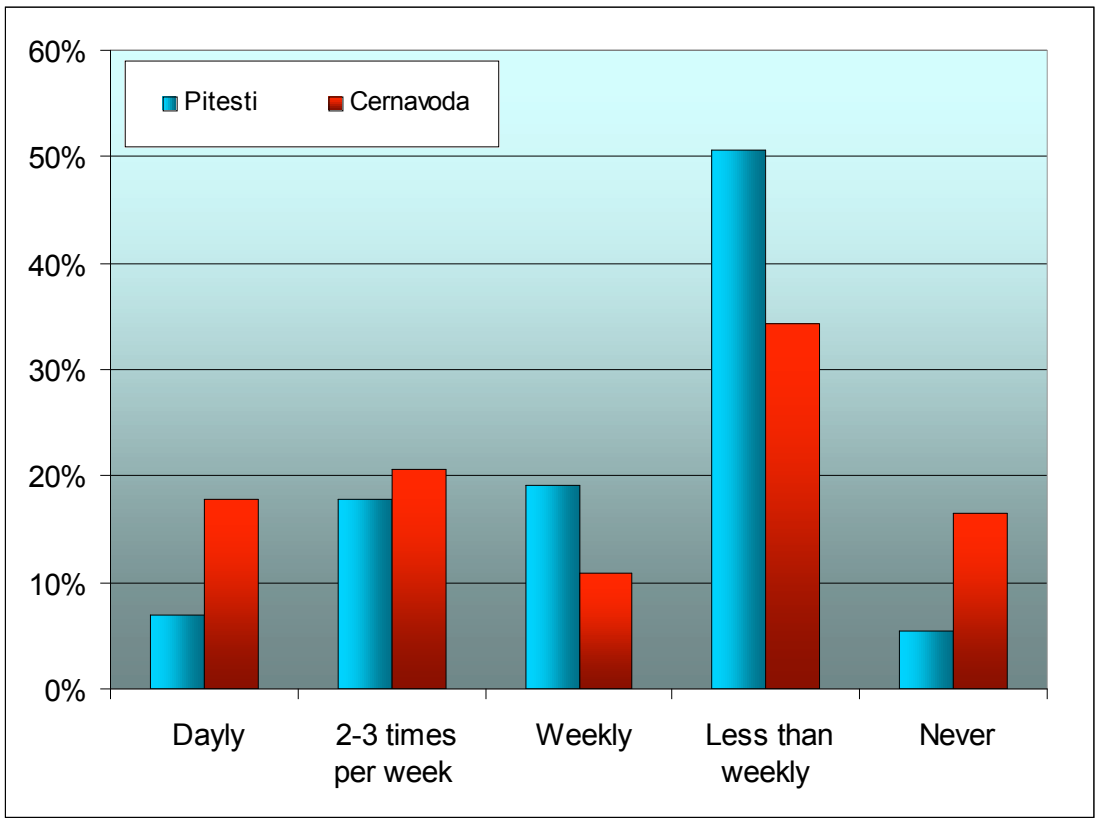


Fig.3.1.4 Internet using frequency

(B)-Electricity producing alternatives

Our investigation was focused on:

(B1)-Knowledge related to electric power alternatives in Romania (What electric power plants exist in Romania?)

(B2)-Perceived pollution level (Speaking about the impact on the environment (or in other words, pollution) for the power plants you know, give a mark between 1 and 5, according to how less pollutant they are.)

(B3)-Pollution by carbon dioxide (Scientists believe that global warming is caused by Carbon Dioxide emissions so which electric power plants used all around the world produce the most carbon dioxide do you think?)

(B4)-Location of the NPP in Romania

The main results are presented in figures 3.1.5 (B1), 3.1.6-1,2,3,4,5,6,7 (B2), 3.1.7 (B3) and 3.1.8 (B4).

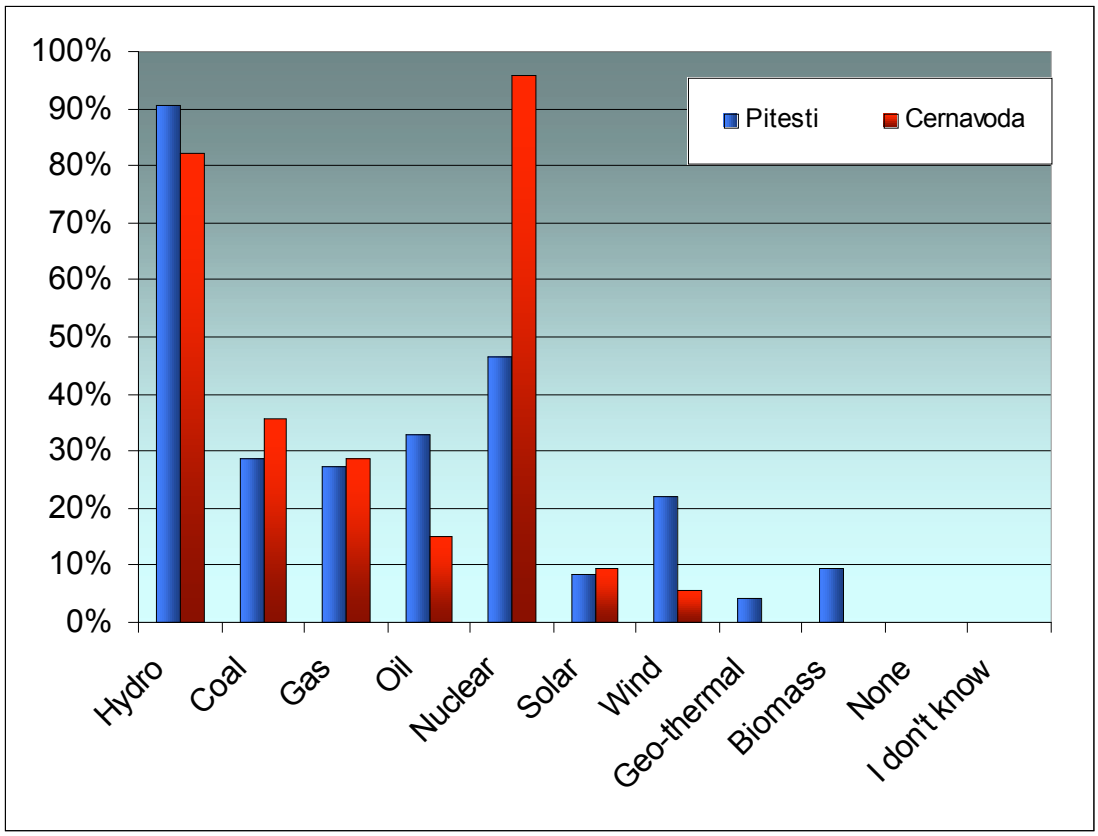


Fig.3.1.5 Notoriety for different electricity producing alternatives

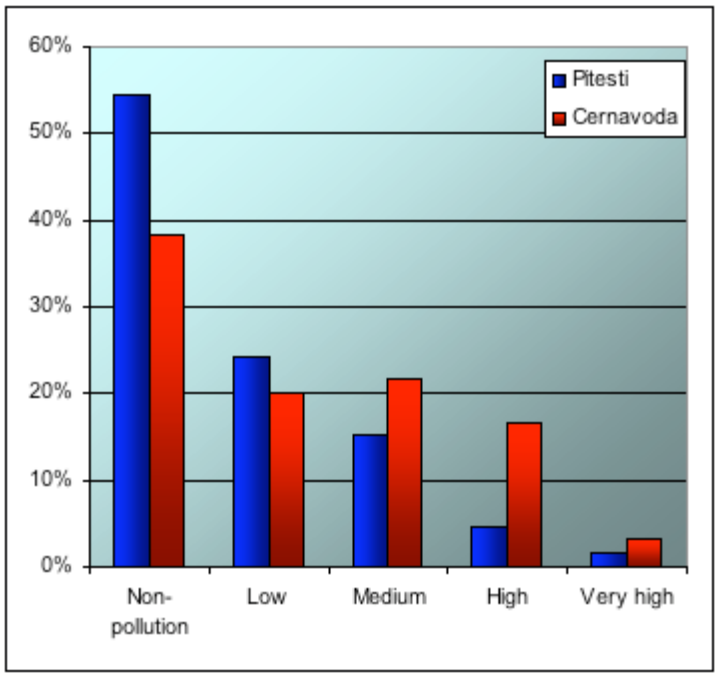


Fig.3.1.6-1 Perception about pollution generated by Hydro power plant

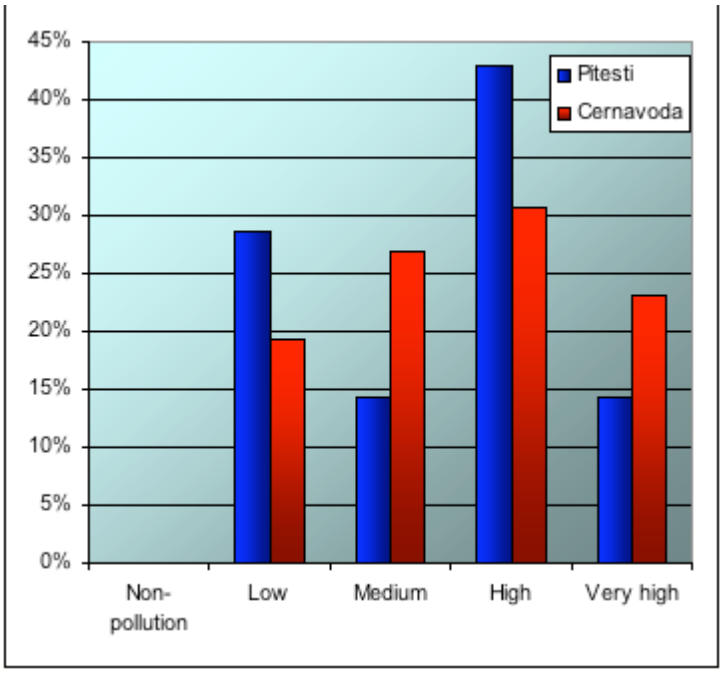


Fig.3.1.6-2 Perception about pollution generated by Coal power plant

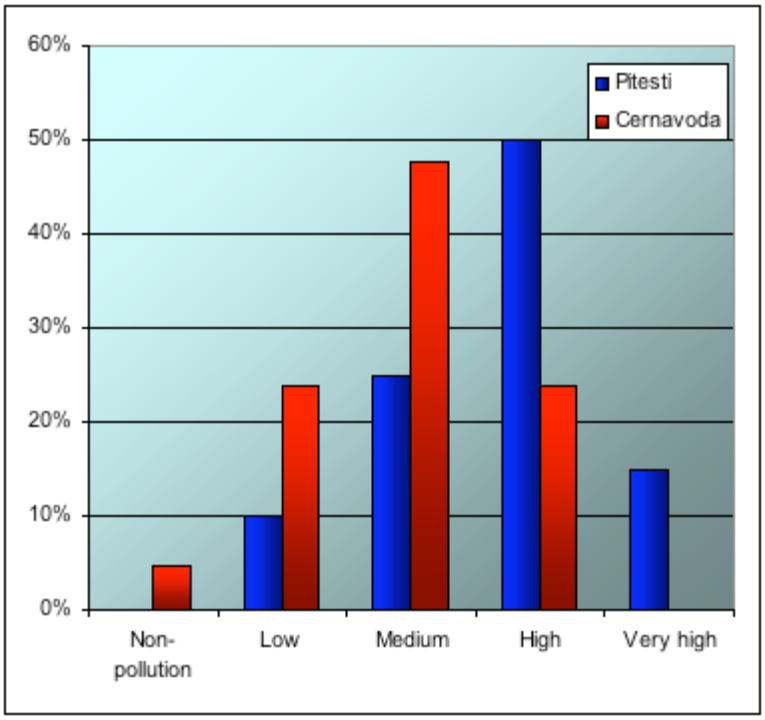


Fig.3.1.6-3 Perception about pollution generated by Gas power plant

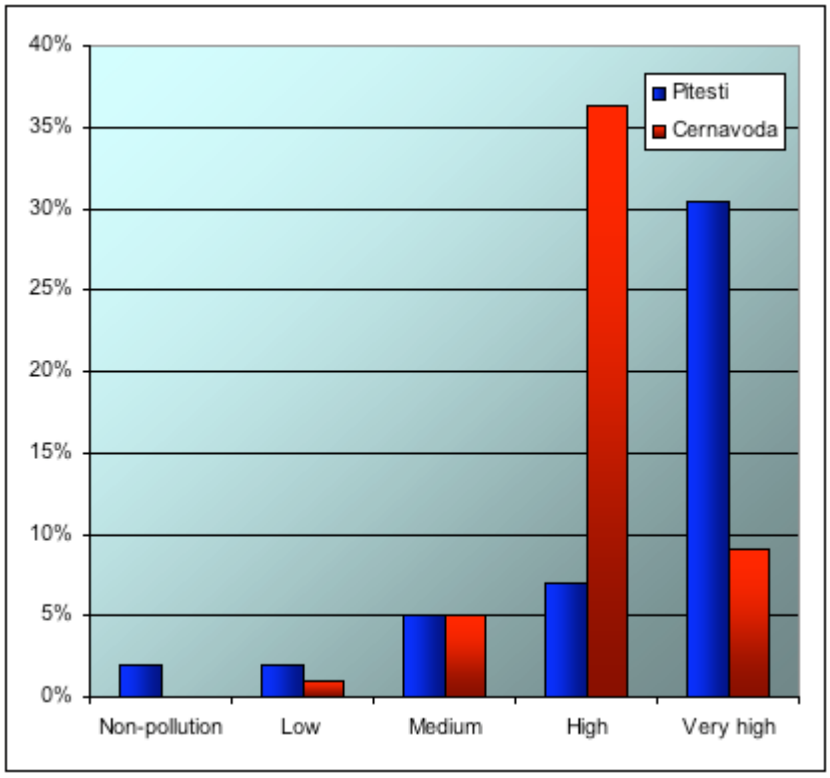


Fig.3.1.6-4 Perception about pollution generated by Oil power plant

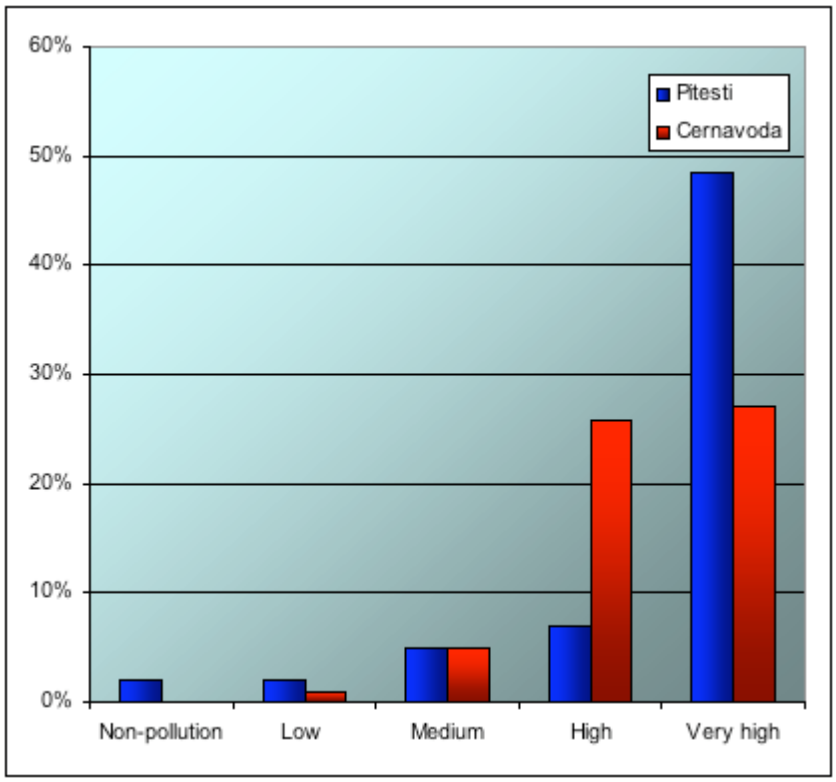


Fig.3.1.6-5 Perception about pollution generated by Nuclear Power Plant

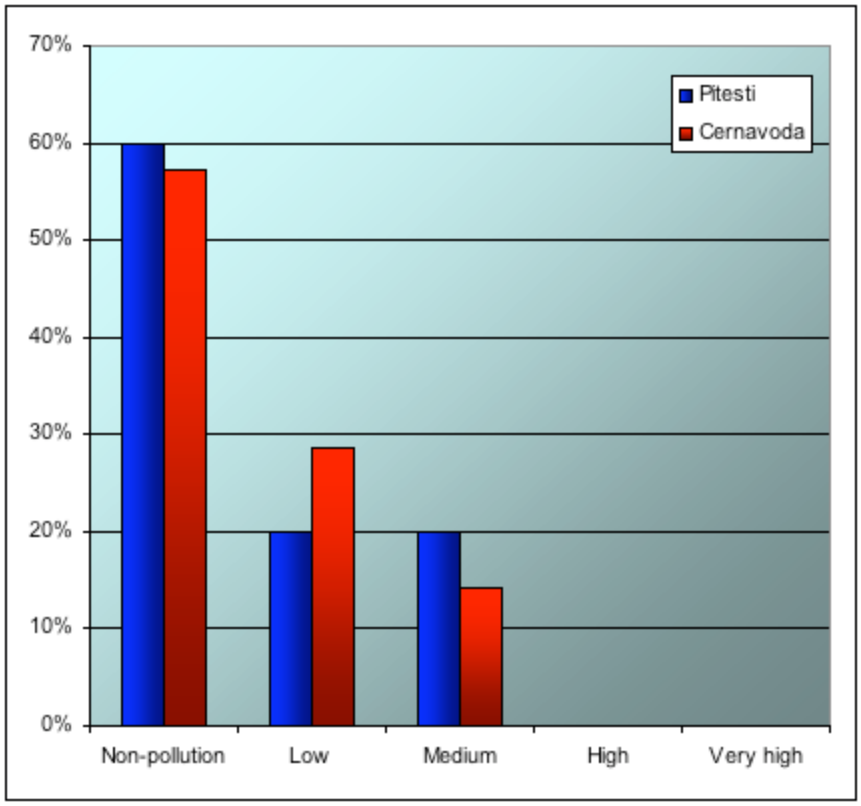


Fig.3.1.6-6 Perception about pollution generated by Solar Power Plant

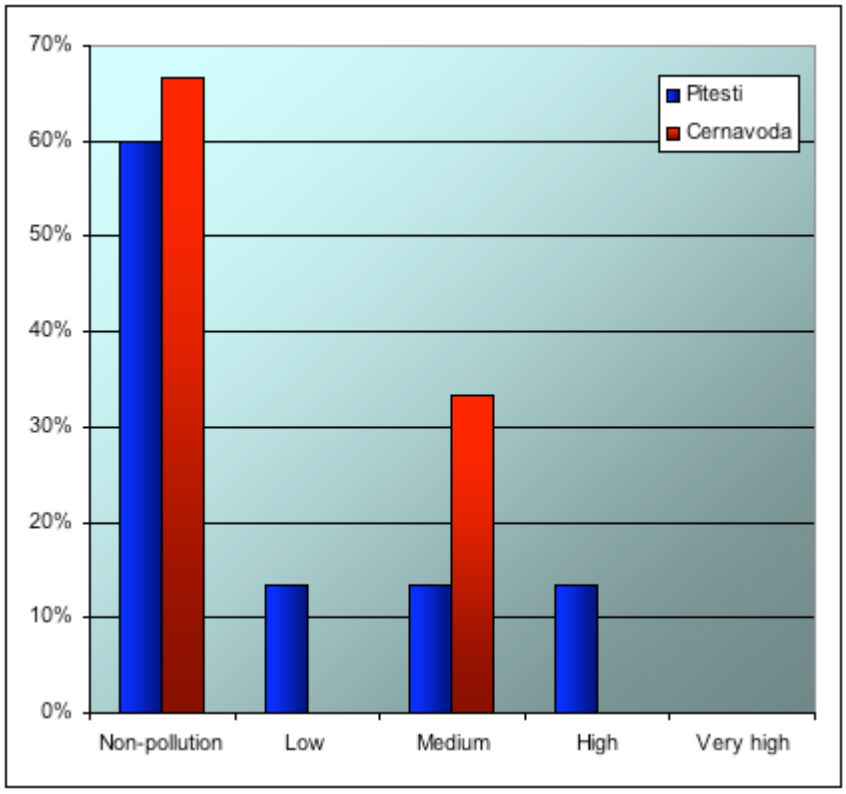


Fig.3.1.6-7 Perception about pollution generated by Wind Power Plant

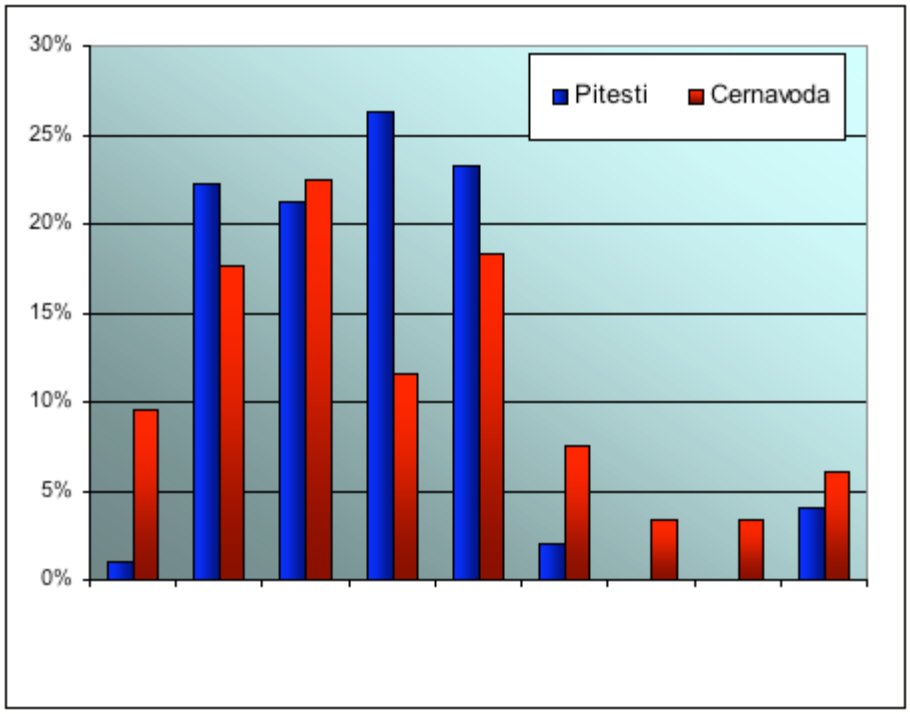


Fig.3.1.7 Perception about pollution by Carbon Dioxide

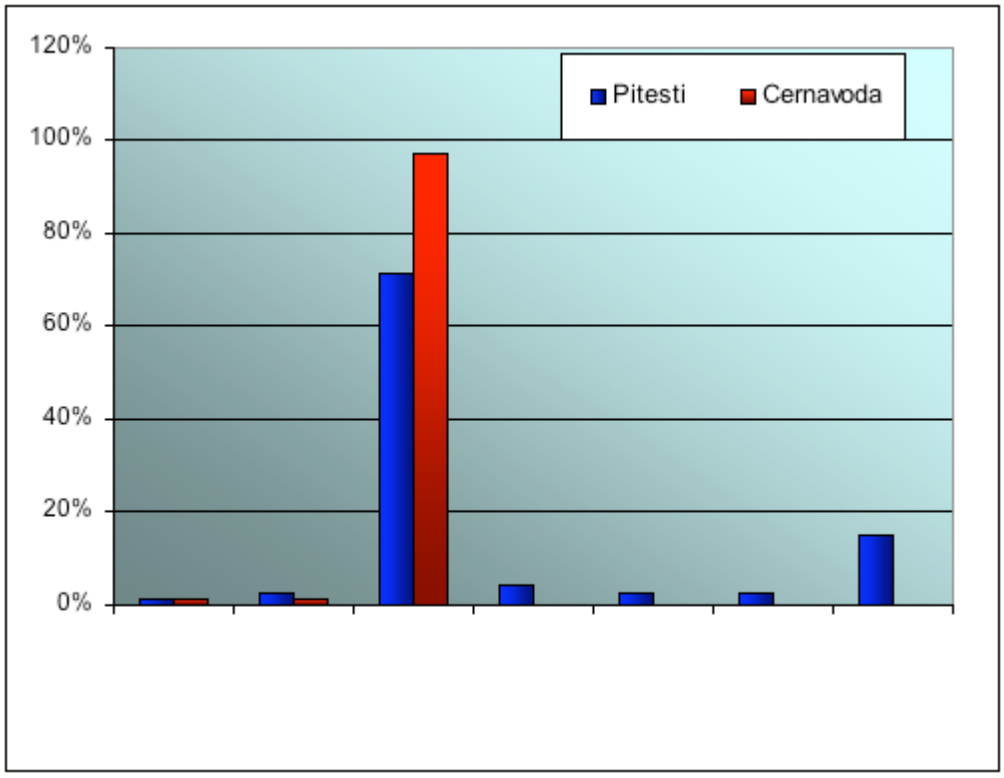


Fig.3.1.8 Location for Romanian NPP

(C)-Radioactivity, NPP and nuclear wastes

Our investigation was focused on:

(C1)-Radioactivity/radiations knowledge (Have you ever heard the words "nuclear radiations" or "radioactivity"?)

(C2)-Sources for knowledge (Where did you hear about them?)

(C3)-Radioactivity perception (What "nuclear radiations" means for you?)

(C4)- Origin/sources of radioactivity (From the listed items, with which are you associating the nuclear radiations?)

(C5)- Knowledge for radioactive/nuclear waste (Have you ever heard the words "radioactive waste" or "nuclear waste"?)

the nuclear radiations?)

(C6) Sources for knowledge (nuclear wastes) (Where did you hear about them?)

(C7) Main difference nuclear-classical wastes (In your opinion, what is the major difference between the common waste (as the garbage) and the radioactive waste?)

(C8) Knowledge for nuclear waste repository (Have you ever heard something about repositories for radioactive waste or nuclear waste?)

(C9) Perception for the nuclear waste repository location in the vicinity (How much would you be concerned if a radioactive waste repository were built close to your town?)

(C10) Perception about needed protection distance between repository and home (How far from your house should be placed a repository in order do not have an effect on your life?)

(C11) Classical –RW comparison from the point of view of associated dangers (Let's try to compare the radioactive waste to the classic waste (pollutants from industry or other fields of the economy). In your opinion, which of them are the most dangerous?)

(C12) Importance for different imposed conditions for repositories (In order do not produce an environmental pollution and do not jeopardize the human health, which are, in your opinion, the most important conditions requested for such a repository?)
(C13) Dangers associated with NPP (Which of the following dangers could be associated with a nuclear power plant?)
(C14) Perception about the importance of the NPP associated danger (How severe is the danger from each one?)
(C15) Frequency of NPP assciated danger (In your opinion how likely is it that will happen?)
(C16) Dangers associated with RW repositories (Which of the following dangers could be associated with a radioactive waste repository?)
(C17) Perception about the importance of the danger (How severe is the danger from each one?)
(C18) Frequency of RW reposirory associated dangers (In your opinion how likely is it that will happen?)

The main results are presented in figures 3.1.9 (C1), 3.1.10 (C2), 3.1.11 (C3), 3.1.12 (C4), 3.1.13 (C5), 3.1.14 (C6), 3.1.15 (C7), 3.1.16 (C8), 3.1.17 (C9), 3.1.18 (C10), , 3.1.19 (C11) , 3.1.20 (C12) , 3.1.21 (C13), 3.1.22 (C14), 3.1.23-27 (C15), 3.1.28 (C16), 3.1.29-36 (C17), 3.1.37-43 (C18).

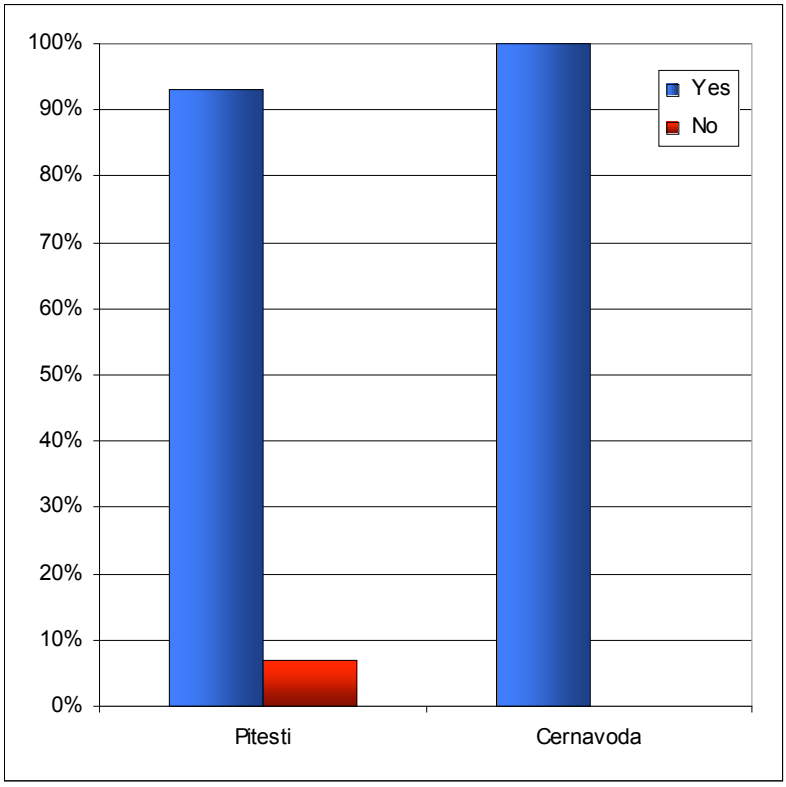


Fig.3.1.9 Radioactivity/radiations knowledge

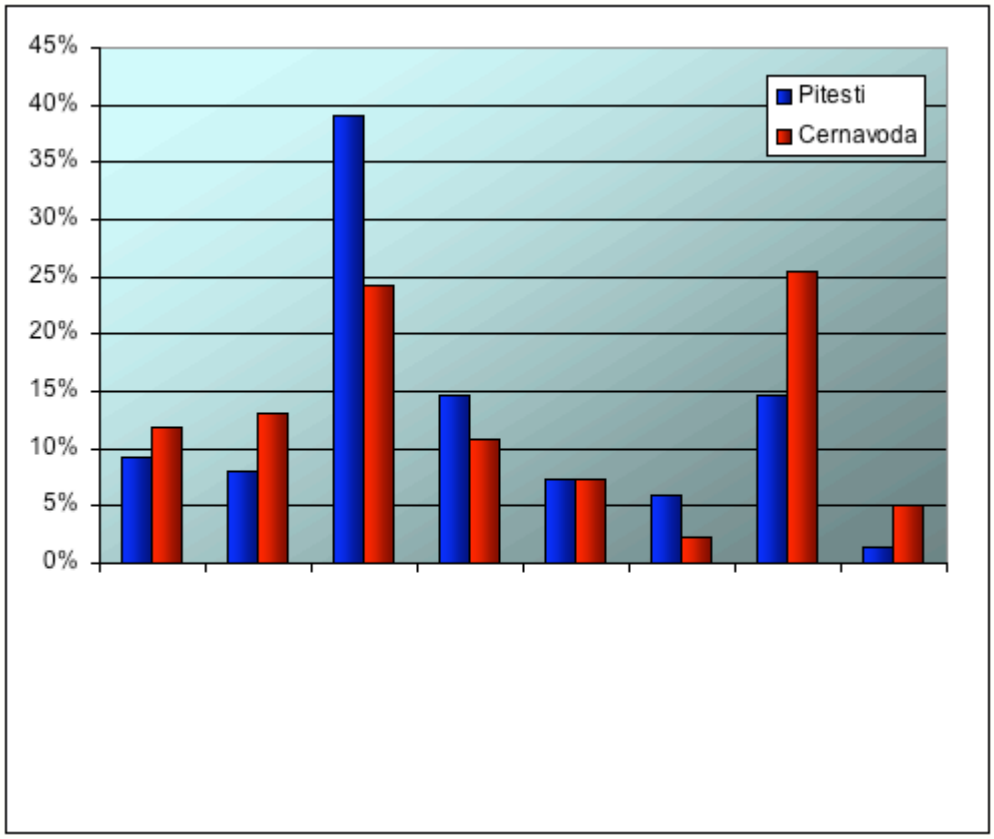


Fig.3.1.10 Source of knowledge for radioactivity/radiations

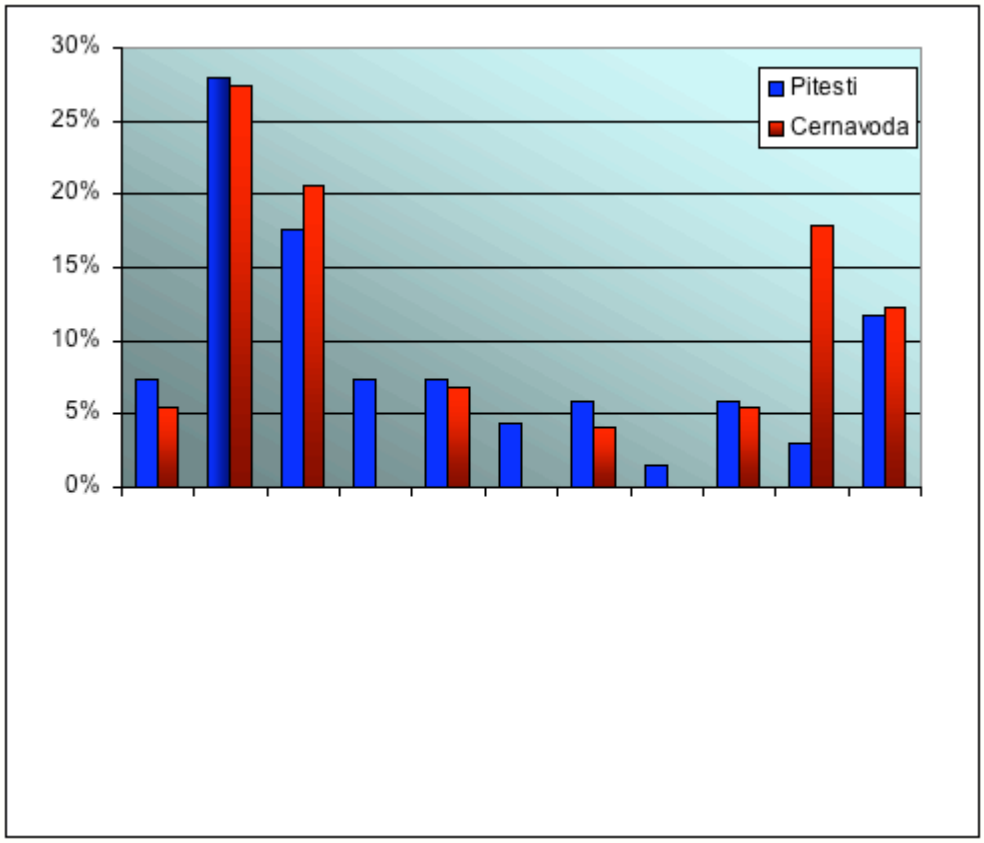


Fig.3.1.11 Radiation/radioactivity perception

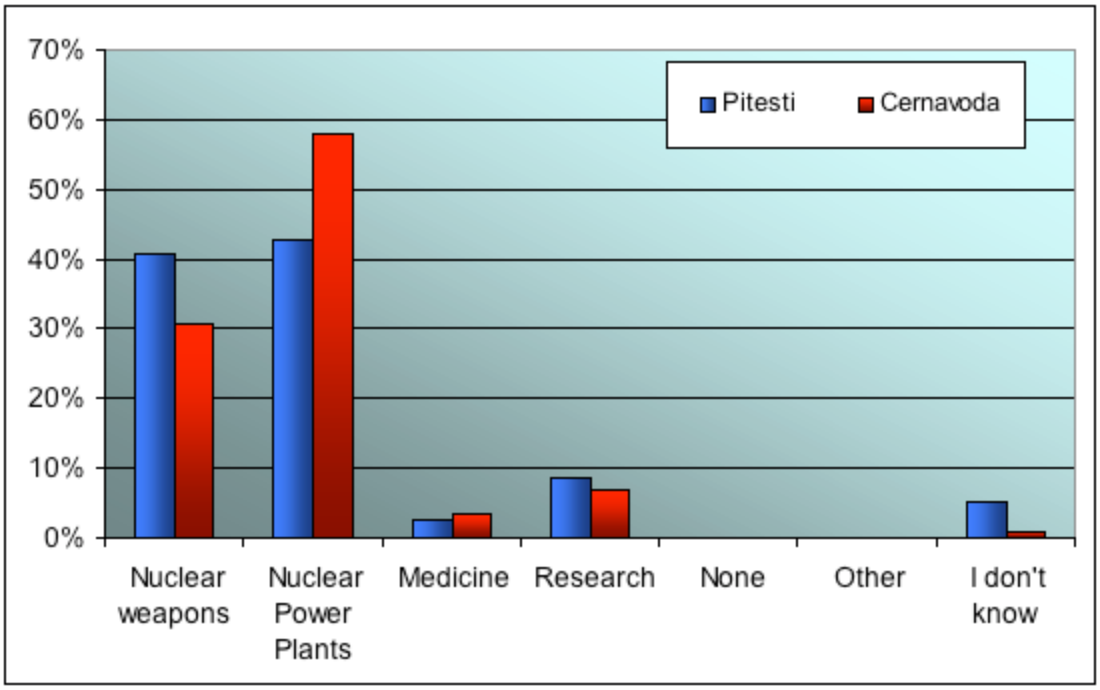


Fig.3.1.12 Sources for radiation/radioactivity releasing

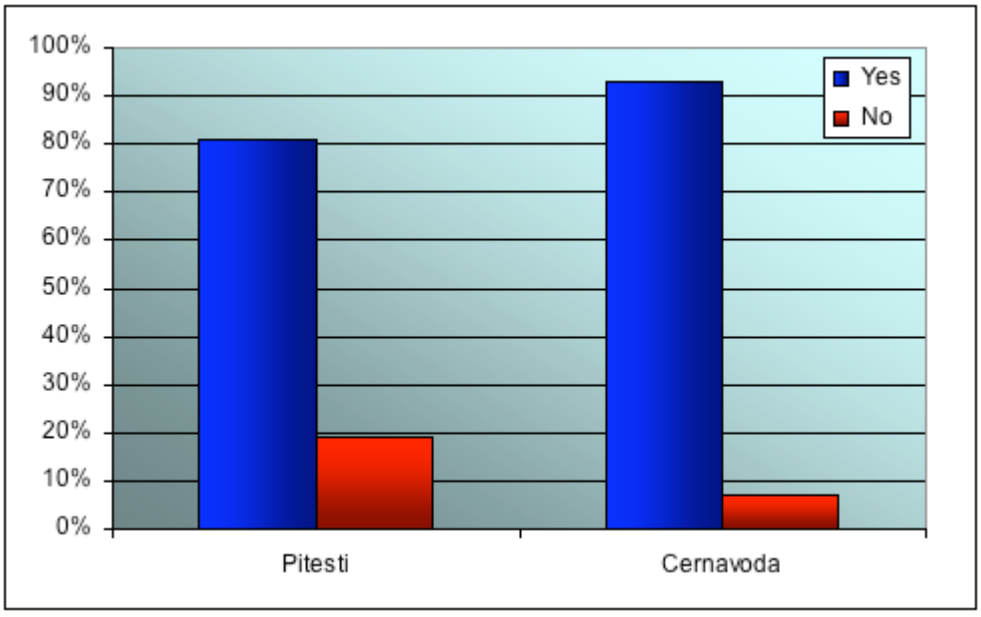


Fig.3.1.13 Radioactive wastes knowledge

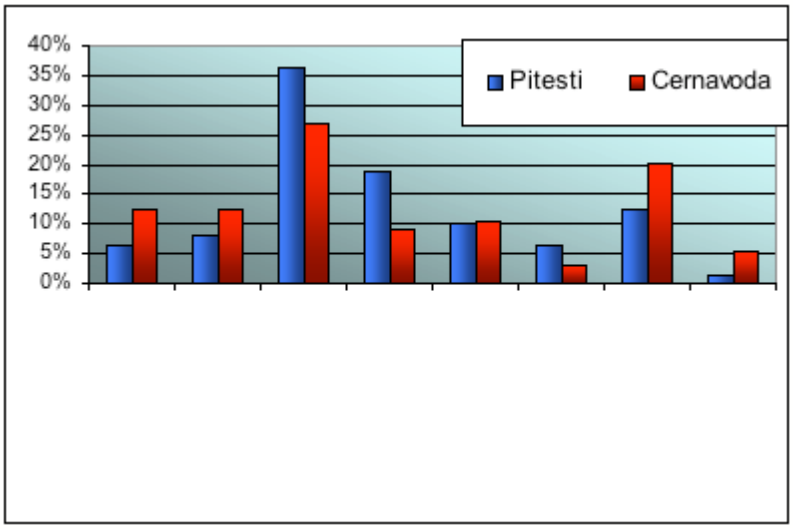


Fig.3.1.14 Sources for radioactive wastes knowledge

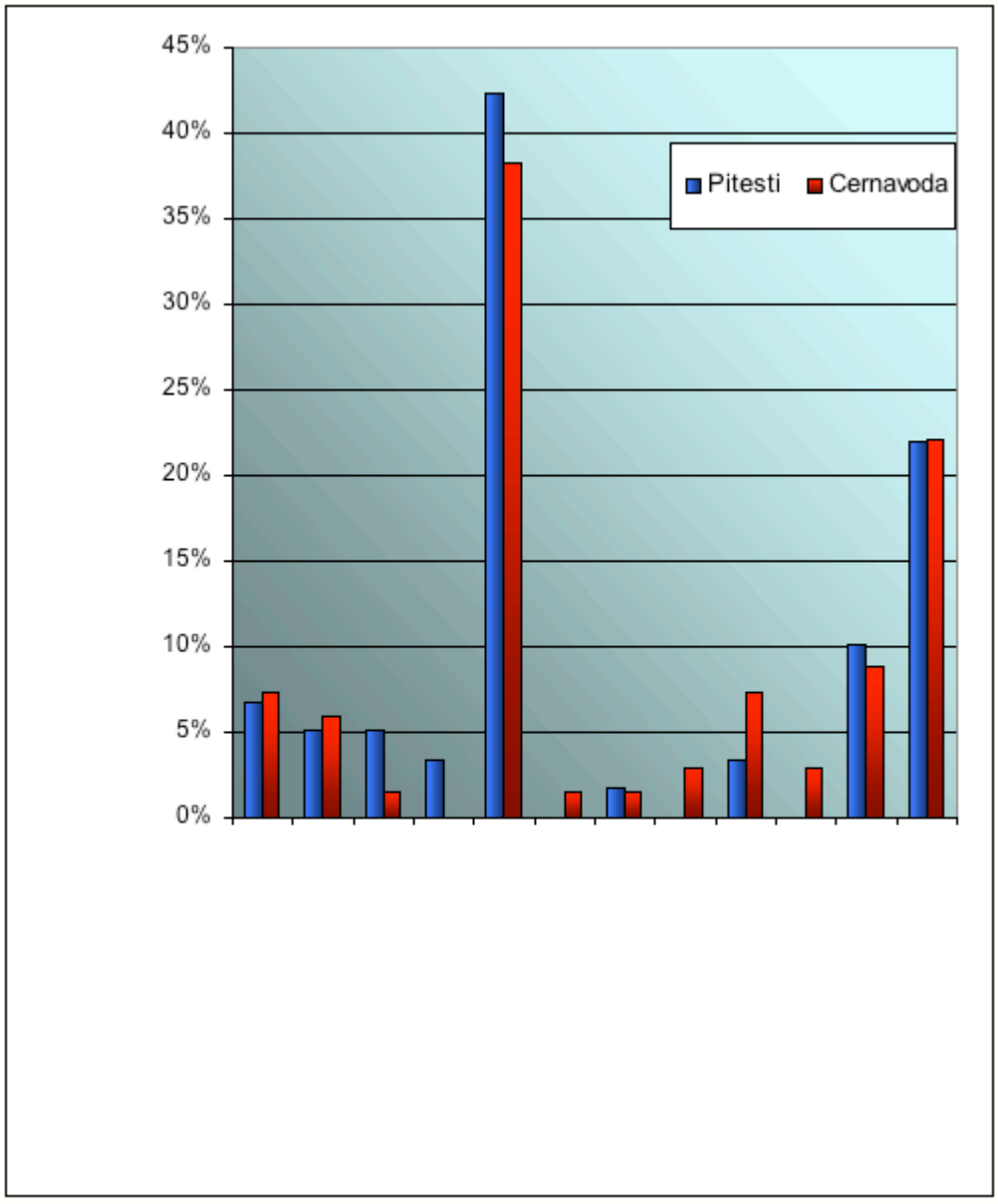


Fig.3.1.15 Main differences between classical and nuclear wastes

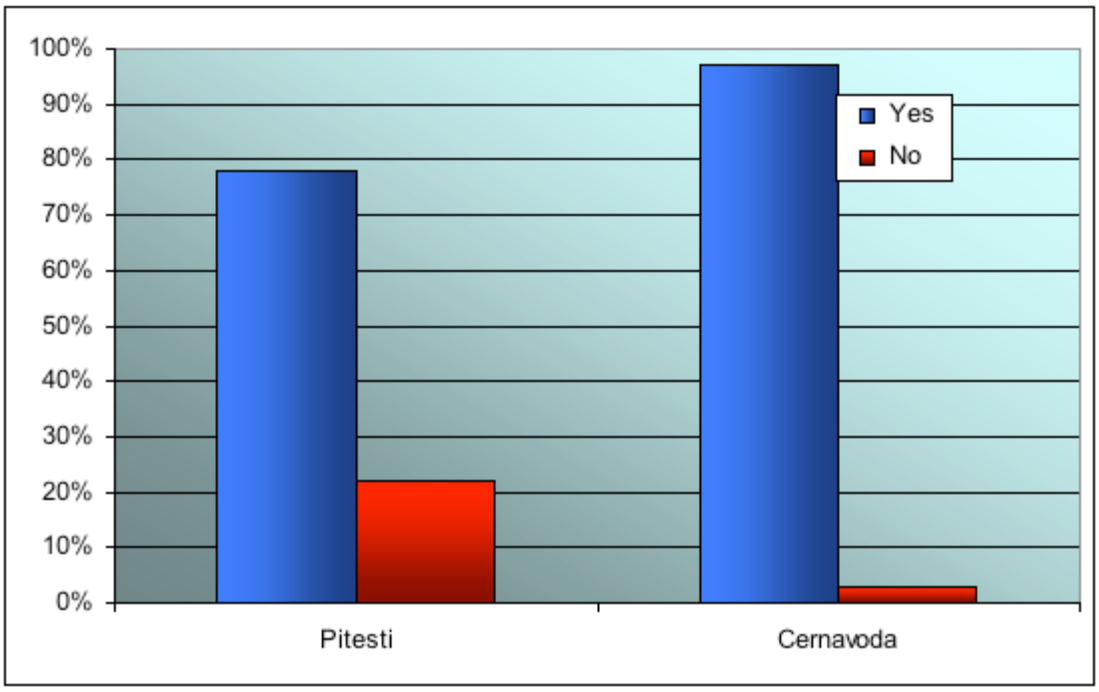


Fig.3.1.16 Knowledge for RW repository

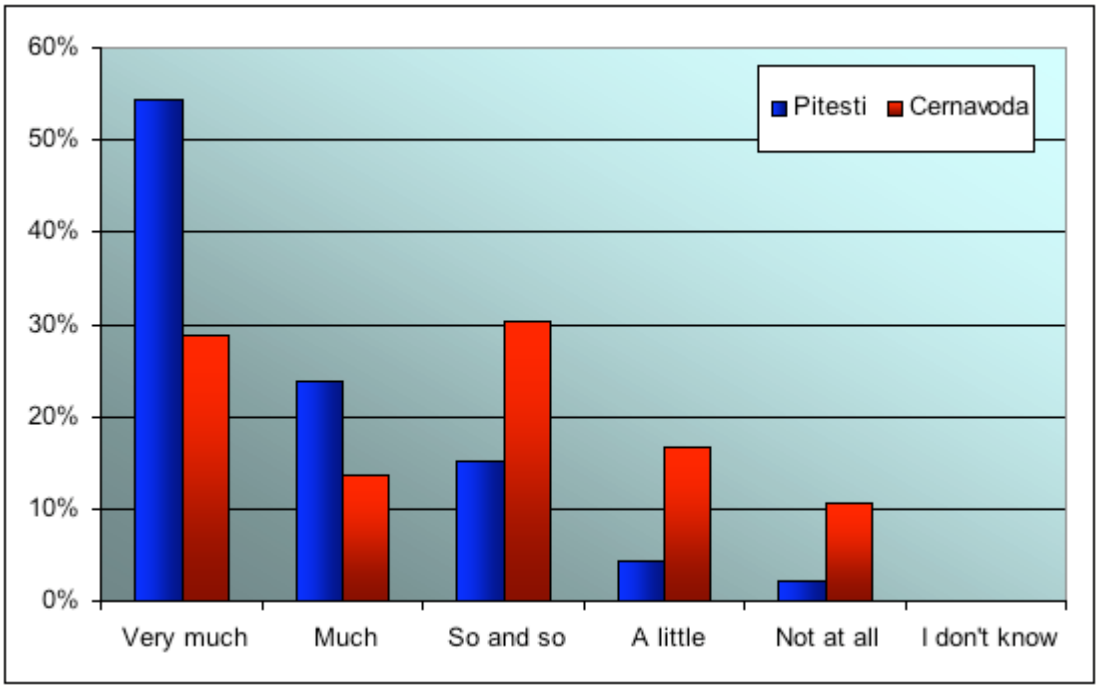


Fig.3.1.17 The worry related to a 'near home' RW repository

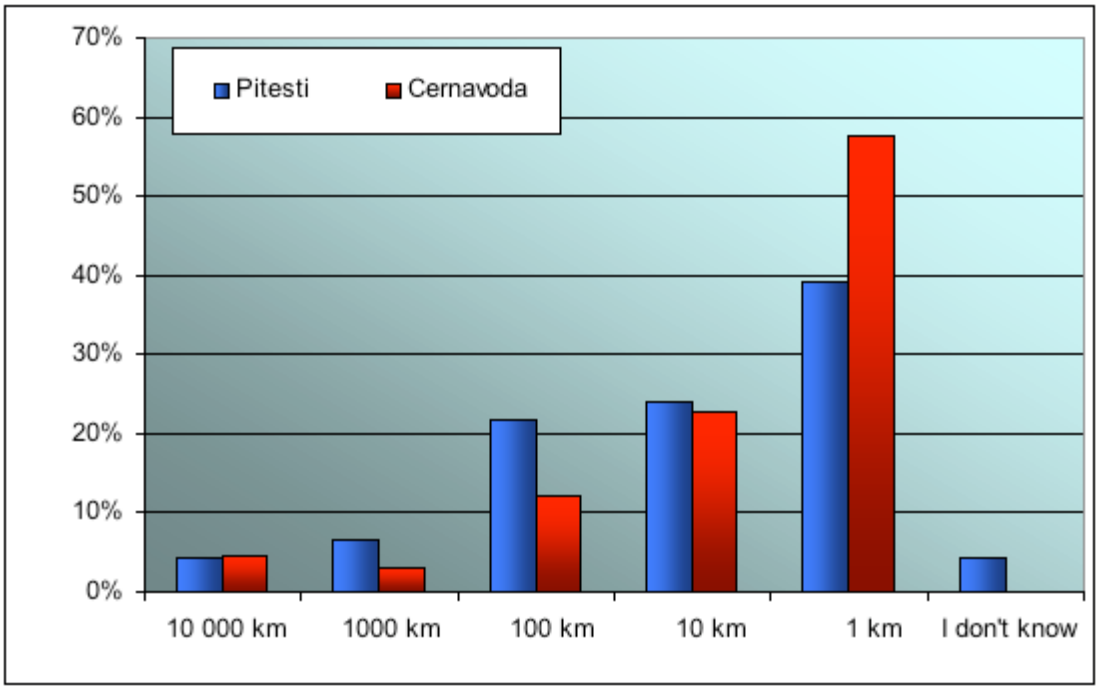


Fig.3.1.18 Distance home-repository from where an effect on inhabitants life occurs

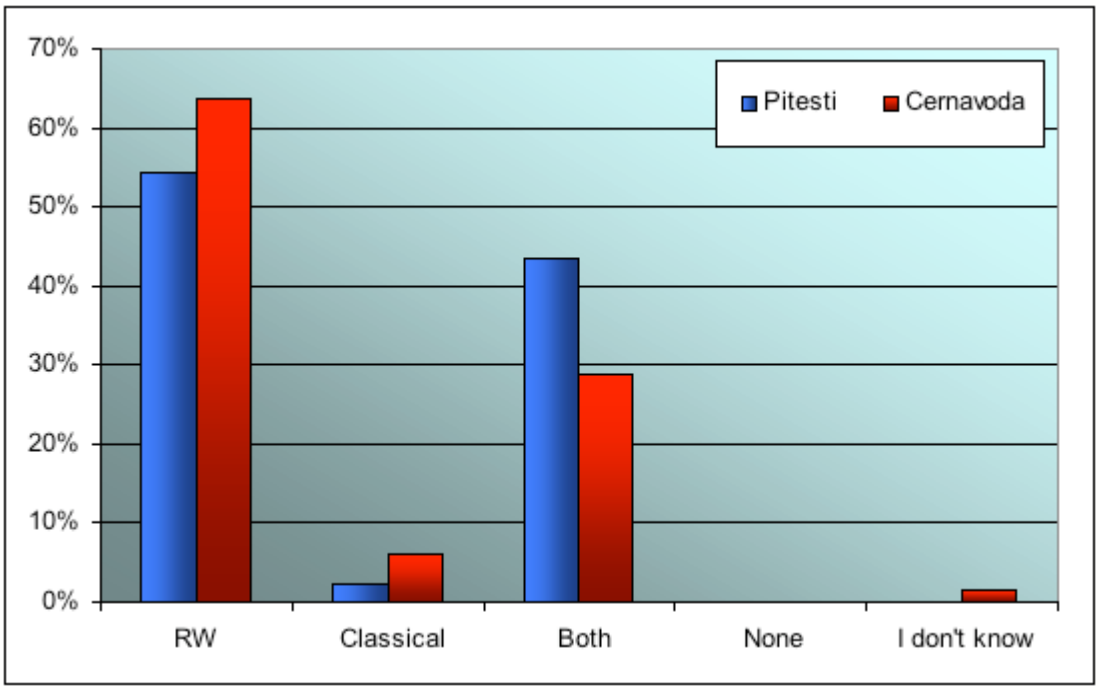


Fig.3.1.19 RW-classical wastes comparison (more dangereous)

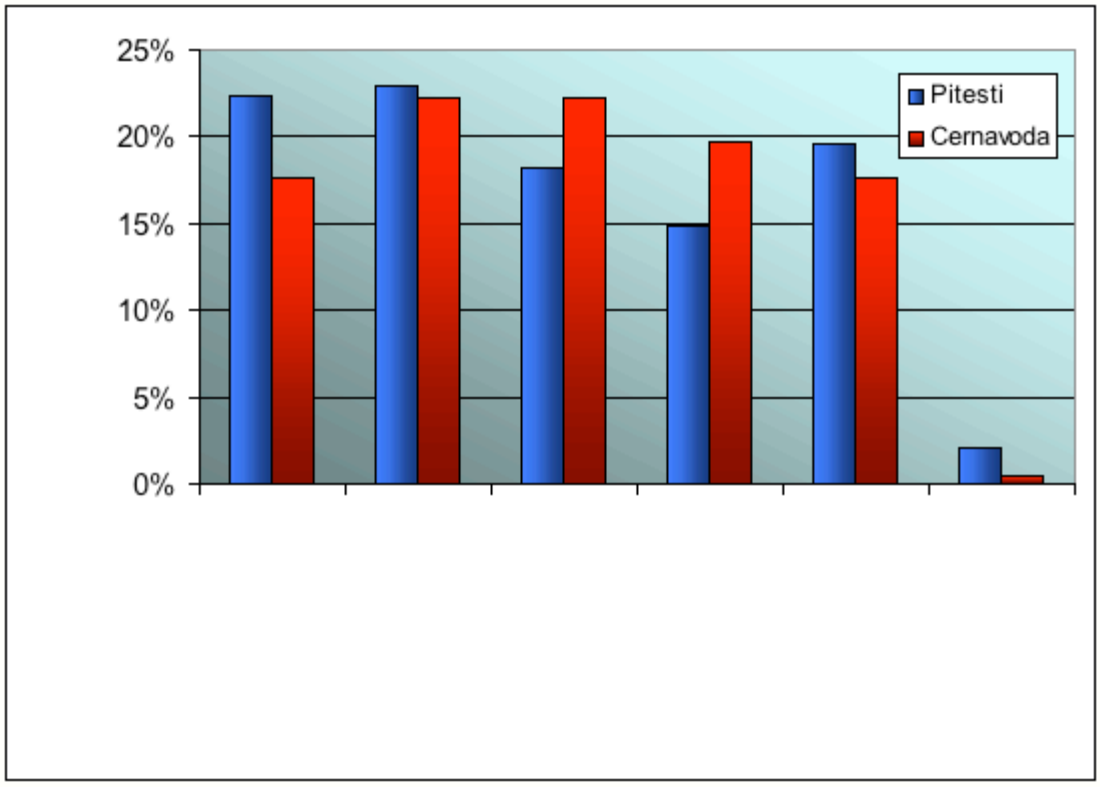


Fig.3.1.20 Importance for different imposed conditions for RW repositories

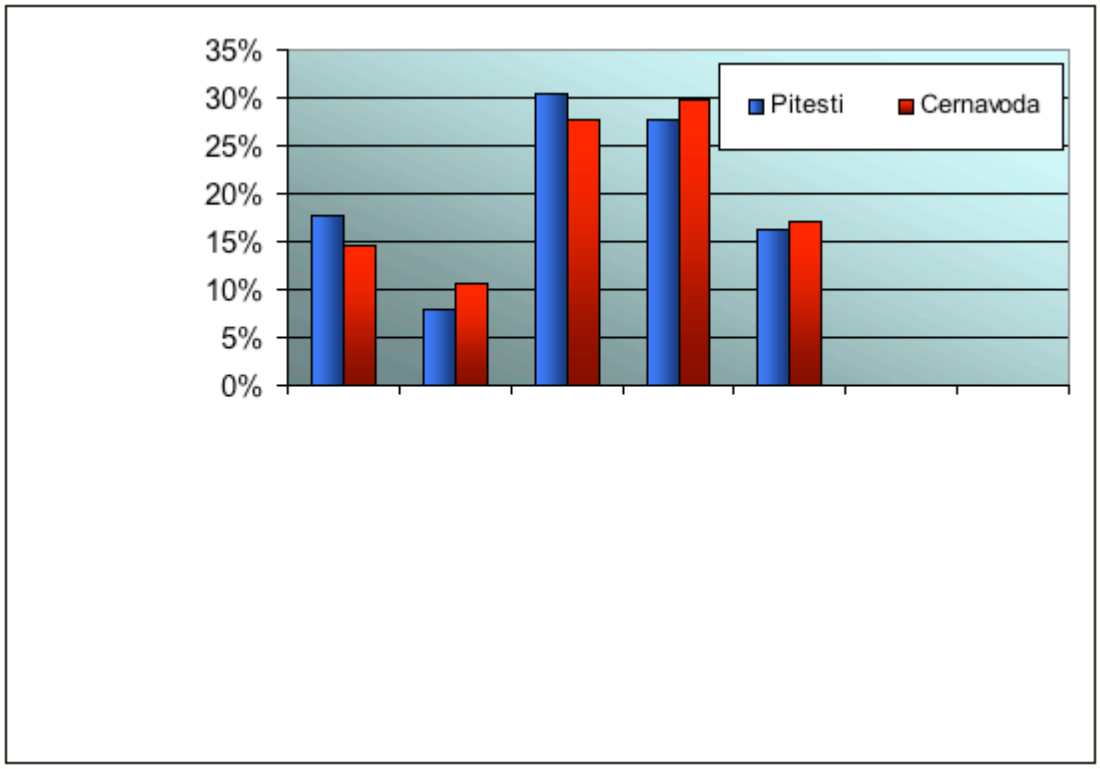


Fig.3.1.21 Dangers associated with NPP

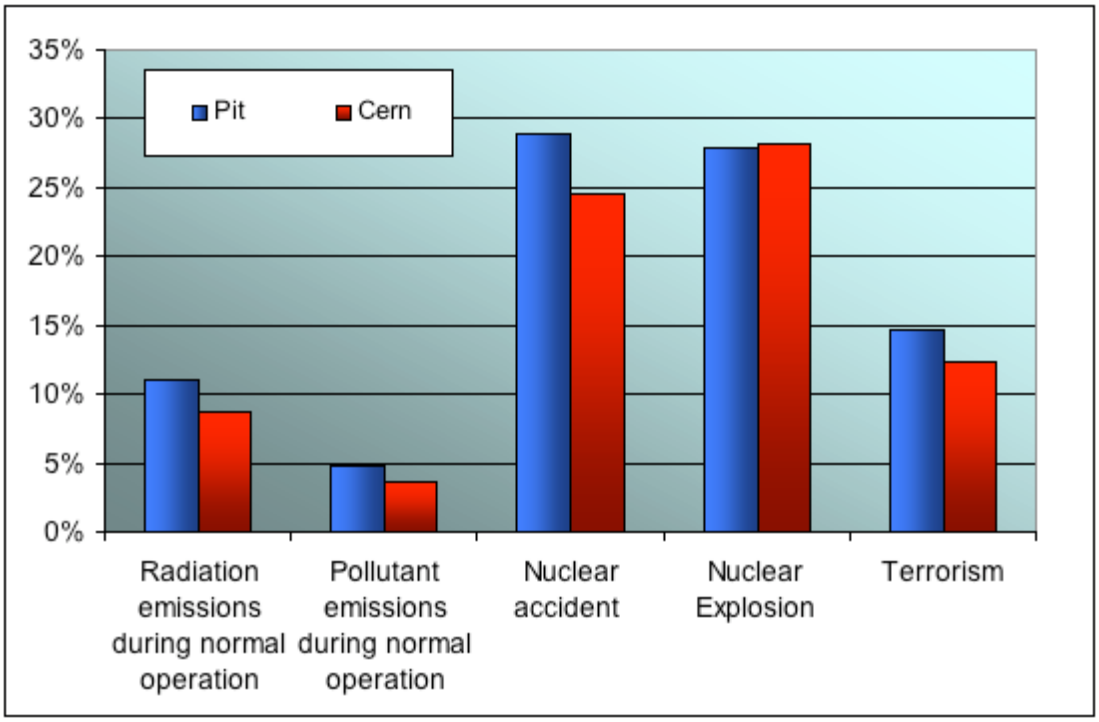


Fig.3.1.22 Severity of dangers associated with NPP (very important & important)

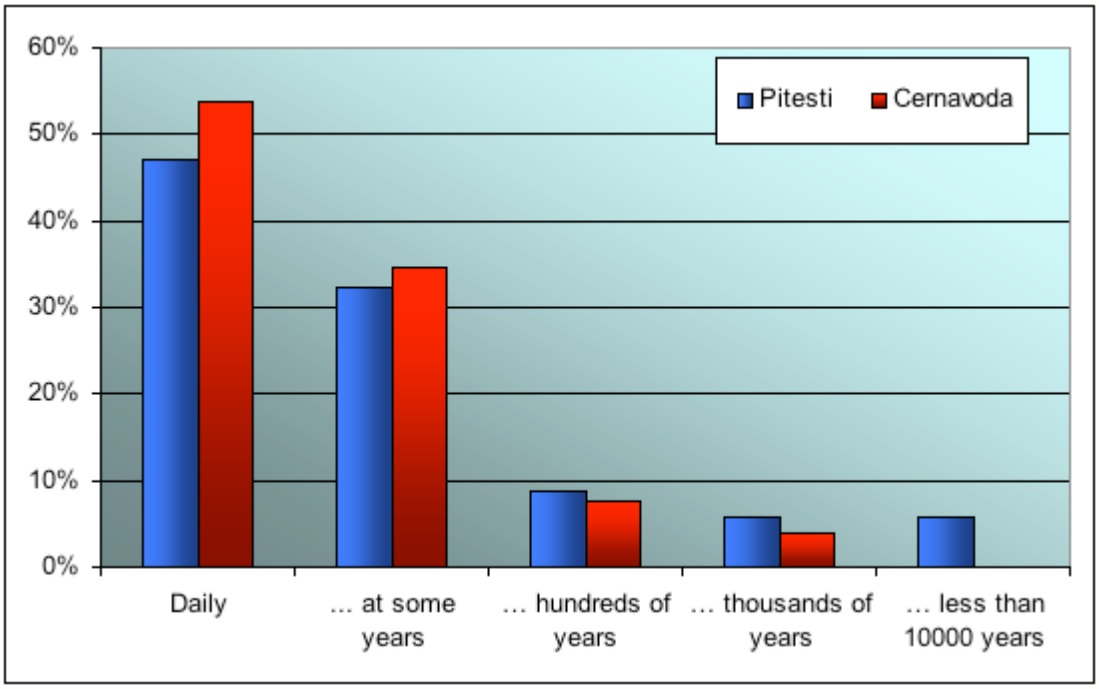


Fig.3.1.23 Perceived frequency for radiation emission during normal operation

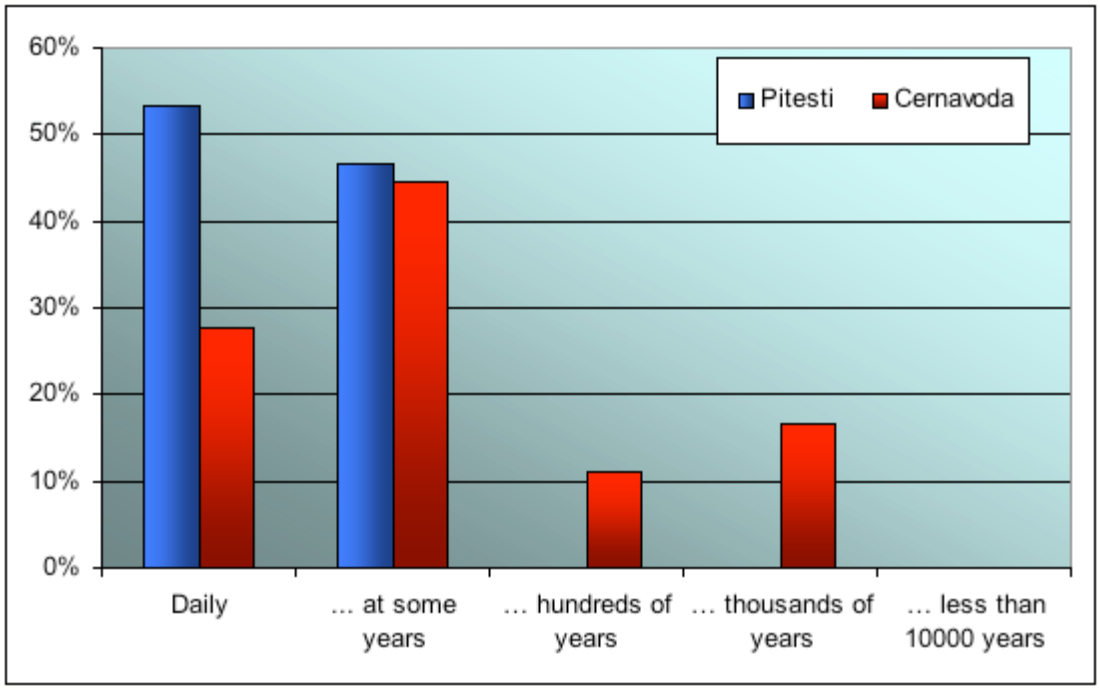


Fig.3.1.24 Perceived frequency for pollutant emission during normal operation

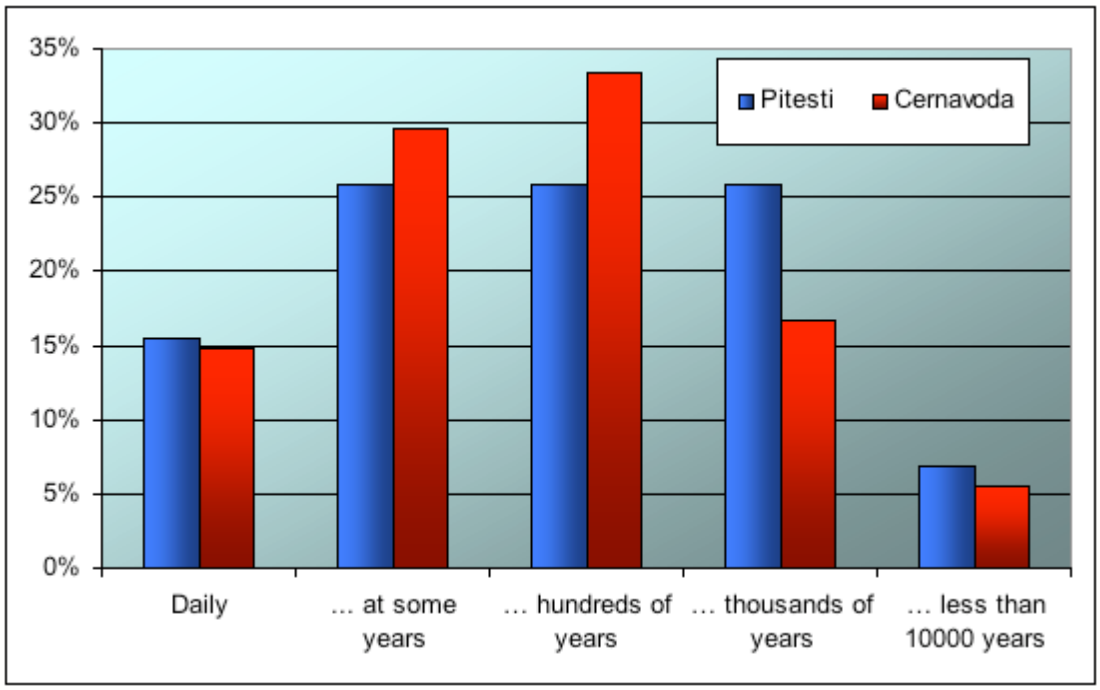


Fig.3.1.25 Perceived frequency for nuclear accident

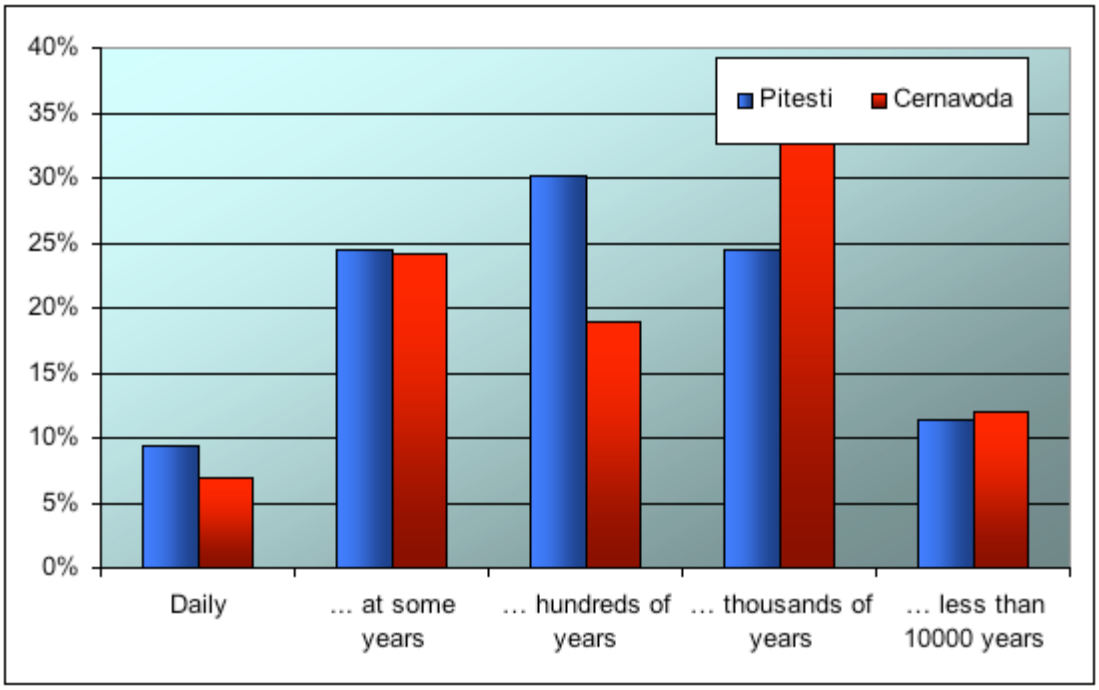


Fig.3.1.26 Perceived frequency for nuclear explosion

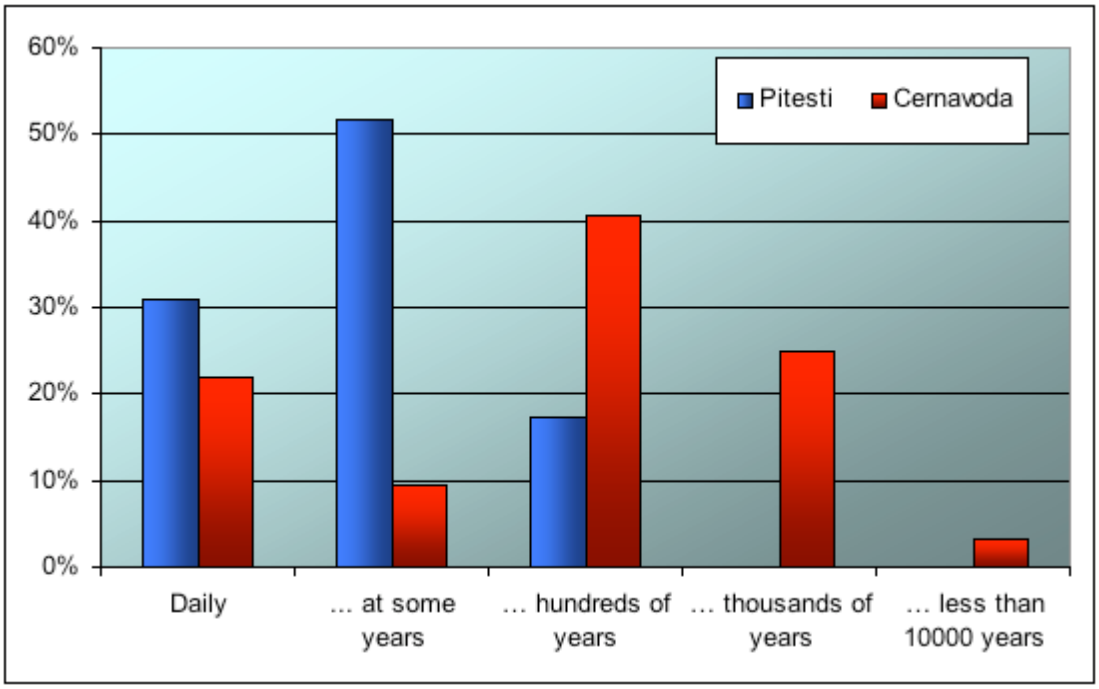


Fig.3.1.27 Perceived frequency for terrorism attack

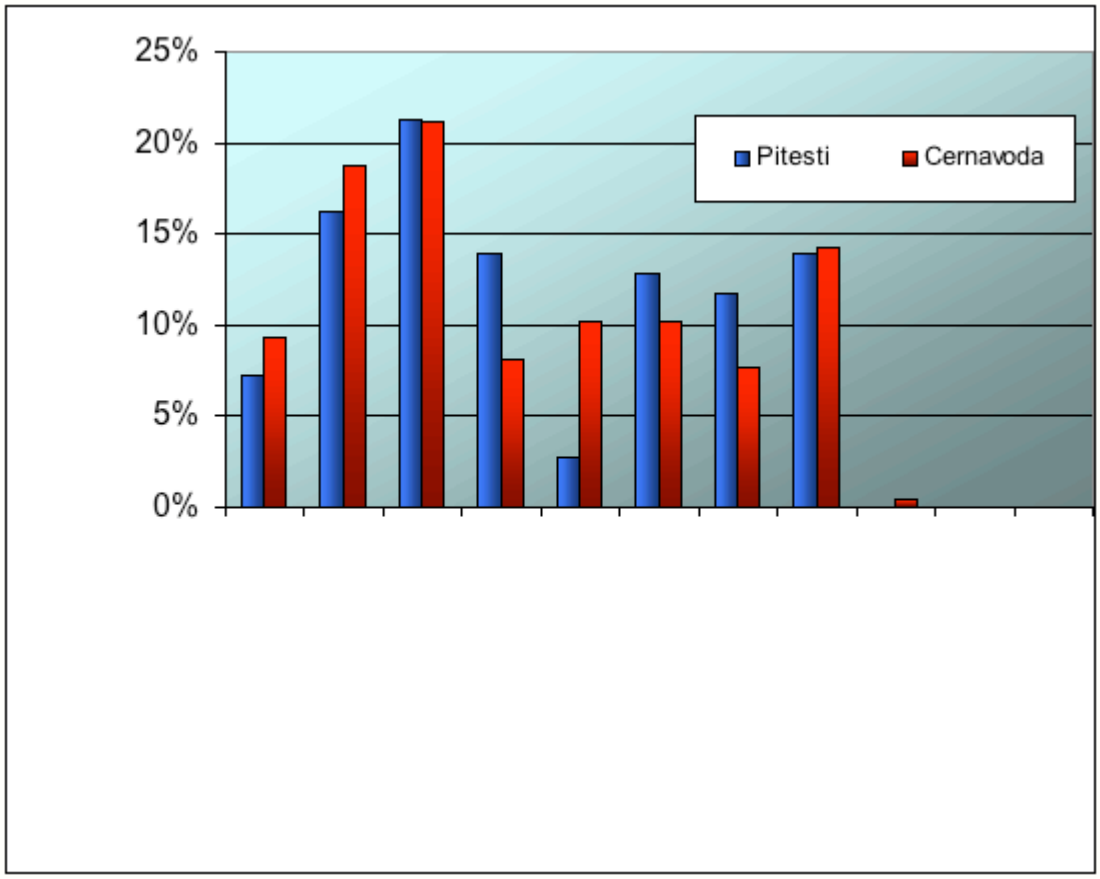


Fig.3.1.28 Dangers for RW repository

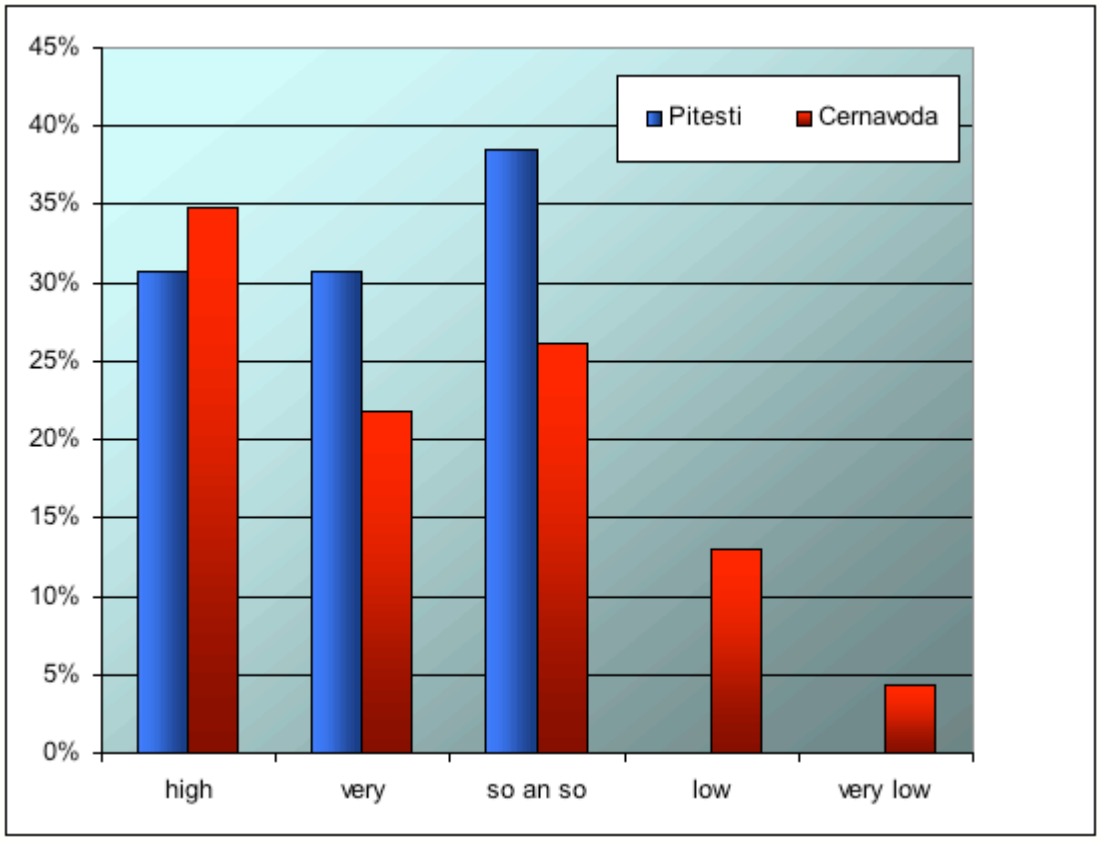


Fig.3.1.29 Radiation and material releasing during operation-perceived severity

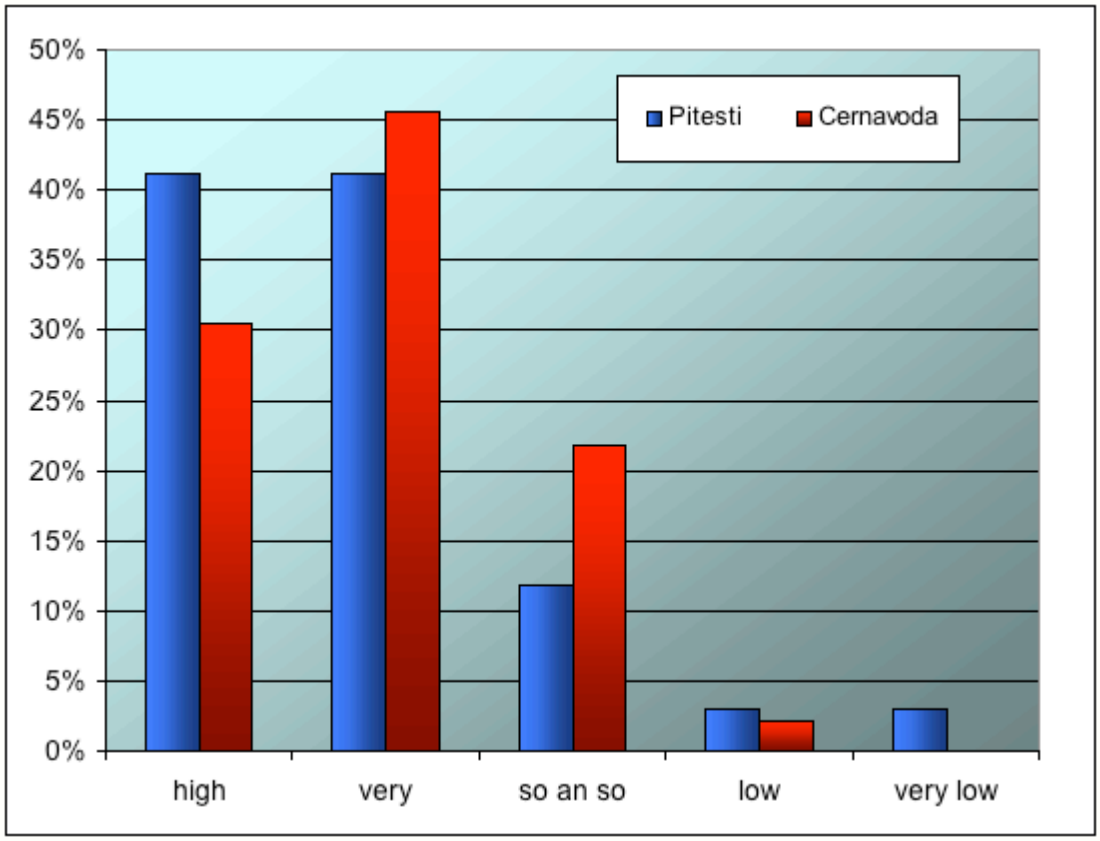


Fig.3.1.30 Water and soil contamination during normal operation-perceived severity

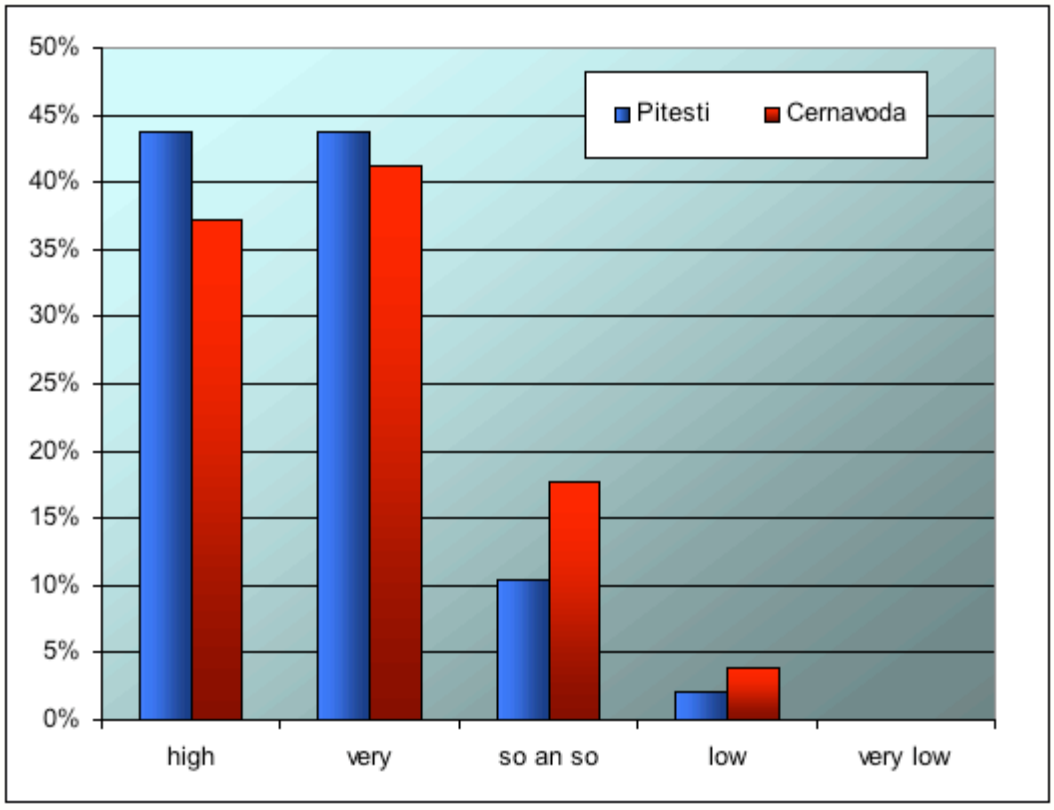


Fig.3.1.31 Water and soil contamination during accidents-perceived severity

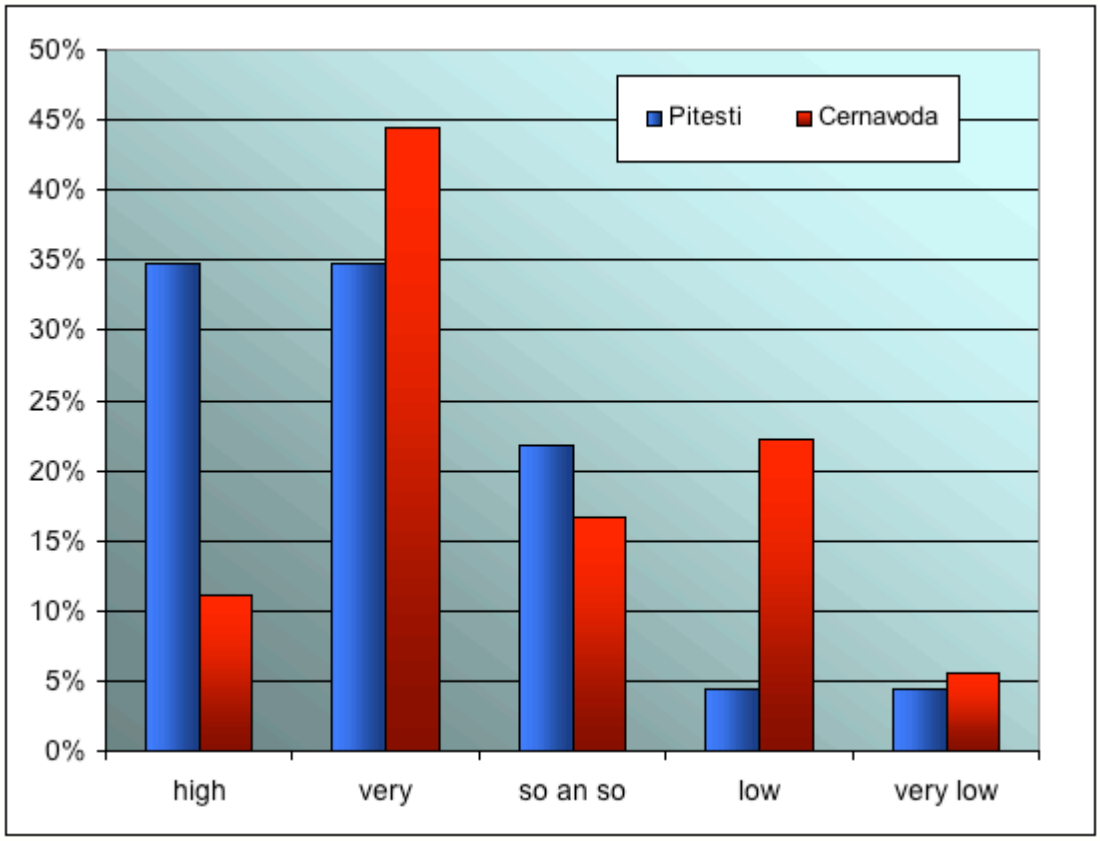


Fig.3.1.32 Water and soil contamination after 100s years-perceived severity

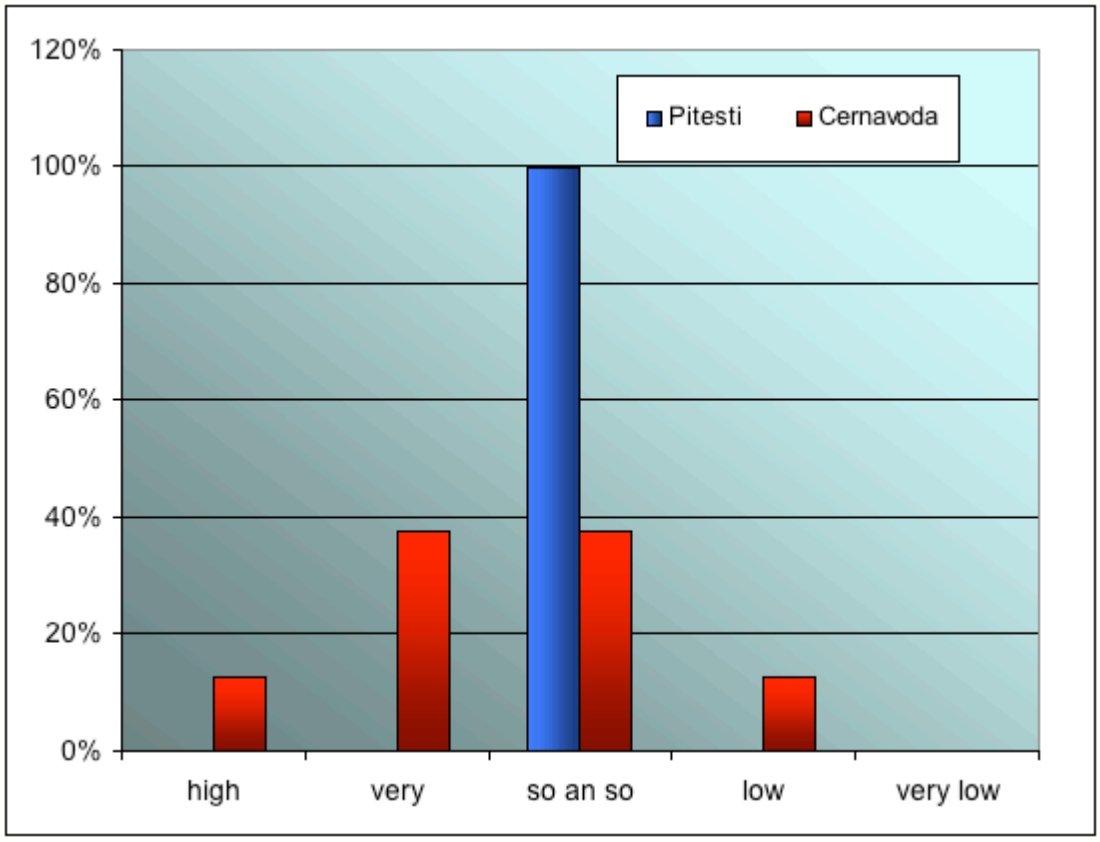


Fig.3.1.33 Pollutant emmisions during normal operation -perceived severity

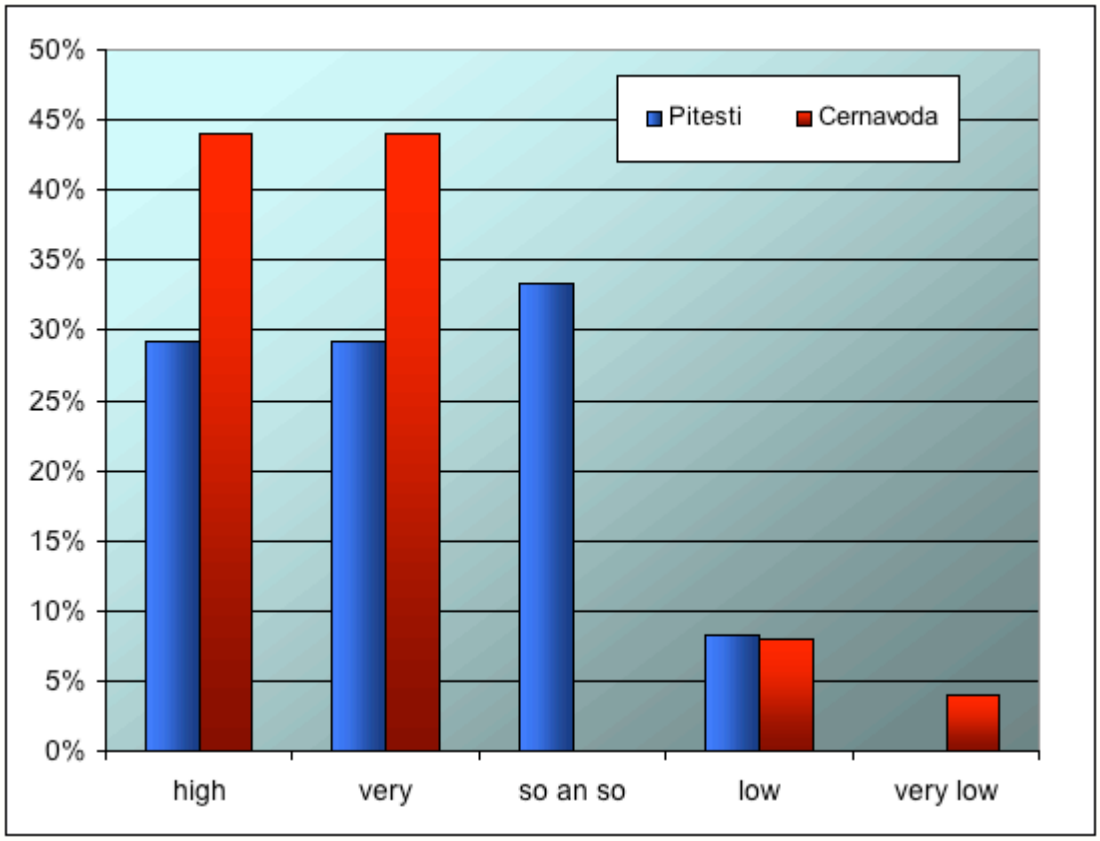


Fig.3.1.34 Human intrusion -perceived severity

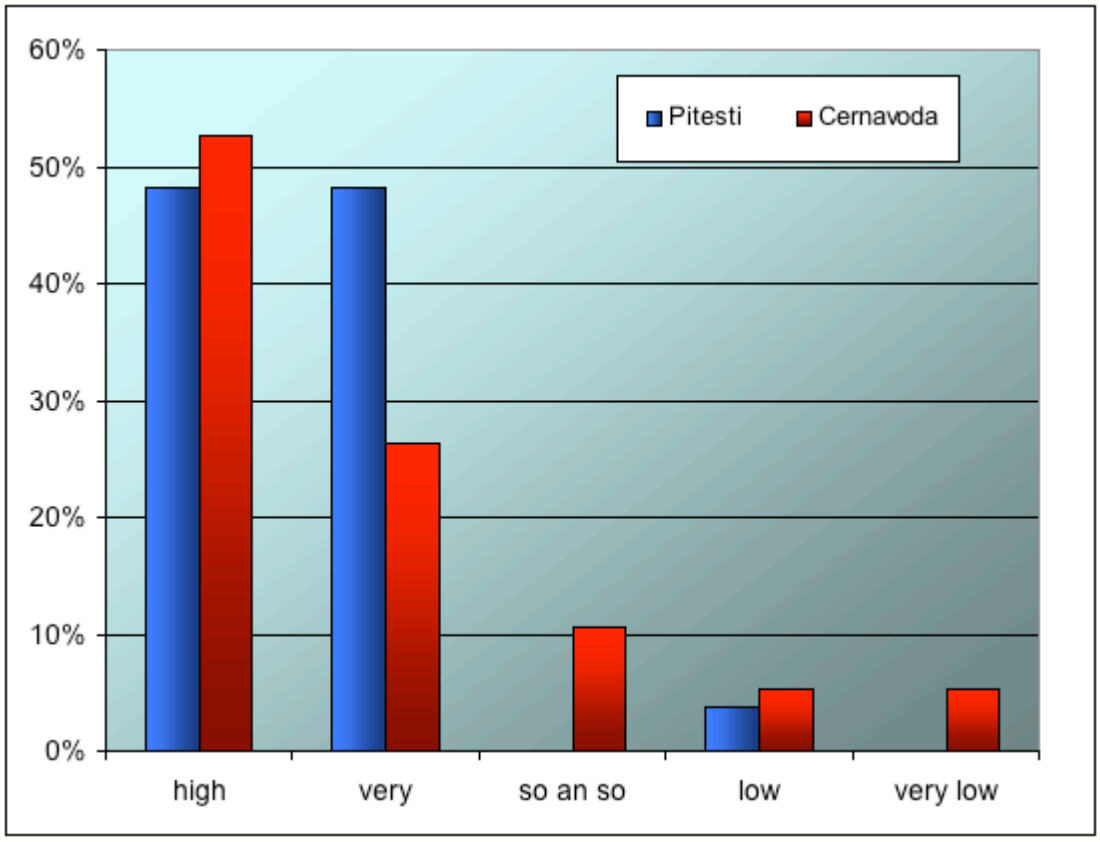


Fig.3.1.35 Terrorism -perceived severity

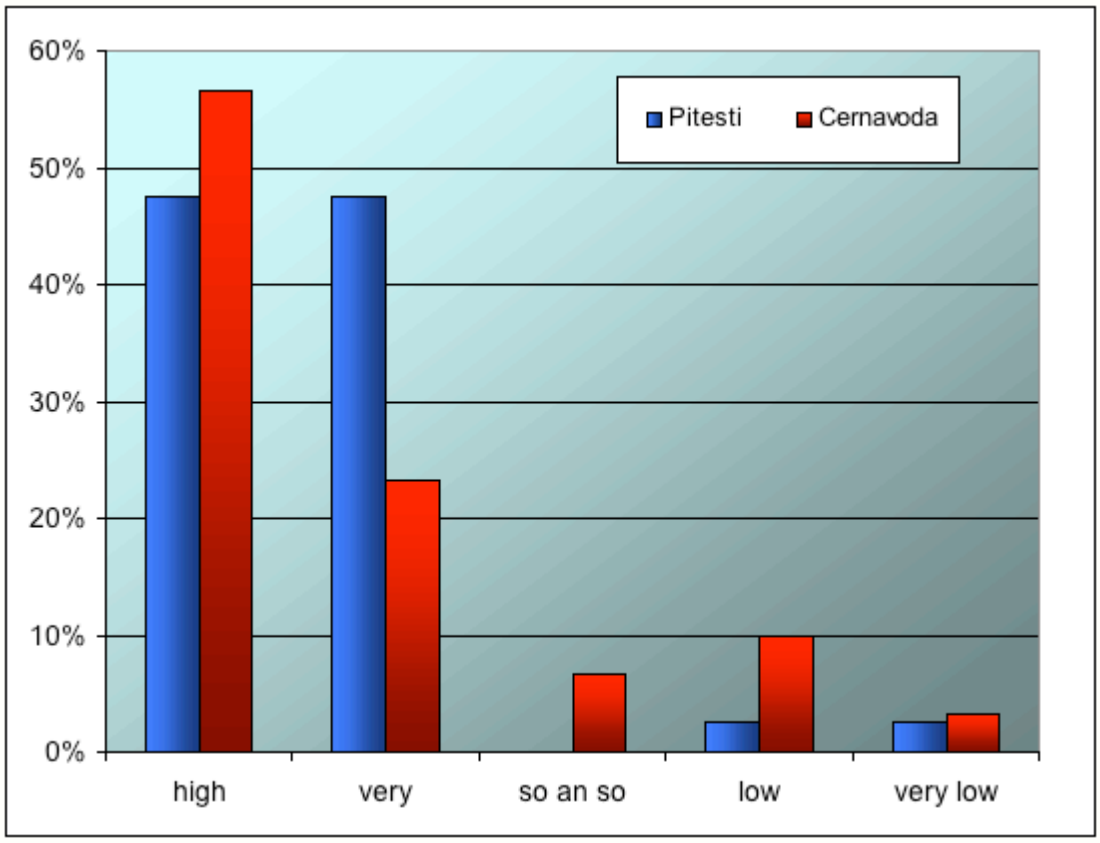


Fig.3.1.36 Natural hazards -perceived severity

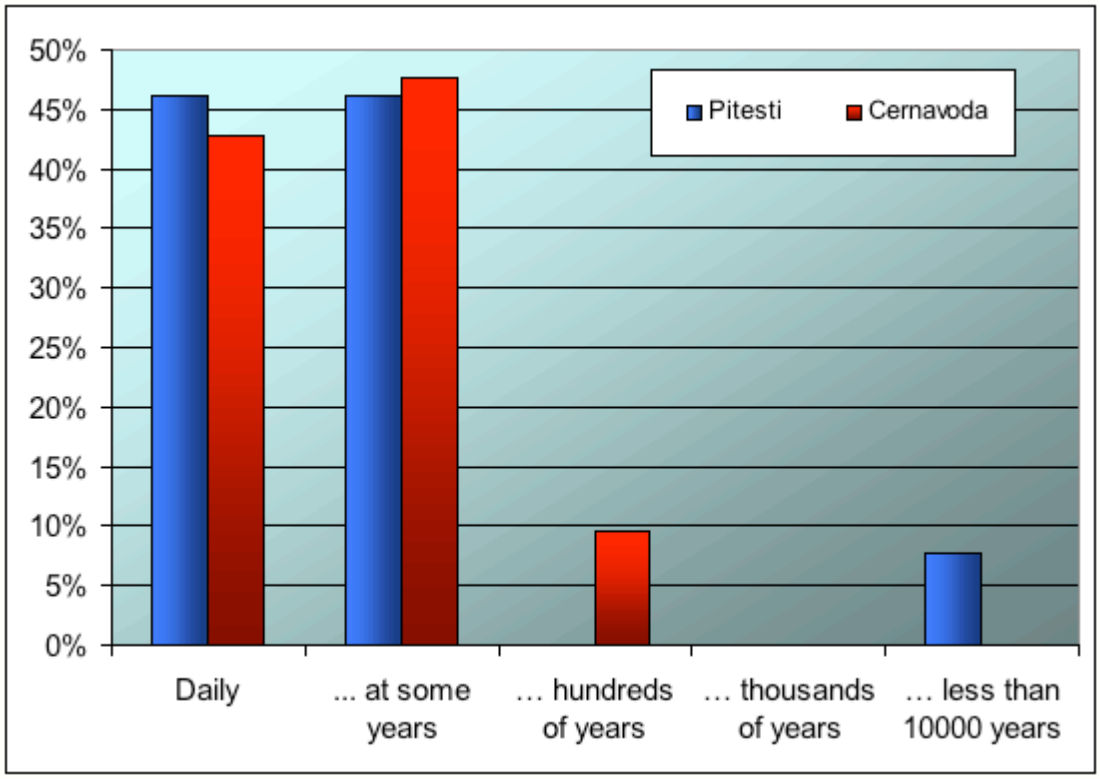


Fig.3.1.37 Perceived frequency for: Radiation and material releasing during operation

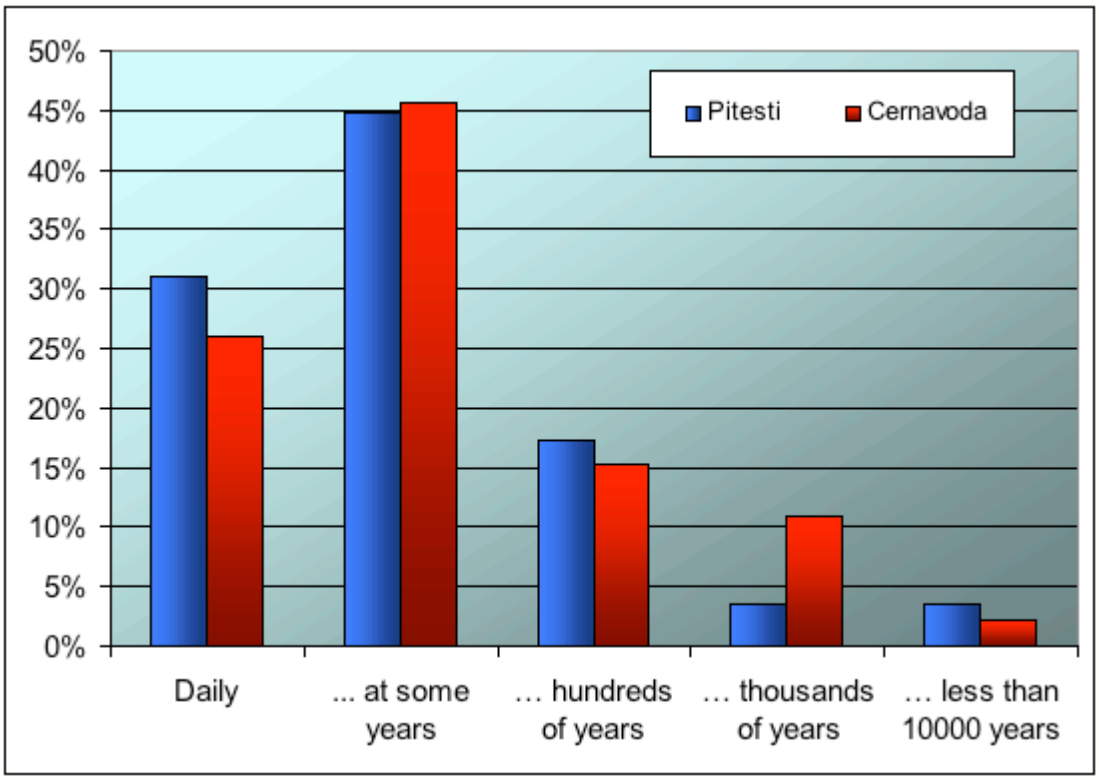


Fig.3.1.37 Perceived frequency for: Water and soil contamination during normal operation

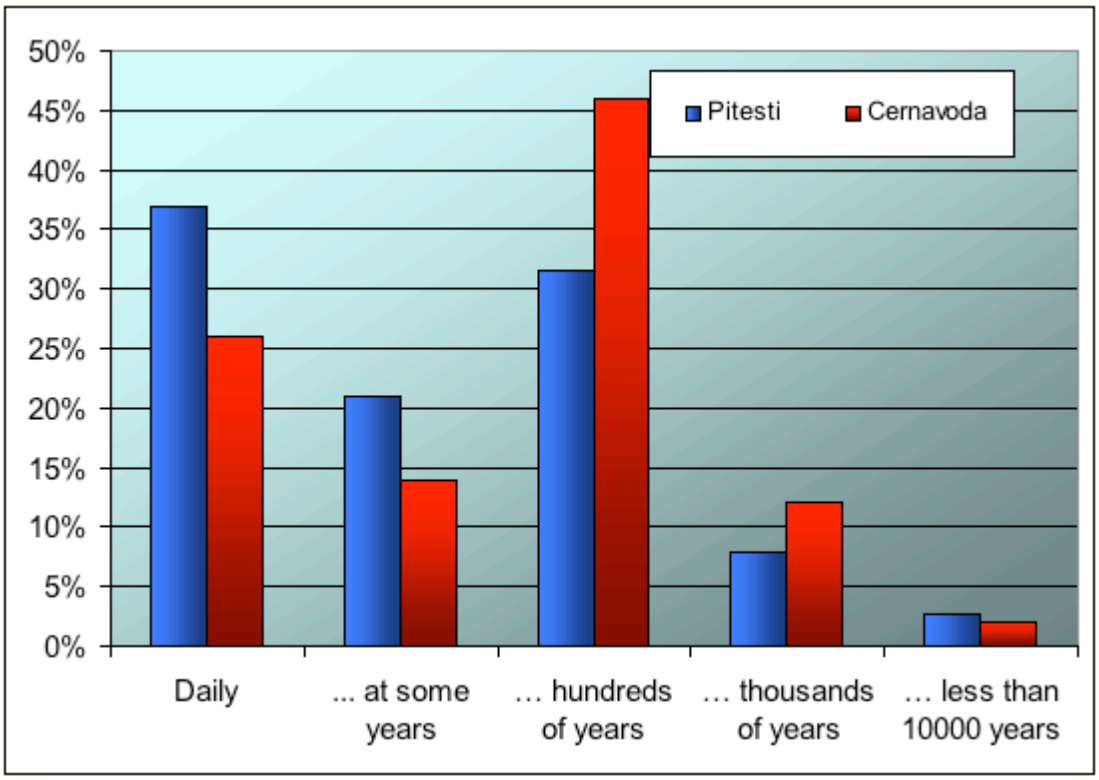


Fig.3.1.38 Perceived frequency for: Water and soil contamination during accidents

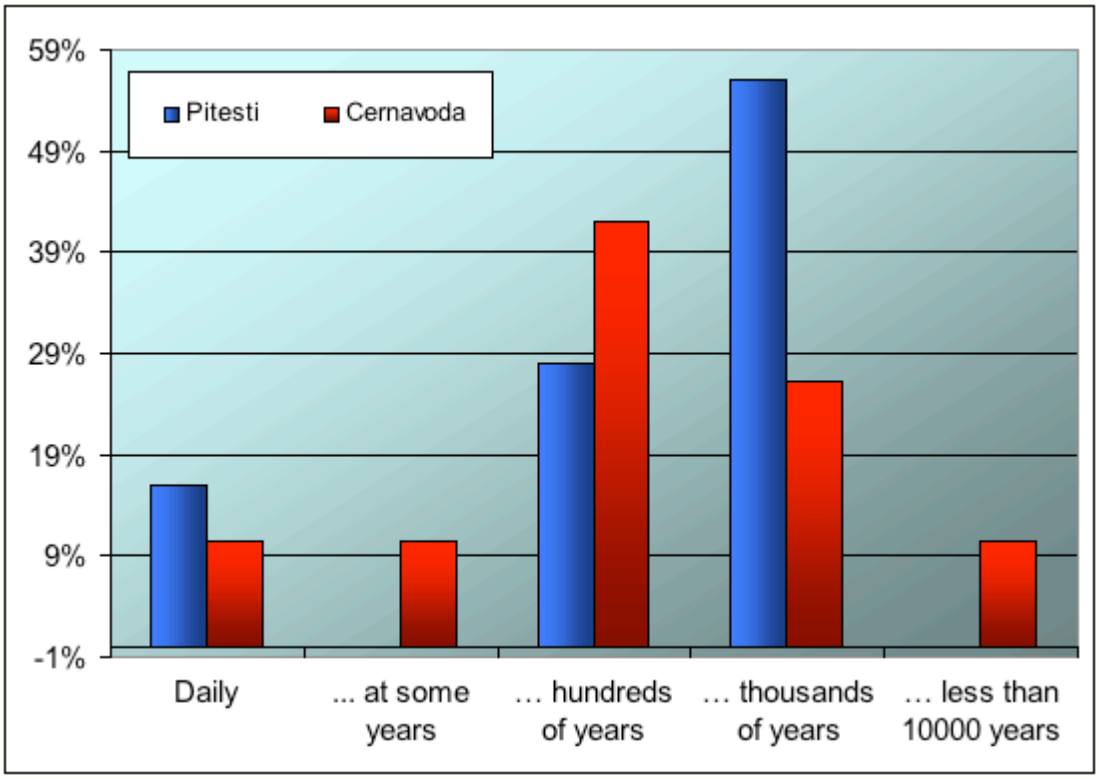


Fig.3.1.39 Perceived frequency for: Water and soil contamination after 1000s years

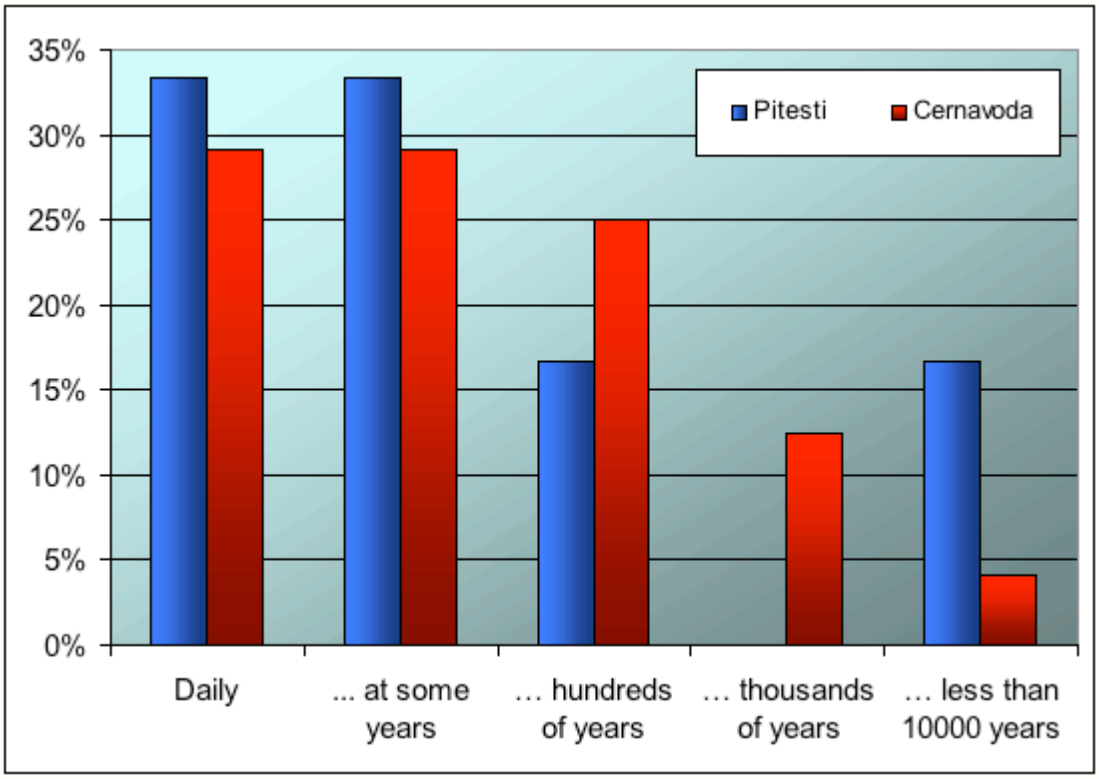


Fig.3.1.40 Perceived frequency for: other pollutant released in normal operation

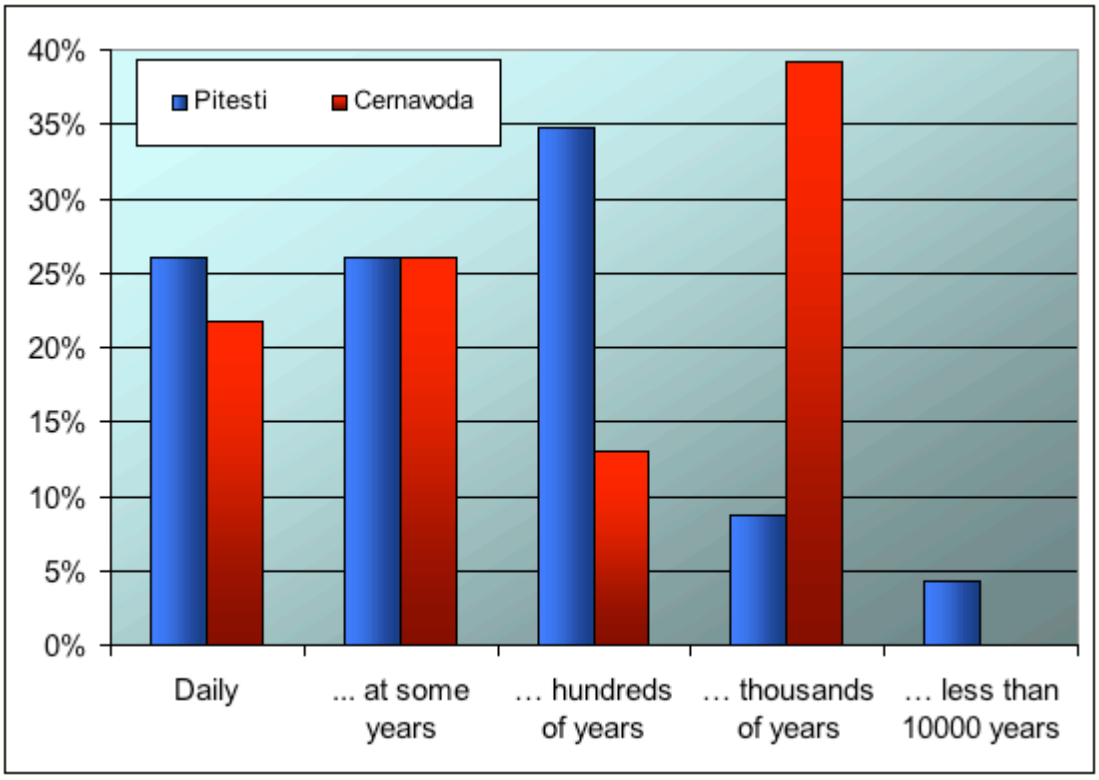


Fig.3.1.41 Perceived frequency for: Human or animal intrusion

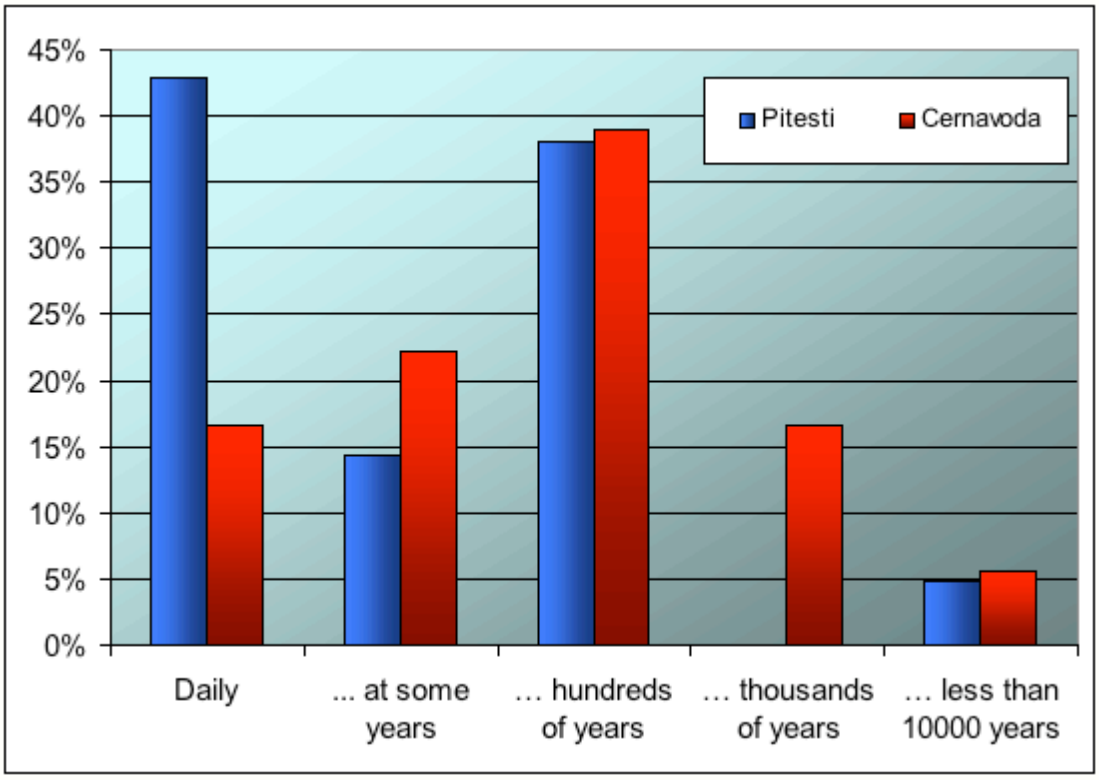


Fig.3.1.42 Perceived frequency for: Terrorism

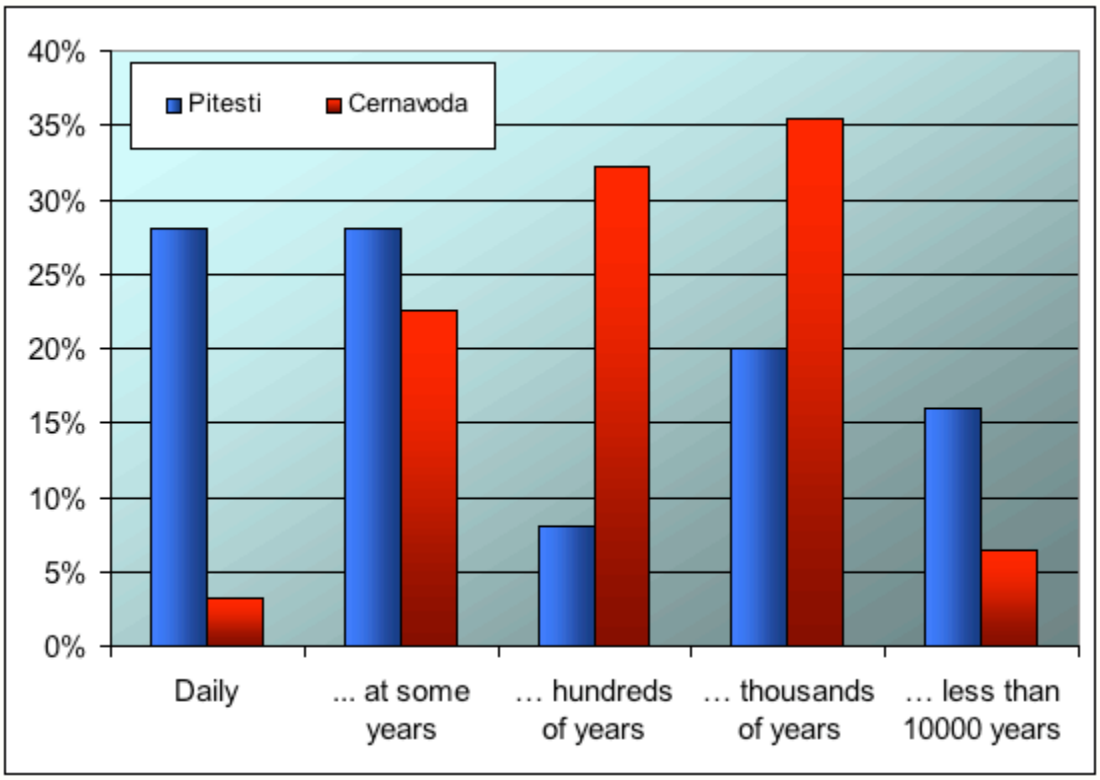


Fig.3.1.43 Perceived frequency for: Natural hazards

(D)-Demographics

Our investigation was focused on:
(D1)- Gender
(D2)-Birthday year
(D3)-Number of family members
(D4)-Mother's profession
(D5)-Father's profession
The main results are presented in figures 3.1.44 (D1), 3.1.45 (D3) , 3.1.46 (D4) , 3.1.47 (D5).

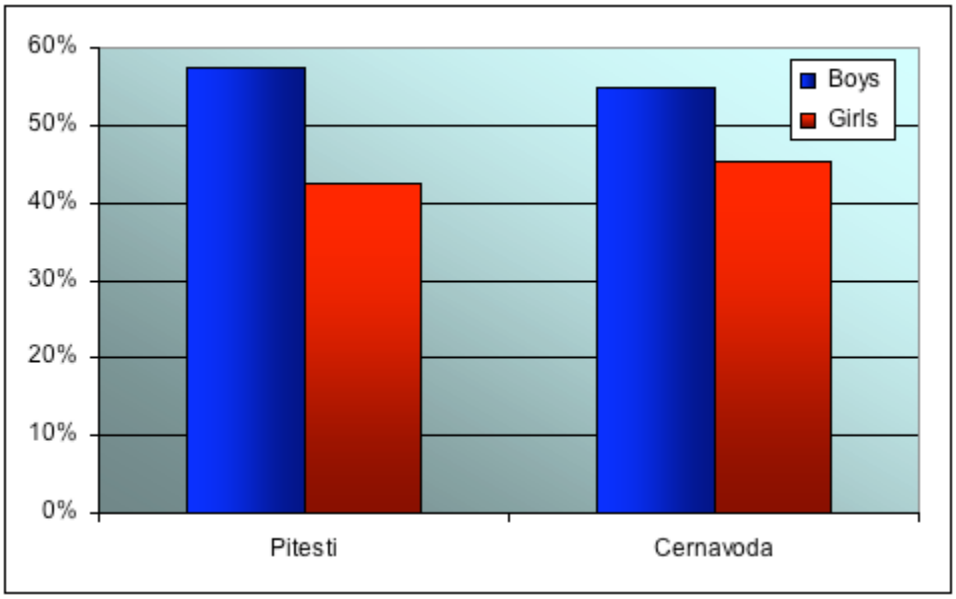


Fig.3.1.44 Structures of the groups

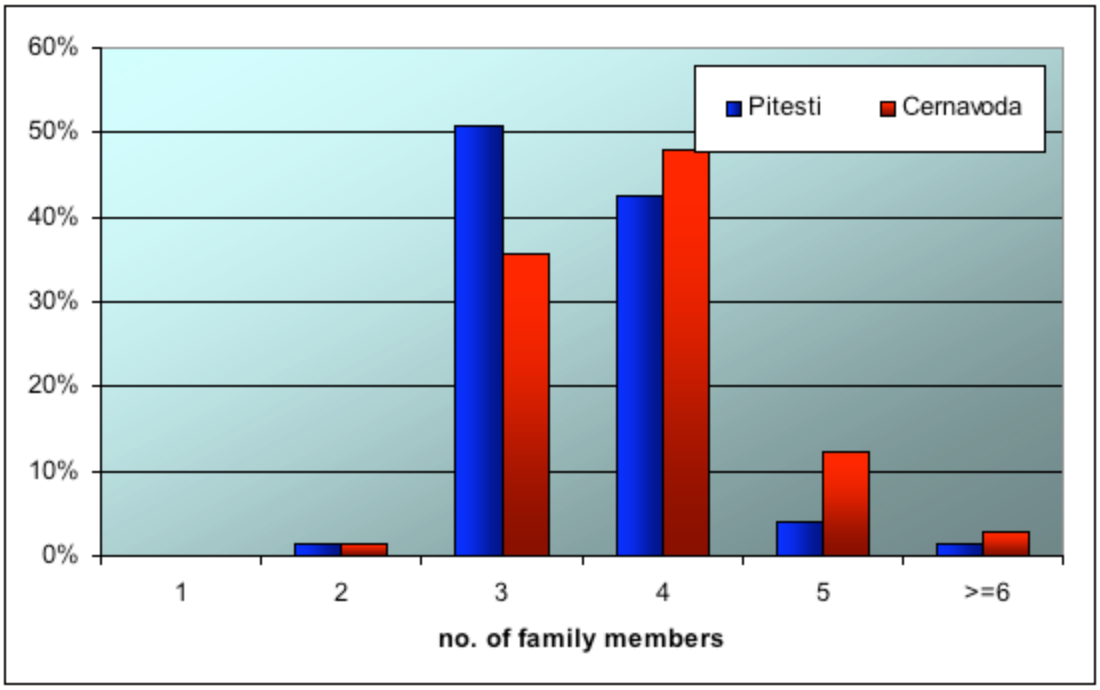


Fig.3.1.45 Structures of the groups- no. of family members of the respondent

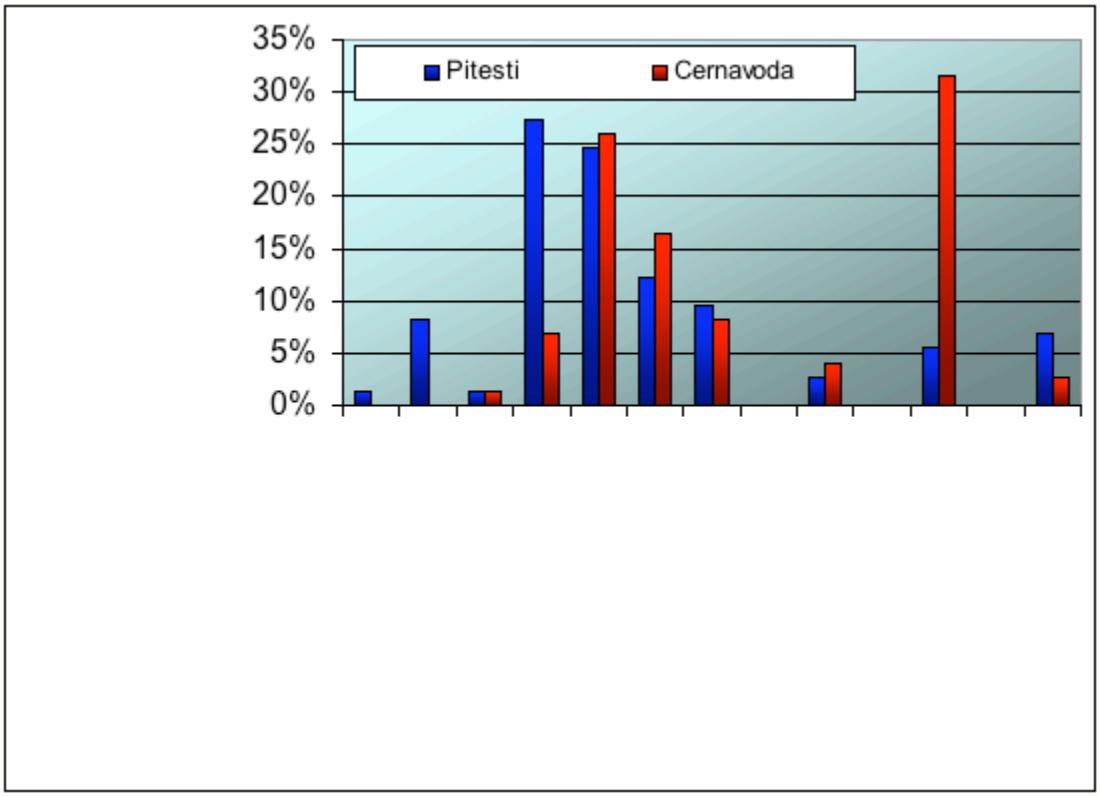


Fig.3.1.46 Structures of the groups- mother's proffesion

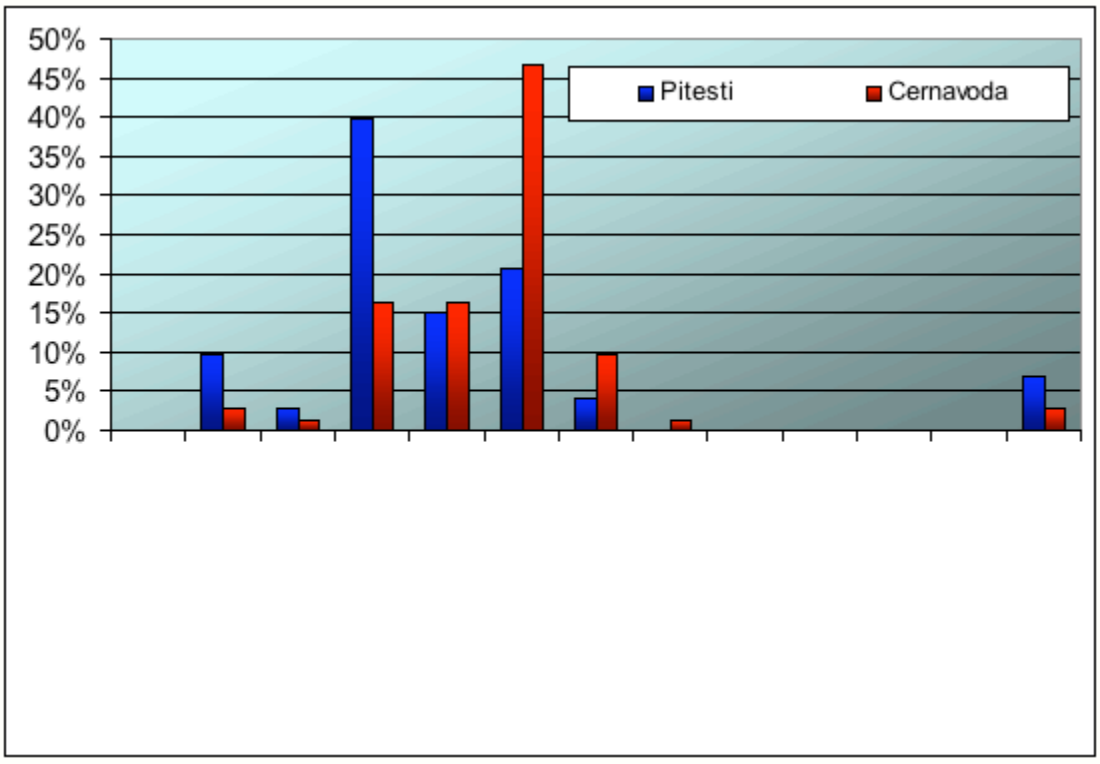


Fig.3.1.47 Structures of the groups- father's proffesion

3.2 Conclusions of reference measurement

(1) The children answers are similar with the answers of a population of adults. The main motivation for this situation are connected with the sources of the information (the family and the media play an important role).

(2) The answers for opened questions (C3, C7) proofs a fairly knowledge about radiation and RW.

(3) An important number of children are confused related to different alternative of electric power (existing in Romania, pollution comparison, CO2 release). However, the nuclear power and hydro power are very known by the children.

(4) The knowledge of the children reveals the absence of a systematic educational programme in the fields of energies alternatives and environmental impact.

(5) The radioactivity is perceived as an important danger for both groups (more than 50% answered by negative effects).

(6) Generally RW are perceived as more dangerous than Classical Wastes.

(7 The concern about a possible repository placed near the town is important if the distance is lower than 10 km. An important acceptance of the repository is observed in Cernavoda, despite the perception of the risk is higher than in Pitesti.

(8) The most important conditions for a RW repository are the presence of the barriers and the placement into an unpopulated area.

(9) The main risks for NPP are: nuclear accidents and nuclear explosion.

(10) The main risks for RW repository are: 'Water and soil contamination during accidents' and 'Water and soil contamination during normal operation'.

(11) The results for frequency of the different dangers are generally very spread on the scale. There are some trends discussed in the previous paragraph, but, generally, the answers reveals random answers or answers non-based on a previous judgement.

(12) There are some differences between the two groups, differences introduced by the presence of the NPP in Cernavoda, but the differences are not very important. The present analyse is intended only for the knowledge of the present level of the knowledge and attitudes of the children from the selected groups. This level will be compared with the knowledge and attitudes measured after the attending of the educational program.

3.3 Educational Program – Premises and Design

The design of the Educational Program (EP) is based on:

-the similarity of nuclear knowledge from different groups both in Cernavoda and Pitesti; thus, the same EP should be applied in Cernavoda and Pitesti;

-the strong and weak points revealed by the reference measurement;

-the necessity to incorporate many types of information into a very restricted period (few teaching/studying hours);

-the availability of attractive and easily applied materials e.g. the access to other teaching resource(web, site visits, teacher trainings);

At the same time CHK-3 is a part of research work in COWAM2-WP1 and specific Romanian interest in this research must be harmonized with general and specific objectives of WP1. Therefore, the recommendations from different memebers of WP1 (including many stakehholders) were introduced in EP's design. Moreover, the EP proposal was discussed in 2nd Annual Seminar and improved after discussions. The main recommendation was to

introduce participatory methods/tools in CHK-3 in order to evaluate the effectivity/efficiency of its.

The structure of the EP is based on 5 units, see Table 3.2.1.

Table 3.3.1 Educational Program Structure

Unit	
1	Energy. Alternatives for electricity production
2	Radioactivity and nuclear radiations
3	Fission. Nuclear energy. Nuclear Power Plant
4	Radioactive nuclear wastes (RNW) (sources,characteristics, locations)
5	Role of the public in nuclear power development and RNW Management

EP's Structure

The purpose, unit objectives, methods and material provided are presented in Table 3.2.2-6.

Tabelul 3.3.2 Unit 1

Unit	Main Purpose	Matherials/ Movie	Duration of unit	Unit objectives
1. Energy. Alternatives for electricity production	Helps children understand the energy concept, different energies and the alternatives for electric power production. Compare the advantages and disadvantages of the alternatives.	Booklet, Movie/ Presentation, Discussion, Debat	One 50-minutes class period	As a result of participation in this unit of study, the learner will be able to: -understand the energy concept (mechanical, heat, electric power, nuclear energy) and the transformation between different forms; -identify the presence of the electricity in our life and its importance; -understand the different methods to produce electric power; -understand that each alternative has advantages and disadvantages; -compare the advantages and disadvantages in the Romanian context

Tabelul 3.3.3 Unit 2

Unit	Main Purpose	Matherials/ Movie	Duration of unit	Unit objectives
2. Radioactivity and nuclear radiations	Helps children understand the radioactivity and associated phenomena.	Booklet, Movie/ Presentation, Discussion, Debat	One 50-minutes class period	As a result of participation in this unit of study, the learner will be able to:-discuss the natural and artificial radioactivity and its presence in our life;-differentiate nuclear radiation (alfa, betta and gamma); -understand the dangers of the radiation, associated effects and the ways to protect against it;

Tabelul 3.3.4 Unit 3

Unit	Main Purpose	Matherials/ Movie	Duration of unit	Unit objectives
3. Fission. Nuclear energy. Nuclear Power Plant	Helps children understand the main aspects of nuclear power (fission reaction, NPP, advantages, dangers and methods for protection/prevent).	Booklet, Movie/ Presentation, Discussion, Debat	Two 50-minutes class period	As a result of participation in this unit of study, the learner will be able to:-explain the fission reaction concept;-explain the producing of electricity in NPP; -identify the differences between classical plants and NPPs; -discuss the advantages and disadvantages of NPP; -identify the main problems associated with NPP (accidents and RNW) and discuss the methods for preventing or mitigation of the consequences (the concept defense in depth)

Tabelul 3.3.5 Unit 4

Unit	Main Purpose	Matherials/ Movie	Duration of unit	Unit objectives
4.RNW-sources, characteristcs, locations	Helps children establish that a national challenge exists because there is an accumulation of nuclear waste. Aids children in differentiating among types of waste. Identify the conditions and danger associated with RNW management.	Booklet, Movie/ Presentation, Discussion, Debat	Two 50-minutes class period	As a result of participation in this unit of study, the learner will be able to: -discuss the relevance of nuclear waste to his/her life; -list and define the categories of nuclear waste; -state how each type of waste is or will be disposed of; -write a brief statement explaining the paradoxical relationship between the total volumes and radioactivities of nuclear wastes; -discuss where spent fuel and/or high-level nuclear waste is currently stored in Romania

Tabelul 3.3.6 Unit 5

Unit	Main Purpose	Matherials/ Movie	Duration of unit	Unit objectives
5.Role of the public in nuclear power development and RNW Management	Helps children to understand the concept of decision making process and the public participation	Booklet, Movie/ Presentation, Discussion, Debat	One 50-minutes class period	As a result of participation in this unit of study, the learner will be able to: -discuss the difference between classical DAD method and public participation in decision making process; -explain the advantages of the public participation method; -identify the ways to involve the public; -identify the actors in DMP and local communities role; -discuss the responsabilities of the present generations related to RNW

Methods

Three methods were proposed for EP's applying:
(M1) Classical presentation
(M2) Discovery method (Individual study)
(M3) Simulate a Local Committee functioning (participatory method)
The methods are shortly presented in fig. 3.3.1-3.3.3.

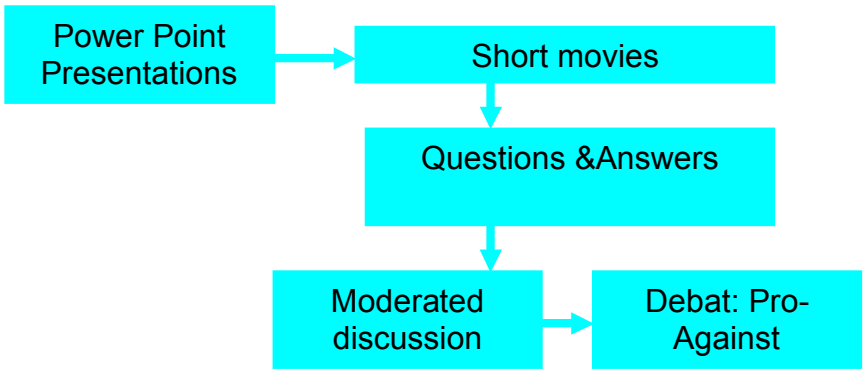


Fig. 3.3.1 Method 1

M1 is based on the classical teaching presentation. It consits on PowerPoint presentation and short movies. A short discussion based on question, answers and comments is included. After that, a lecturer moderated discussion is performed and if the interest level of youngsters is high a pro&agains debat is started. The units and their durations can be seen in tables 3.3.2-3.3.6.

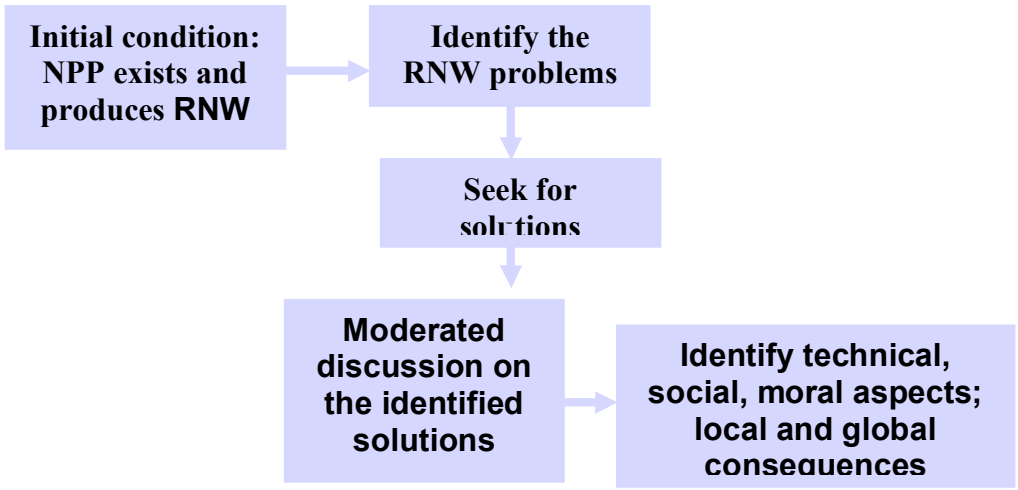


Fig. 3.3.2 Method 2

Method M2 is based on the individual study. A short discussion, moderated by the lecturer, is done in order to relieve the main problems: NPPs are in operation and produce RW, there are some RW problems in the public debat. The youngsters are invited to propose solution sfor the identified problems. The duration of individual study is proposed in the range 2 weeks-2

months, depending on the local school context. After the individual study a moderated discussion about the identified solutions, tehnical/moral aspects, local/global consequences is designed.

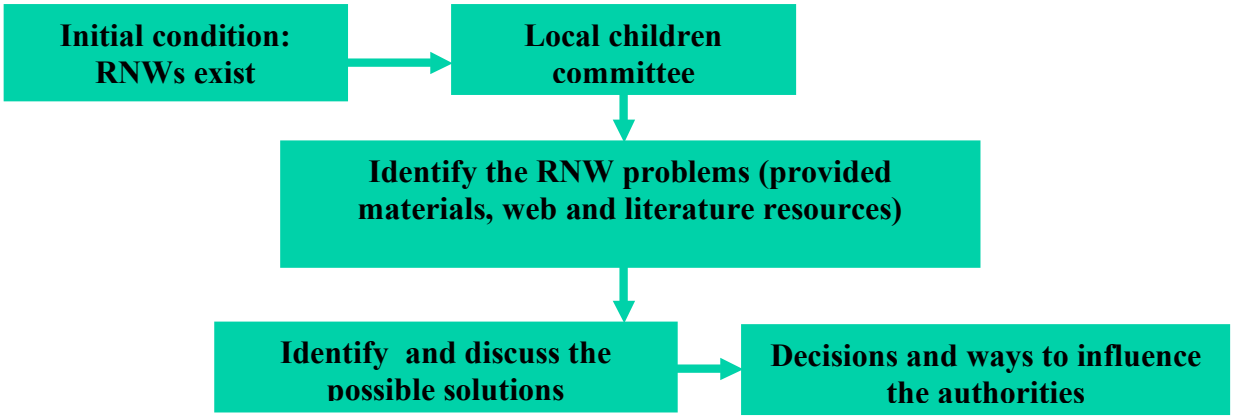


Fig. 3.3.3 Method 3

Method M3 is a participatory tool. A first short discussion about the initial conditions (RW exists in Cernavoda and a practical and safety solution is needed) is intended for the start of work. After that, based on democratic debat and elections the LC structure, objectives and staff should be adopted. Youngsters work together in small groups/teams to identify the RW problems and solutions. They should discuss the possible solutions and adopt decisions in order to communicate with the silent majority, local NGOs or authorities.
For all three methods the youngsters receive some materials and references for their study and research.

Materials

Generally, the materials are presented in tables 3.3.2-3.3.6.

(1) A **booklet** entitled "What we must know about nuclear power and radioactive nuclear wastes?" was written especially for the youngsters involved in the CHK-3 research. The booklet is structured in 5 units containing 38 items to be discussed. The contents of the booklet is seen as a basic material for understading the main aspects related to energy, electricity peroducing, radiations, nuclear energy, nuclear waste and public participation in the RW decision making process. The atractivity of the booklet is increased by graphical aspects and the direct adressed style. Booklet should be used in all three methods (M1, M2, M3). A copy for each youngster and teacher involved in the project was distributed.

(2) Some **Power Point presentation** were designed: 5 for M1 (one per uni, detailed presentations), 1 for M2 (general presentation for nuclear energy and derived problems), 1 for M3 (general presentation for public participation in nuclear energy and RW decisions).

(3) As teaching/studying support some **movies** were used; they consist of selected parts from European Communities, 2004 - "Nuclear Safety", "Security of electricity and gas supplies" documentary films and a general Cernavoda NPP Presentation provided by Nuclearectica SA Company.

(4) **A list of references** was provided in order to help individual study and LC simulating process (web adresses, books). Moreover, since a part of youngsters doesn't use frequently the internet, a stuctured information from the references was electronically written on CD.

3.4 Educational Program Implementation

Groups and Methods

The groups involved in the EP implemantation and the corresponding used methods are presented in Table 3.4.1.

Compared with the reference measurement a new group (School no. 1 Cernavoda) was introduced. Since the interest for RW problems is greater in Cernavoda compared with Pitesti and we didn't want to have a 'negative expected' result with M3 in Pitesti, only groups from Cernavoda were involved in EP for M3. We mention that both two groups for M3 are new groups in our research. The main motivation is the old groups (8^{th} grade, now) are pressed by the final exam; thus, we have selected two new groups (7^{th} grade) in order to avoid this pressure and with the intention to work together for a longer period.

Table 3.4.1 Groups involved in EP Implementation

Method	Pitesti	Cernavoda
M1 (Classical Presentation)	School no. 11 School no. 13	-
M2 (Discovery)	School no. 5	School no. 3 School no. 4
M3 (Simulate LC)	-	School no. 1 School no. 2

Duration

The EP was implemented in Pitesti in January-February 2006. For M1 five lessons (one or two 50-minutes class period) were used, one per week. For M2 a lesson (one 50-minutes class period) was used at the beginning of January, with the intention that at least 4 weeks should be dedicated to individual study. At the end of February, post-educational measurement of knowledge and attidudes were performed.

In Cernavoda, the EP was started in February 2006. For M2 an introductory presentation of nuclear energy and RW was performed. For M3, LC organization- adopting the structure, 'staff' democratic elections, distributing the materials – was done. The intention was to have new measurement of knowledge and attitudes (based on new questionnaires) at the beginneing of April. Taking into account the problems of avian flu in Cernavoda, started in March, the measurement were postponed after quarantine closing in Cernavoda. The measurement was performed in May 2006.

Short Description

M1 lessons were based on the Power Point presentations, questions&answers, discussion&debat. During M1 lessons we have taken notes containing: questions and answers from teacher to students and from students to teachers, level of participation, attention etc. After attending, students fill a form with own appreciation about each unit, including questions and suggestions.

M2 lesson was based on a single, introductory, PPt general presentation. The booklets, internet adresses & keywords, a list of items, the presentations used in M1 and a collection of articles and web pages written on a CD, were provided as support for individual study. During the introductory lesson we have taken notes.

M3 method was started by the discussion concerning to the question "Why a LC in Cernavoda?". The discussion was intended to reveal the actual situation in Cernavoda: the presence of the NPP introduces the neccessity of population&environment protection measures, a solution for RW continuosly generated in NPP operating etc. After that the discussion was continued with the role of a local committee, possible objectives and structures. The proposed structure is presented in fig. 3.4.1.

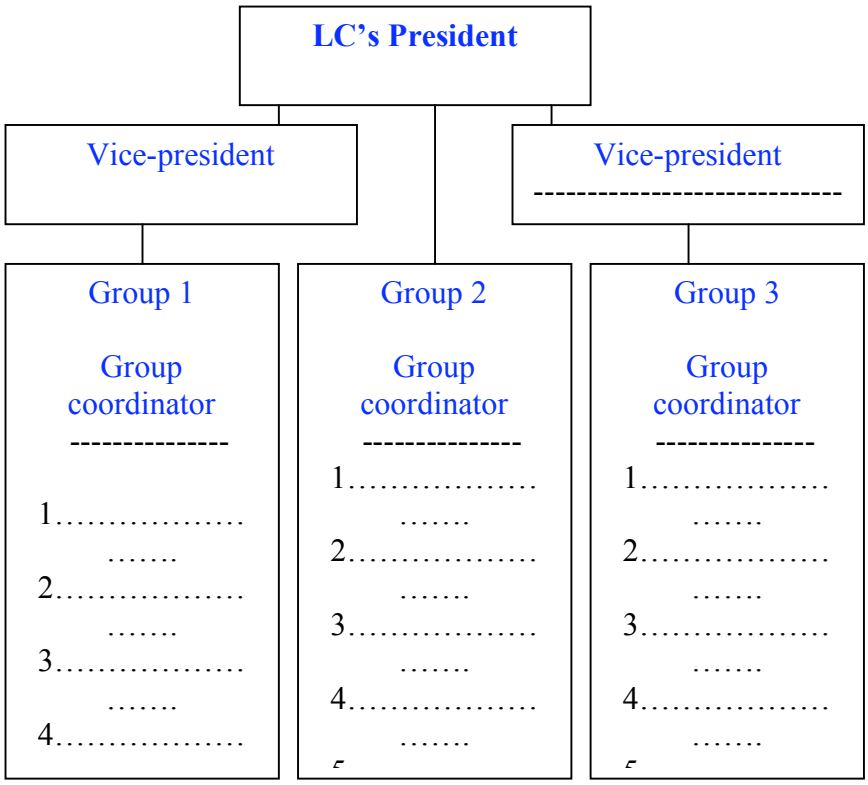


Fig. 3.4.1. Proposed structure for youngsters' LC in Cernavoda

The stucture is intended to stimulate competition between groups and to allow specific tasks for each youngster. The proposed objective for Cernavoda LC was "to identify the problems related to NPP and to inform people from Cernavoda town". After discussion and debat, the structure and the objective was adopted by vote. The staff was democratically elected.

Three tasks were adopted for LC:

-to collect data;

-to analyse (selecting useful information, comparing different sources, conclusions);

-to produce information for general public (posters, drawings, presentations, booklet, newsletter, etc.).

The list of resources contains:

1.Booklet "What we must know about nuclear power and radioactive nuclear wastes?"

2.A CD containing information collected from internet and 3 movies about nuclear

3.Collection of web addresses + Keywords for search

4.Information center (Town Hall)

5.Family and people from NPP

6.Project initiators (e-mail communications):

7. Any other credible source

The youngster will work together in LC's groups and will be co-ordinated by the staff. Teachers and project initiators will not intervene in the LC's work without a special request of staff.

3.5 Post-educational measurement of knowledge and attitudes

Post-educational measurement were intended to:
-compare the attitudes and knowledge related to reference case;
-relieve the effectivity/efficiency of the methods (M1, M2, M3) in the educational process;
-compare the methods (advantages and drawbacks);
Based on this analyse a set of recommendations for authorities will be released. These reccommendations are presentesd in Chapter 4.

The questionnaire for post-educational measurement consists of 5 sections: A-Energy alternatives; B-Radioactivity; C-NPP; D-Radioactive wastes; E-Demographics. The questionnaire.
The results are presented in the following figures. Since the basic and post-educational questionanires are different, only a part of the graphs contain the reference case in order to compare the attitudes and knowledge after and before EP:

- M1, M2, M3 and Reference Case comparison for different electricity alternatives' notoriety (fig. 3.5.1);
- M1, M2, M3 and Reference Case comparison for radiations/radioactivity association with… (fig.3.5.6);
- M1, M2, M3 and Reference Case comparison for the perception of NPP associated dangers (fig. 3.5.8);
- M1, M2, M3 and Reference Case comparison for the atitude related to the influence of a RW repository placed in the immediate vicinity (fig. 3.5.14);
- M1, M2, M3 and Reference Case comparison for perceived repository-home distance from that a danger is present (fig. 3.5.15);
- M1, M2, M3 and Reference Case comparison for classical and nuclear wastes – dangereous state intercomparison (fig. 3.5.16);
- M1, M2, M3 and Reference Case comparison for importance of conditions for RW repository - results for 'very important' +'important' (fig. 3.5.17);
- M1, M2, M3 and Reference Case comparison for importance of conditions for RW repository - results for 'so and so' (fig. 3.5.18);
- M1, M2, M3 and Reference Case comparison for importance of conditions for RW repository - results for 'low' and 'not important' (fig. 3.5.19);
- M1, M2, M3 and Reference Case comparison for dangers associated with RW repository (fig. 3.5.20);

The rest of graphs shows only M1, M2 and M3 results for intercomparison:

- M1, M2, M3 intercomparison for perception about Hydro's advantages (fig. 3.5.2);
- M1, M2, M3 intercomparison for perception about Coal+Gas+Oil's advantages (fig. 3.5.3);
- M1, M2, M3 intercomparison for perception about Nuclear's advantages (fig. 3.5.4);
- M1, M2, M3 intercomparison for perception about Nuclear's drawbacks (fig. 3.5.5);
- M1, M2, M3 intercomparison for perception about radioactivity/radiations (fig. 3.5.7);
- M1, M2, M3 intercomparison for perception gravity of the danger: radiation emmision during normal operation (fig. 3.5.9);
- M1, M2, M3 intercomparison for perception gravity of the danger: other pollutant emmision during normal operation (fig. 3.5.10);

- M1, M2, M3 intercomparison for perception gravity of the danger: nuclear accident (fig. 3.5.11);
- M1, M2, M3 intercomparison for perception gravity of the danger: terrorism (fig. 3.5.12);
- M1, M2, M3 intercomparison for perception gravity of the danger: radioactive wastes (fig. 3.5.13);
- M1, M2, M3 intercomparison for 'Very high'+'high' perception for dangers associated with RW repository (fig. 3.5.21);
- M1, M2, M3 intercomparison for 'so and so' perception for dangers associated with RW repository (fig. 3.5.22);
- M1, M2, M3 intercomparison for 'low'+'very low' perception for dangers associated with RW repository (fig. 3.5.23);

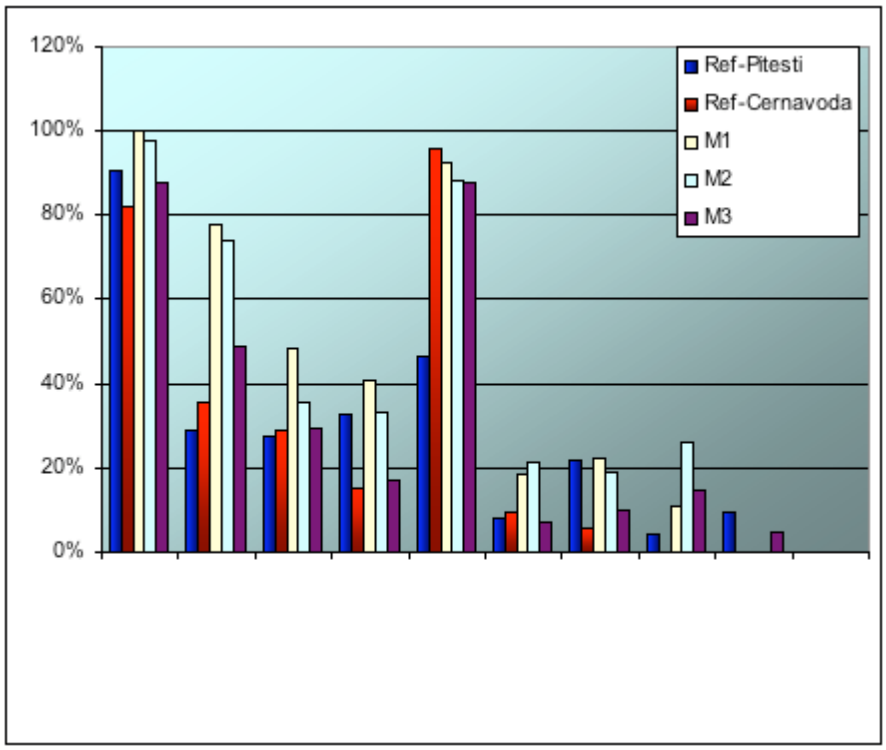


Fig. 3.5.1 Notoriety for different electricity producing alternatives- comparison M1, M2, M3 and reference measurement

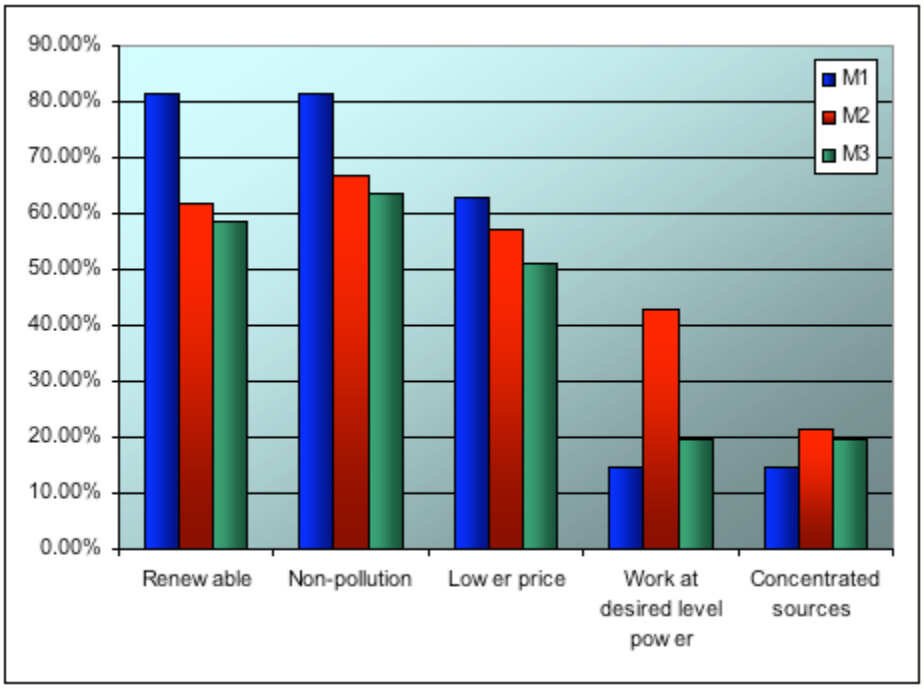


Fig. 3.5.2 Perception for Hydro's advantages - comparison M1, M2, M3

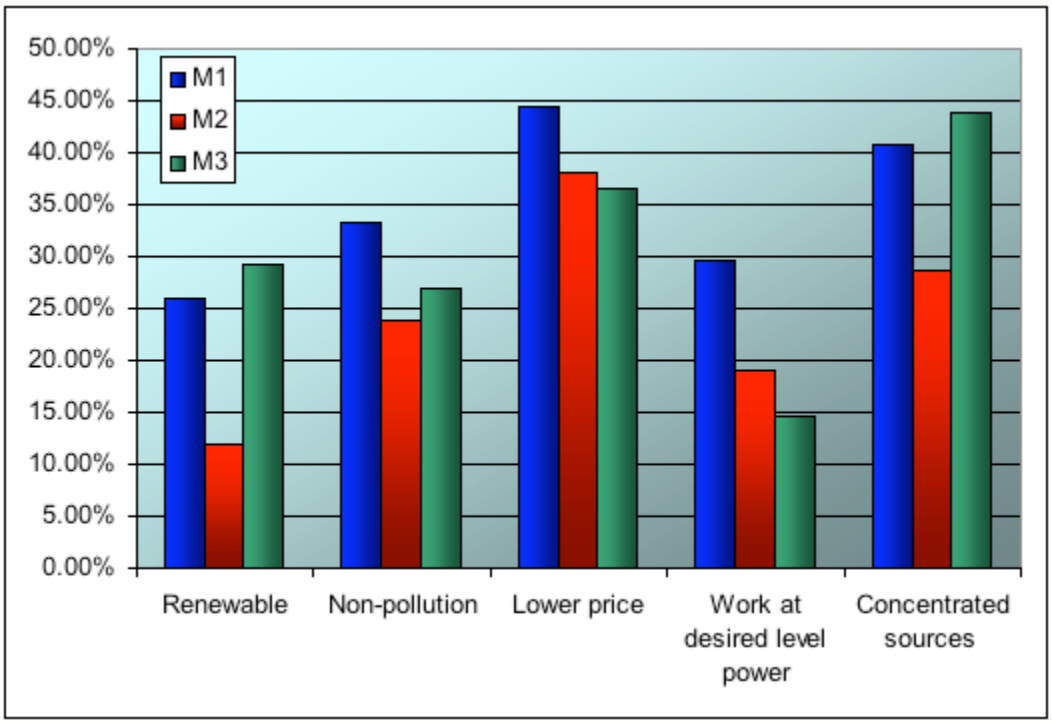


Fig. 3.5.3 Perception for Coal+Gas+Oil's advantages - comparison M1, M2, M3

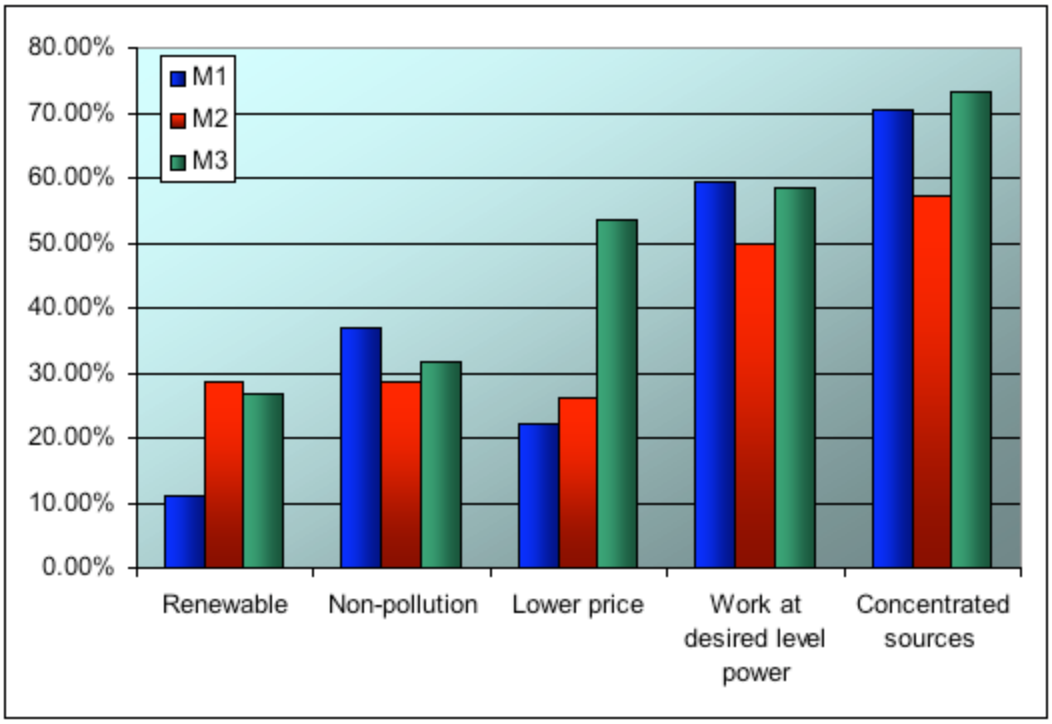


Fig. 3.5.4 Perception for Nuclear's advantages - comparison M1, M2, M3

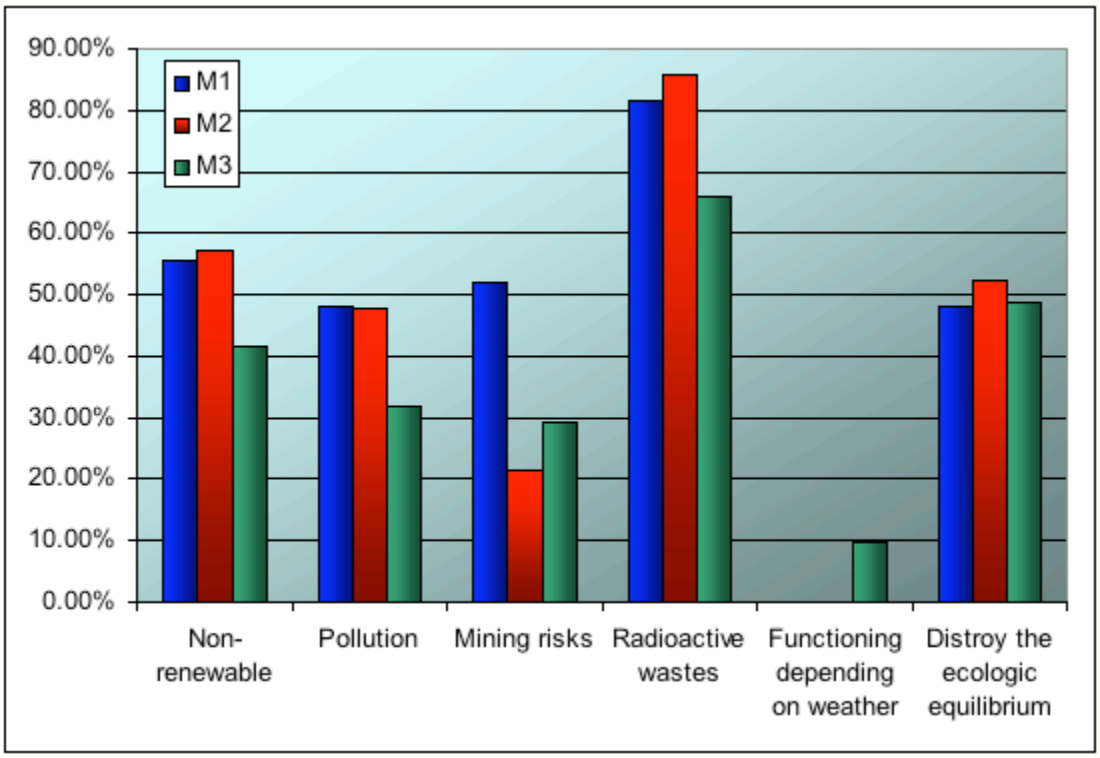


Fig. 3.5.5 Perception for Nuclear's drawbacks - comparison M1, M2, M3

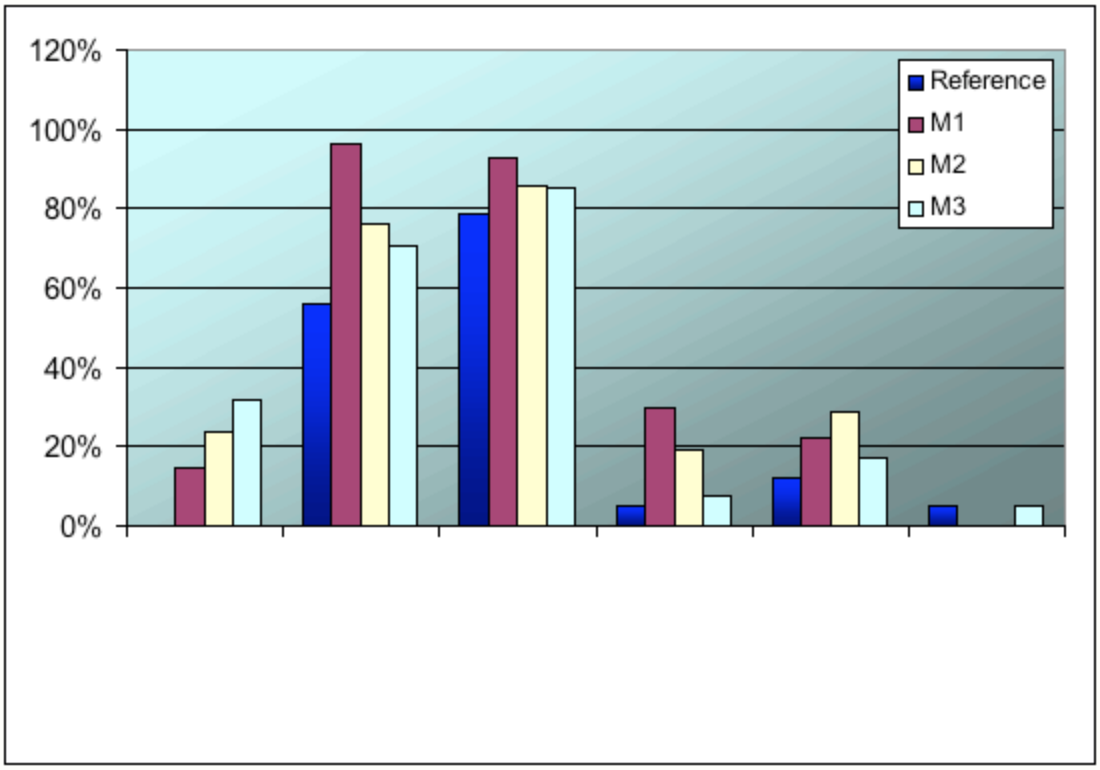


Fig. 3.5.6 Perception for Radiations/radioactivity – assiociated with…

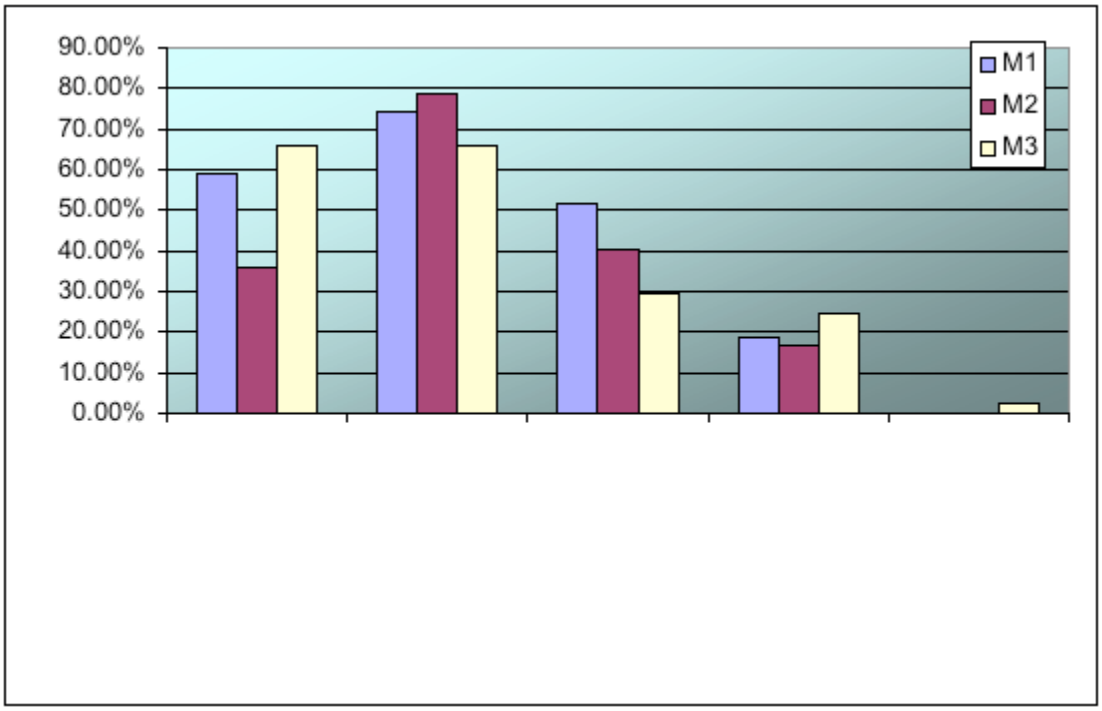


Fig. 3.5.7 Perception about radioactivity/radiations

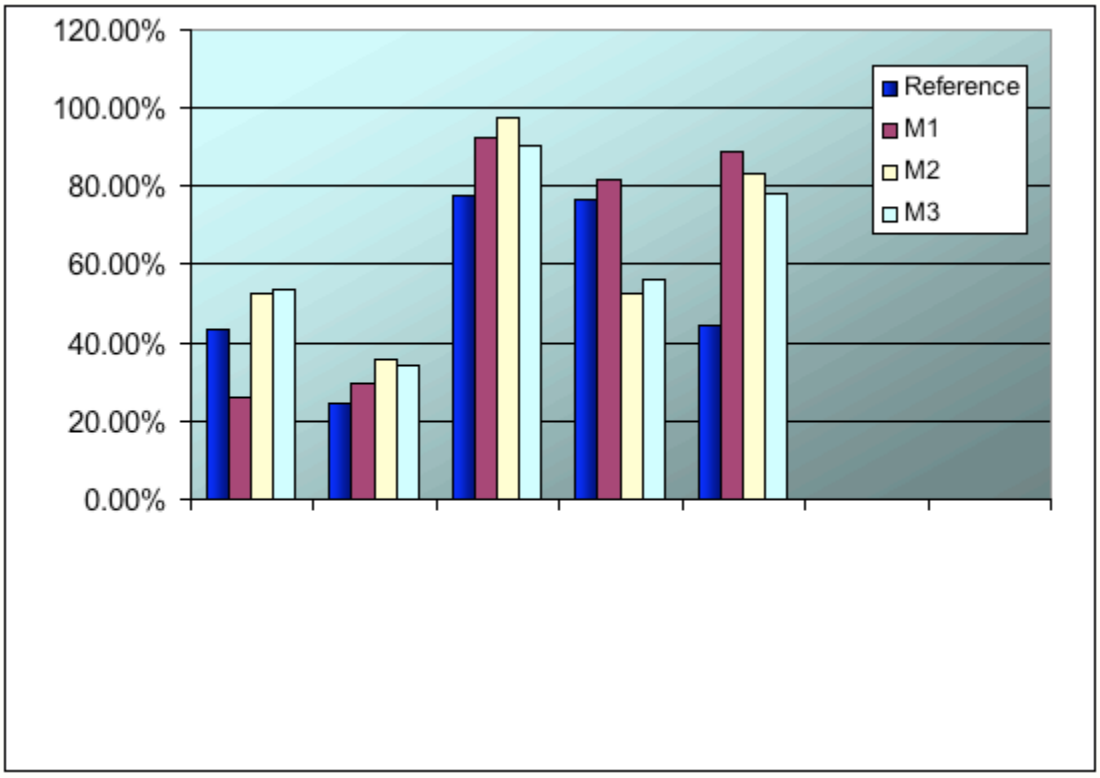


Fig. 3.5.8 Perception about dangers associated with NPPs

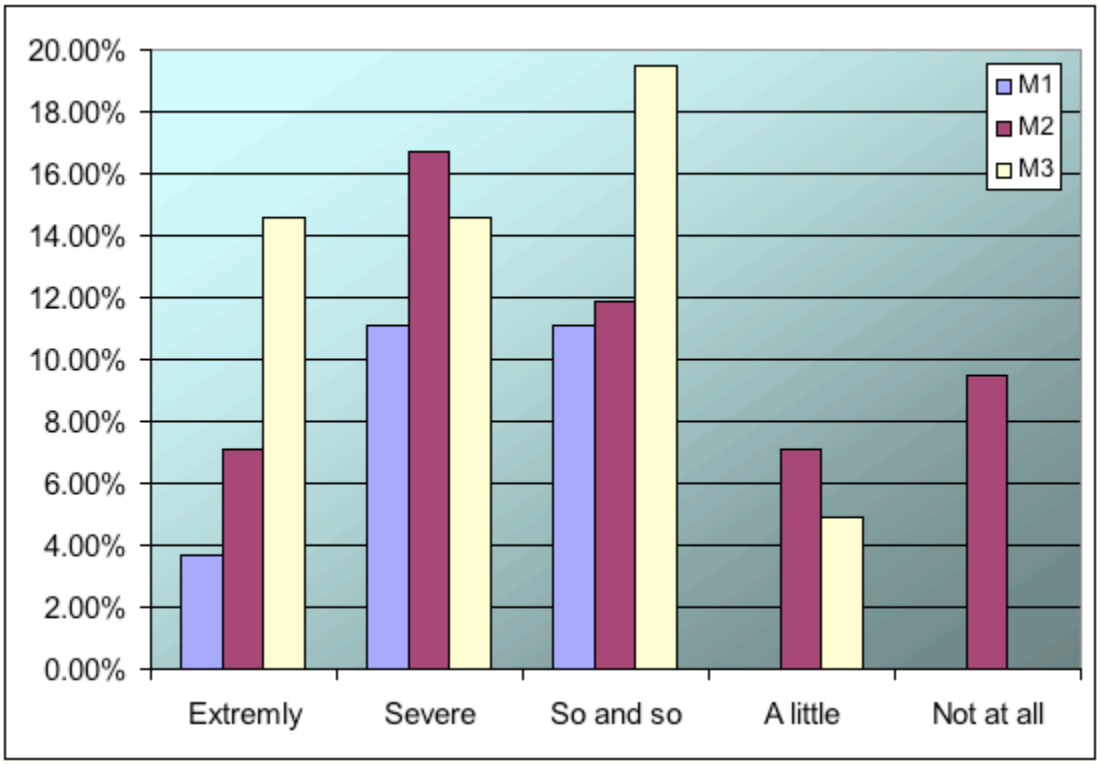


Fig. 3.5.9 Perception about gravity of the danger: radiation emmision during normal operation

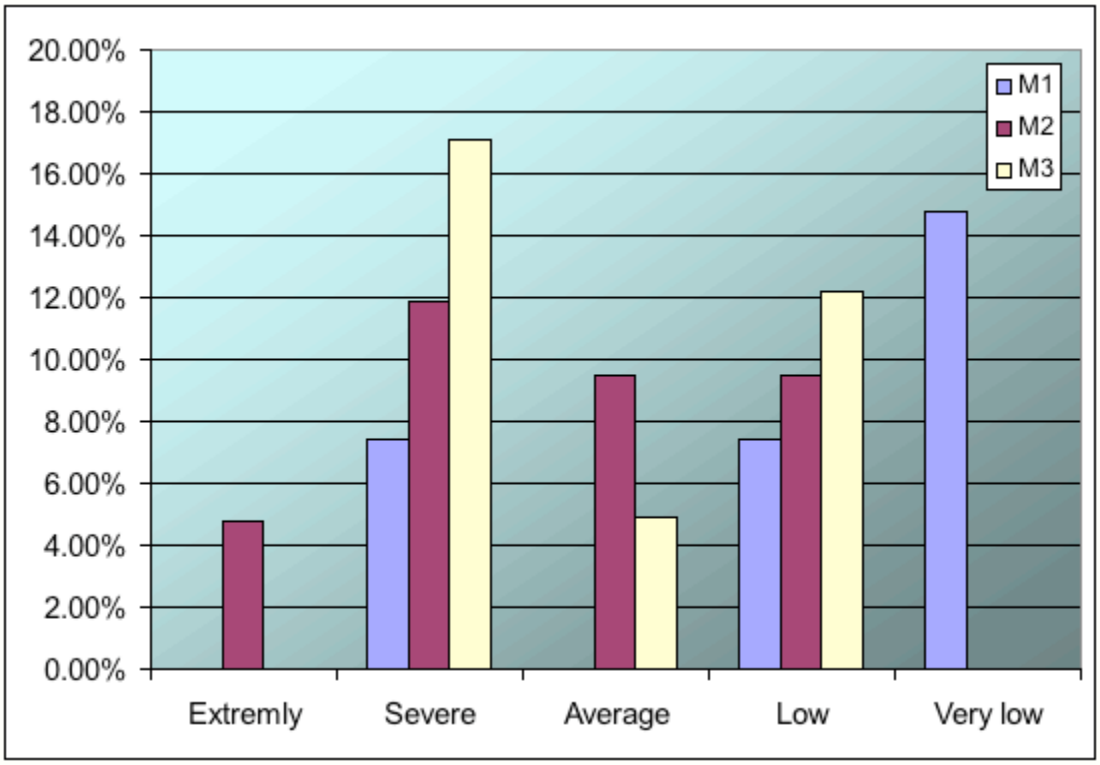


Fig. 3.5.10 Perception about gravity of the danger: other pollutant emmision during normal operation

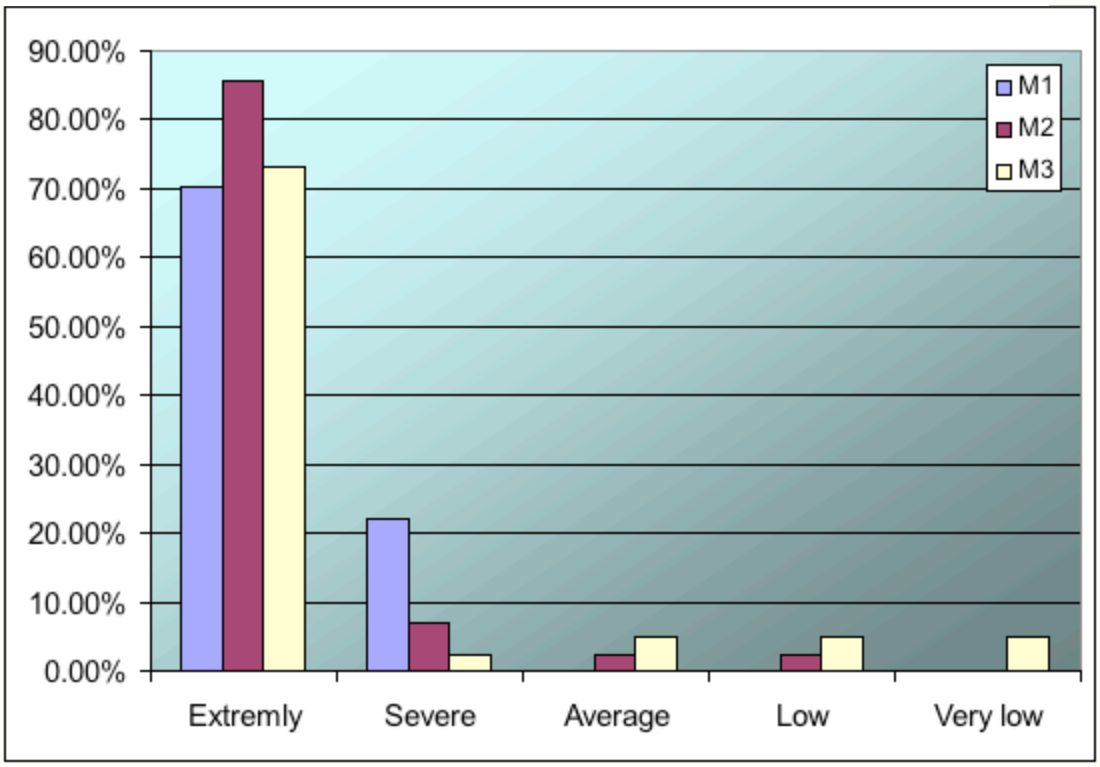


Fig. 3.5.11 Perception about gravity of the danger: nuclear accident

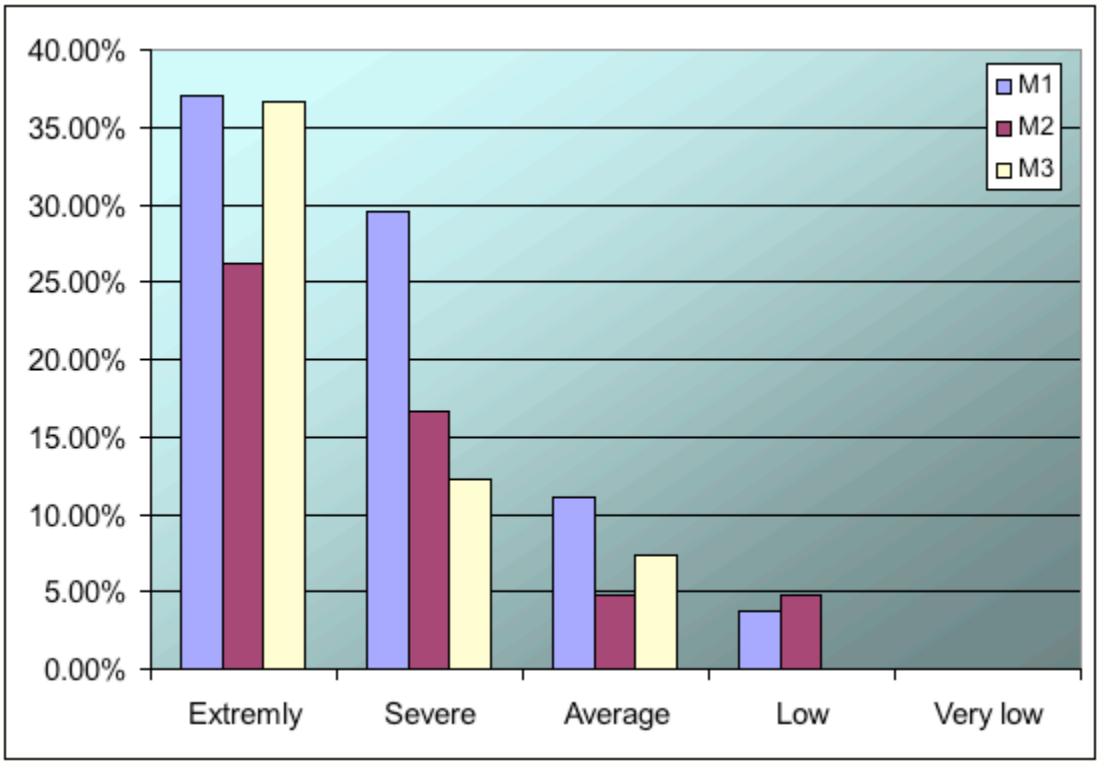


Fig. 3.5.12 Perception about gravity of the danger: terrorism

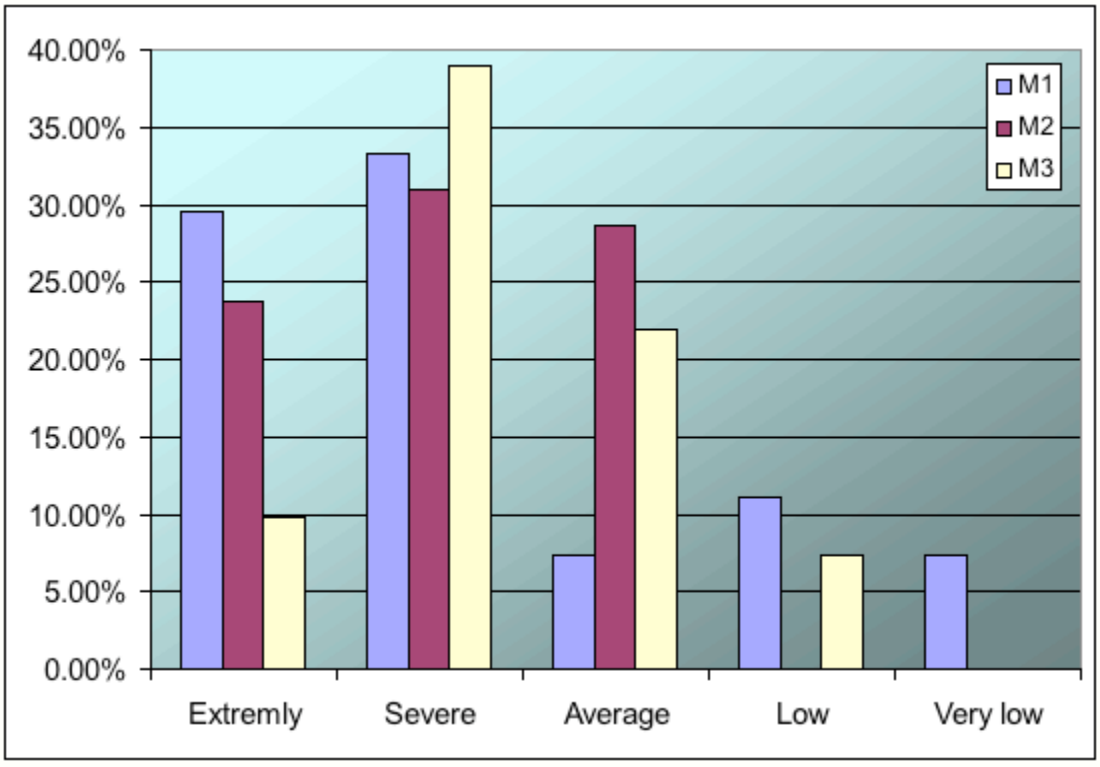


Fig. 3.5.13 Perception about gravity of the danger: radioactive wastes

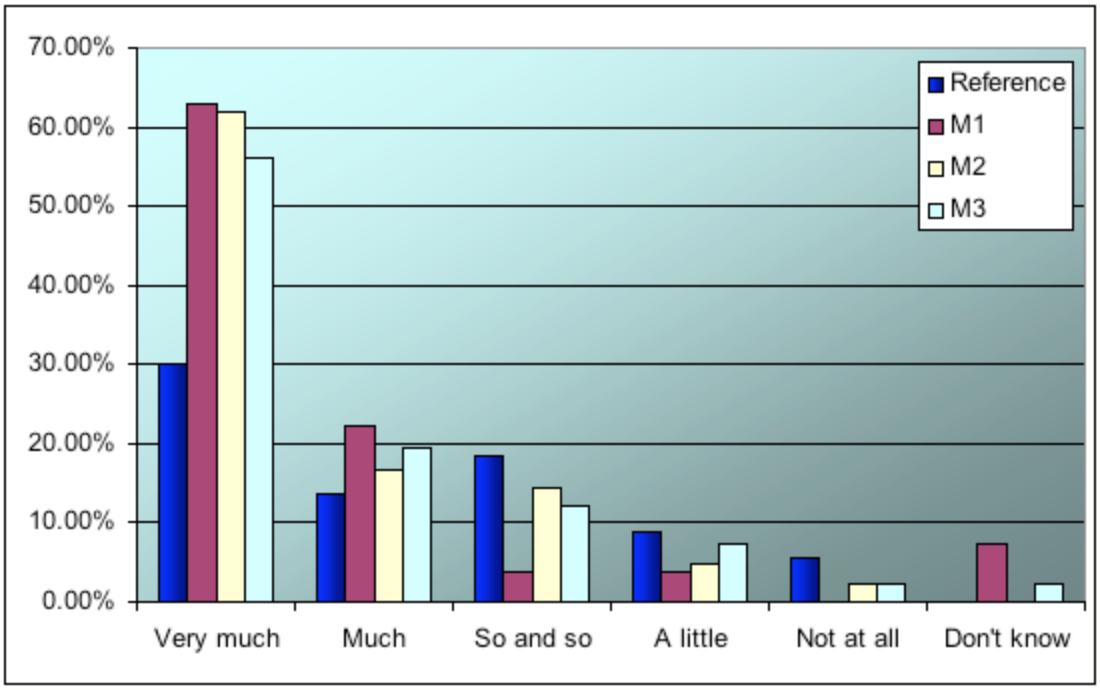


Fig. 3.5.14 Attitude about the influence of a RW repository placed in the immediate vicinity (the worry)

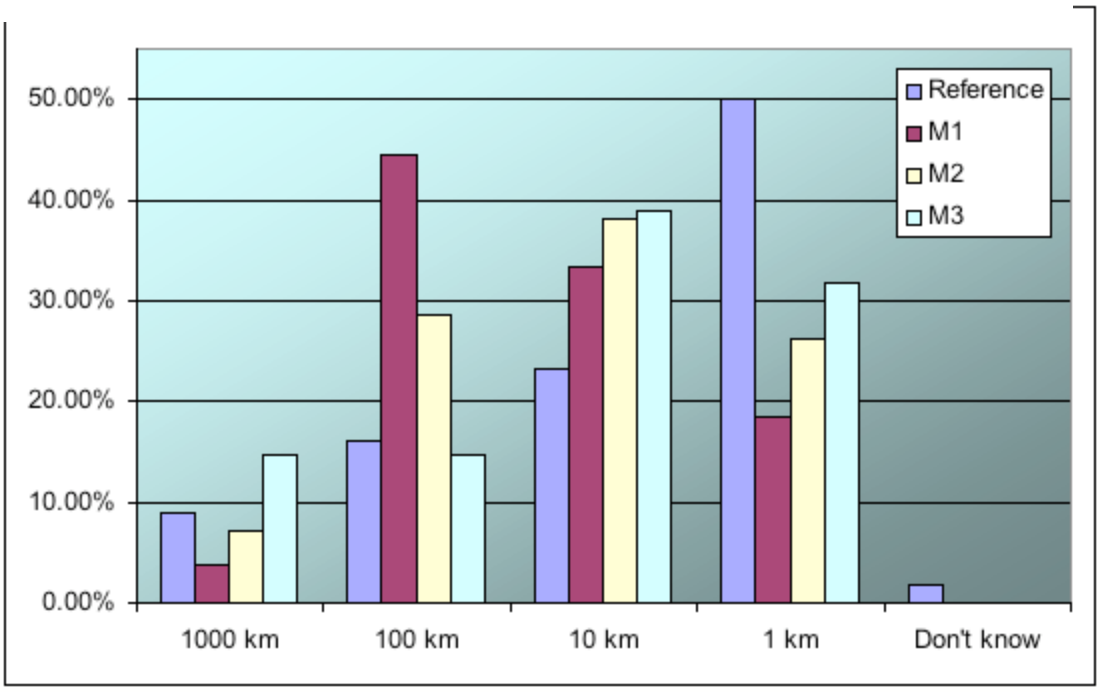


Fig. 3.5.15 Distance repository-home from they perceive a danger

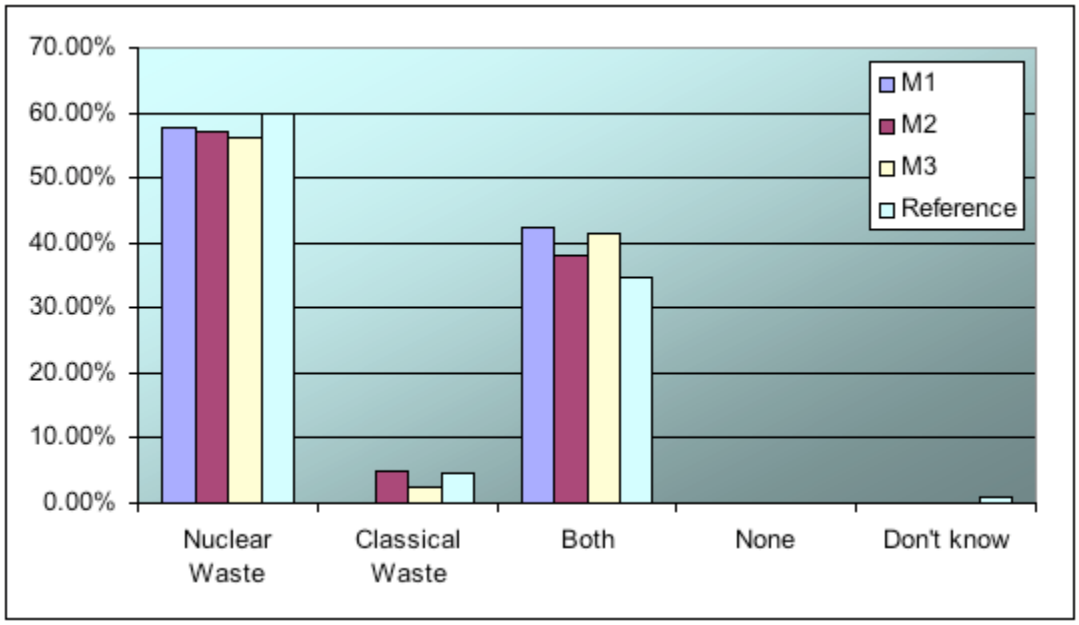


Fig. 3.5.16 Comparison nuclear and classical RW

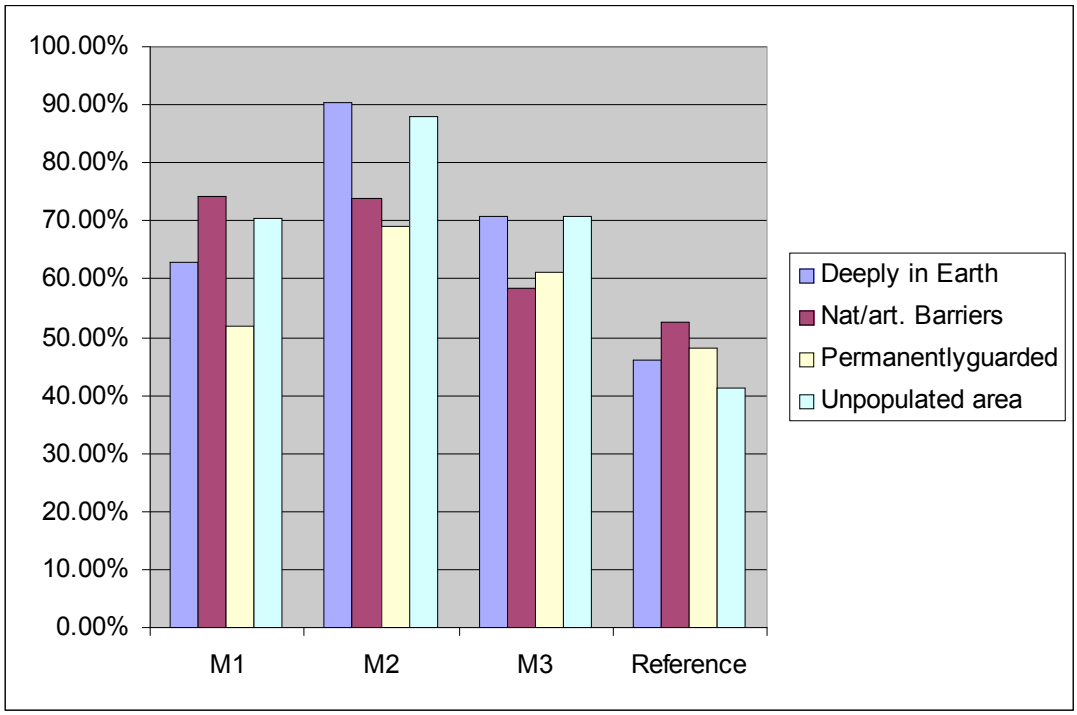


Fig. 3.5.17 Importance of conditions for RW repository - results for 'very important' +'important'

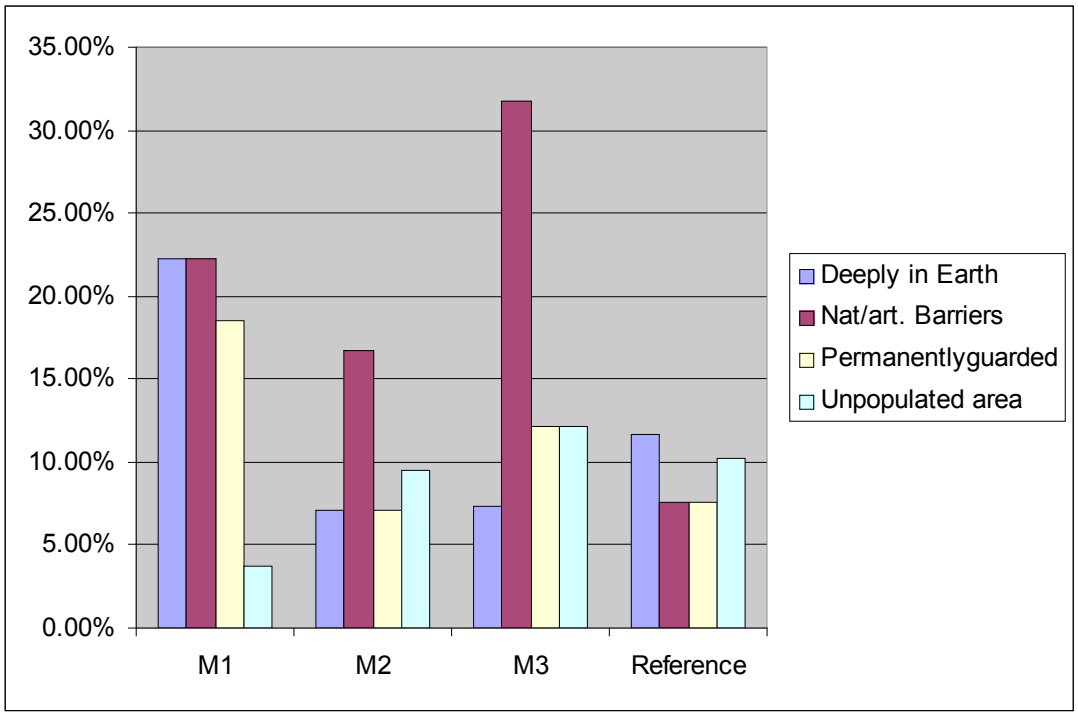


Fig. 3.5.18 Importance of conditions for RW repository - results for 'so and so'

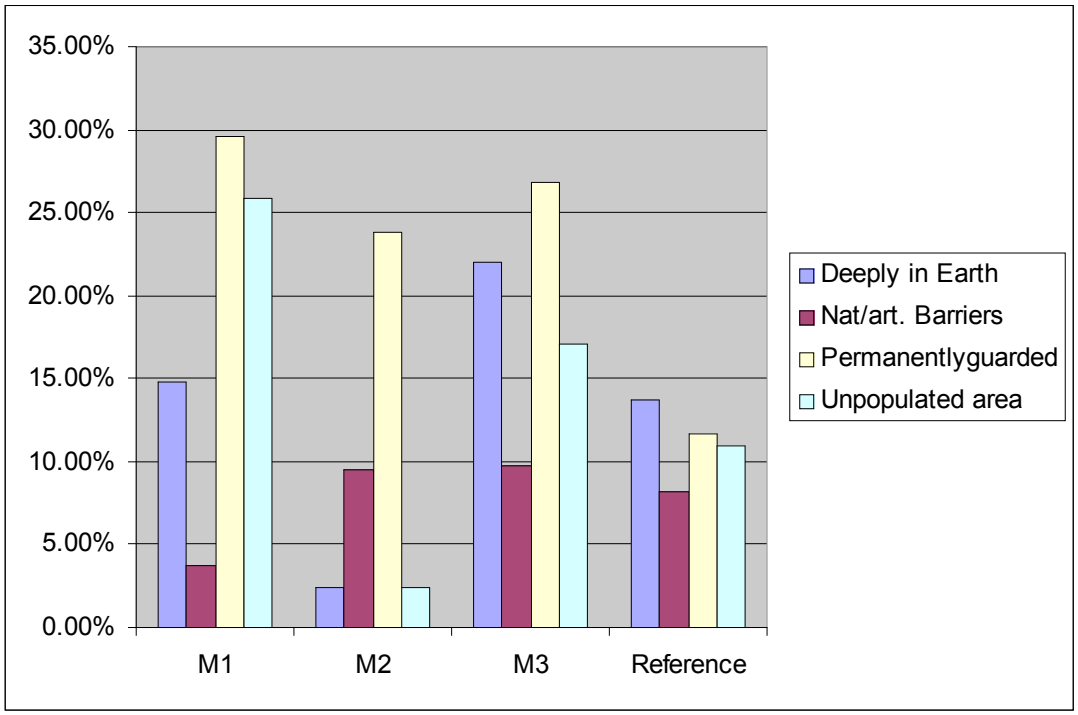


Fig. 3.5.19 Importance of conditions for RW repository - results for 'low + not important'

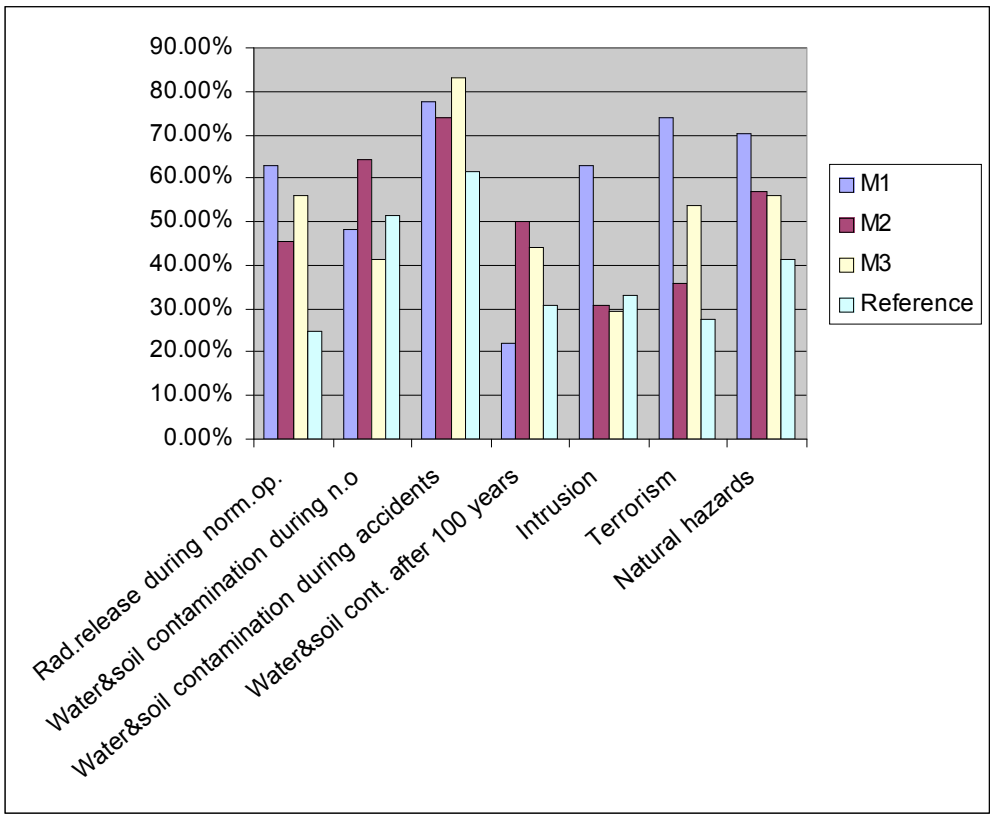


Fig. 3.5.20 Dangers associated with RW repository

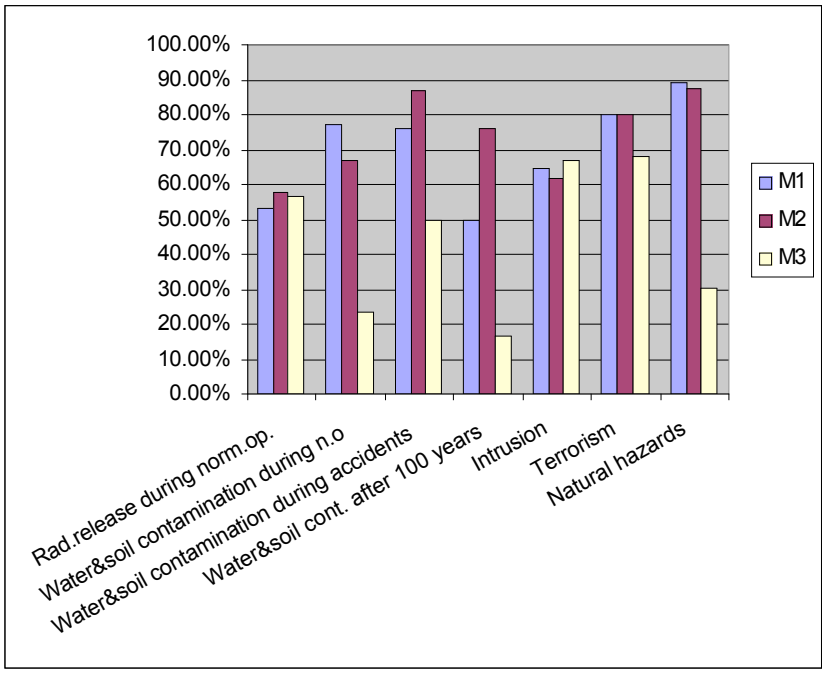


Fig. 3.5.21 'Very high'+'high' perception for dangers associated with RW repository

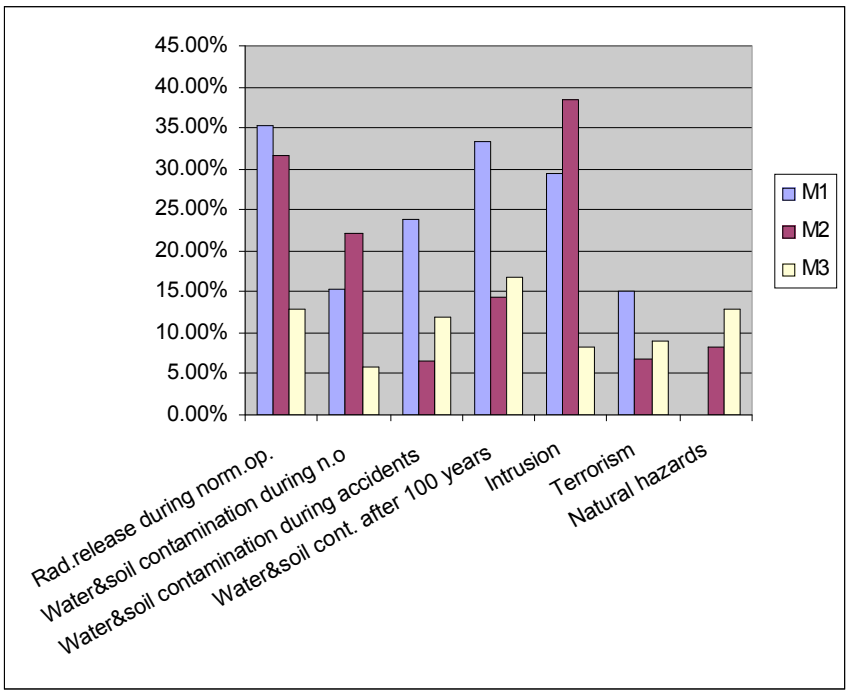


Fig. 3.5.22 'So and so' perception for dangers associated with RW repository

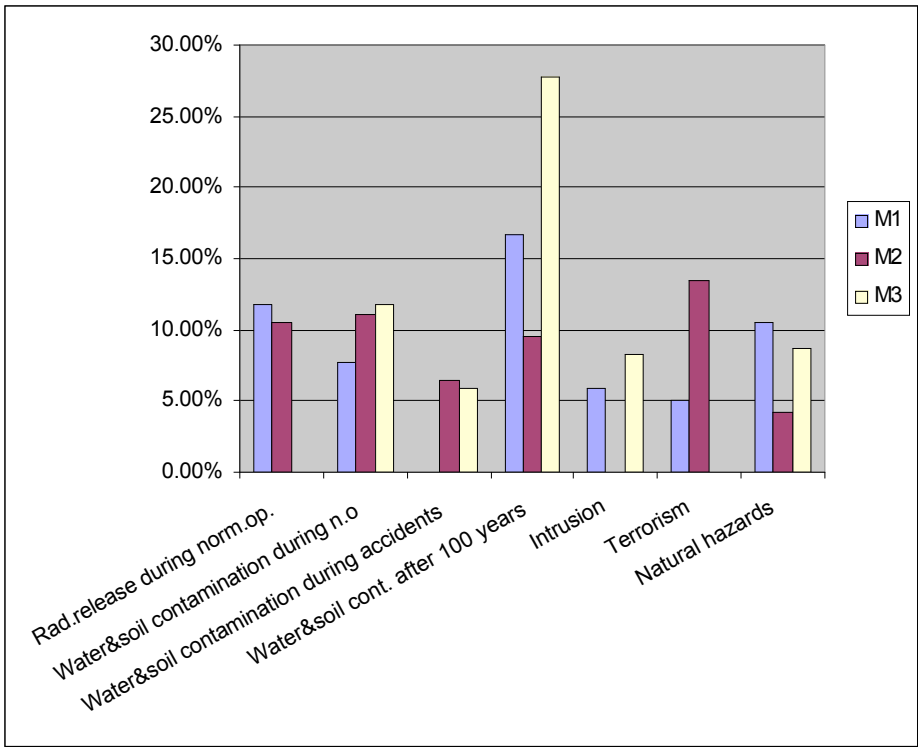


Fig. 3.5.23 'Low' and 'very low' perception for dangers associated with RW repository

Discussion

In order to compare M1, M2, M3 methods a set of parameters was evaluated during lessons:

-interest for subjects;

-discipline;

-costs;
-easy to apply.

For these parameters a scale with 5 steps was used (with 1 means high and 5 low). Combined subjective and objective appreciations were taken into account for evaluation. The results are presented in table 3.5.1. The initial interest and the discipline during lessons/activities were identical. The interest during lessons/activities are higher in M2 and M3. The explanation is connected with the level of participation and the responsibility awareness introduced by M2 and especially by M3. The costs are represented by time resources parameter (higher for M1) and materials (higher for M2 and M3). The parameter 'easy to apply' is a subjective parameter strongly depending on the teachers and local context. However, M1 is expected to be applied easier than M2 and M3. M3 has some dificulties connected with: the general level of knowledge for the class' group, the level of participation/cooperation/atractivity, the easy access to web resources and other information sources etc.

Table 3.5.1 During lessons parameters for EP

	M1	**M2**	**M3**
Interest for the subjects: -Initial -During lessons	 2 3	 2 1	 2 1
Discipline	1	1	1
Participation	3	2	1
Costs: -time for teaching -materials	 1 3	 3 2	 3 2
Easy to apply	1	2	3

Related to M3, we must notice that an initial moderate pessimism was present both for the investigators and COWAM2 community, related to the level of participation and the final results. This initial condition has involved a more careful preparation of the materials and discussion (especially in the identifying the motivations and think possible support to maintain the induced motivations).

Finally a very nice surprise occurred. An enthusiastic participation of the youngsters in all activities of EP-M3 has happened. As products/outputs:

-2 posters for school (School 1 Cernavoda);
-3 posters; web site (School 2 Cernavoda)

have been chosen. A real competition between the three groups of each class has existed. The results are reflected in the final measurement.

In order to communicate their work to the community the decision of the M3 participants was different:

- posting the two big posters in the main hall of the School no.1 to be visible by the colleagues, teachers, parents, visitors etc;
- communicate by a dedicate web-site (School no. 2).

The post-educational measurement shows:

-differences between post-educational and reference measurement; generally, the results are in the expected direction. For example the notoriety for different electricity alternatives (existing in Romania) increses after EP applying (see fig. 3.5.1).

-the perception for the association between radioactivity and nature, weapons, NPP, medicine, research (fig. 3.5.6) is reflected in a increased number of mentions for post-educational mesurement;
-more than 65% of youngsters perceives radiations/radioactivity as dangereous in all cases (fig. 3.5.7): 74% (M1), 79% (M2), 66% (M3); however the radiations/radioactivity are useful (52%-M1, 41%-M2, 29%-M3), only 19%-M1, 17%-M2, 24%-M3 perceive the radiations/radioactivity as useless;
-the main dangers associated with NPP operating are nuclear accident, radioactive wastes, terrorism; The EP applying increases the number of mentions for RW (Reference- 43%, M1-81%, M2-83%, M3-75%) and for nuclear accident (Reference- 68%, M1-93%, M2-98%, M3-90%). For terrorism danger M1 results are similar with the reference case, whereas M2 and M3 decreases the number of mentions (52%-M1, 56%-M2, 77%-reference).
- after EP an increasing of awareness related to an hypothetical RW repository placed in immediate vicinity (reference-30%, M1-63%, M2-62%, M3-56%).
-the 'safety distance' between repository and home increases after EP (for reference case-1 km; for M1-100 km; for M2-10 km; For M3-10 km). Presentations, free discussions, individual study, materials provided have reflected the possible dangers and countermeasures.
-the main dangers associated with RW Repositories are: water&soil contamination during accidents, natural hazards and terrorism; the differences induced by EP and between the methods are presented in fig. 3.5.20.
-generally M1 shows more 'correct answers' (see perception of different alternatives- fig. 3.3.2-5) than M2 and M3; the explanations are based on two possible situations: a part of youngsters doesn't like individual study; they've used different information sources.
-there are differences between the repositories' conditions, dangers, importance and frequency of dangers depending on the methods used, but a general trend exists. It shows an important influence of EP on knowledge and attitudes of youngsters.

IV. RECOMMENDATIONS FOR AUTHORITIES

A document containing the main conclusions and some recommendations for authorities are written in order to be sent to: Ministry of Education and Research, Nuclear National Agency, Regulatory Body (CNCAN), National Agency for Radioactive Wastes (ANDRAD), Cernavoda Local Council. The full length document is in Romanian.

The main recommendations are the following:

(1) taking into account the democratic development of Romania, the integration in EU, globalization aspects and information processes, a public participation in the DMP for nuclear issues is compulsory in the next future;
(2) taking into account that RW problems will be critical in 10-15 years, young generations must be prepared for the DMP; this preparation should be started in schools (5-8th grade);
(3) an interdisciplinary course should be introduced in national Curricula in order to discuss energy alternatives, pollution, safety aspects, security of energy supply, radiations and radioactivity including NPP and RW repository aspects;
(4) for towns/localities with nuclear facilities youngsters may be easily involved in participatory activities like M3 (simulation of Local Committee), debats, discussions, visits, etc.

(5) despite M1 and M2 are very practical for teaching, M3 produces, in our opinion, more stable knowledge and attitudes; moreover, in M3 a transfer from youngsters to the community may occur.

V. CONCLUSIONS

(C1) CHK-3 has investigated the attitudes and knowledge related to radioactivity, NPP and RW in 6 schools from Cernavoda and Pitesti. Youngsters are between 13-14 years old. The influence of the EP applying was estimated in post-educational measurement.

(C2) Three methods: Classical, Discovery and Simulate LC were used in Educational Program. Each method had advantages and disadvantages. The range of applicability was found in each case. M2 and M3 were found to be more interesting and motivating for the participants.

(C3) Although an 'a-priori' pessimism was present for M3, the enthusiastic participation and the results proved that M3 is a very powerful method to learn technical, scientific, social and organizational aspects. In our opinion M3 will produce a real and stable knowledge and, at the same time, it may start a process to determine the local community to build LCs or other specific organizations.

(C4) M2 is easy applicable, attractive, and very adaptive to youngster's level, but we don't wait so lasting results as M3. The classical method, similar to usual classroom teaching, is very important in the classes where the level of participation is medium or low.

(C5) The most important fact is that CHK-3 contributes to the start of youngster prepairing for the future DMP in Romania.

VI. ANNEXES

Annex A -Questionnaire – Reference Evaluation (Basic Measurement for Knowledge and Attitudes)

Section **A** (Sources of information)

No.	Question	Answer	Next
A1	From where do you usually find out about technical/industrial topics? **(Show List A1)** (*Tick all that apply.)*	Textbooks 1 Teachers 2 Radio, Tv. 3 Newspapers, magazines 4 Internet 5 Schoolmates, friends 6 Your family 7 Others 8	A2
A2	Among the previous information sources, which are, for you, the most frequently used? *(maximum three)*	1.---------- 2.---------- 3.----------	A3
A3	Which of them are more trustful for you? *(maximum three)*	1.---------- 2.---------- 3.----------	A4
A4	How often are you using the internet? **(Show List A4)** *(only one answer)*	Daily 1 2-3 times per week 2 Weekly 3 Less than weekly 4 Never 5	B1

Section **B** (**Energy alternatives**)

No.	Question	Answer	Next
B1	What electric power plants exist in Romania? **(Show List B1)** (*Tick all that apply.)*	Hydropower plants 1 Coal fired plants 2 Gas fired plants 3 Oil fired plants 4 Nuclear power plants 5 Solar power plants 6 Wind powered plants 7 Geo-thermal power plants 8 Bio-mass power plants 9	B2
		None 10 I don't know 99	B3
B2	Speaking about the impact on the environment (or in other words, pollution) for the power plants you know, give a mark between 1 and 5, according to how less pollutant they are.	Hydropower plants -------- Coal fired plants -------- Gas fired plants -------- Oil fired plants --------	B3

	(Show Scale B1 and List B1)	Nuclear power plants -------- Solar power plants -------- Wind powered plants Geo-thermal power plants ----- Bio-mass power plants -----	
B3	Scientists believe that global warming is caused by Carbon Dioxide emissions so which electric power plants used all around the world produce the most carbon dioxide do you think?	1.---------- 2.---------- 3.---------- I don't know 99	B4
B4	There is only one nuclear power plant producing electricity in Romania. Where is it placed? **(Show List B5)**	Piteşti 1 Bucureşti 2 Cernavodă 3 Drobeta Turnu-Severin 4 Feldioara 5 ---------- 6 I don't know 99	**Section C**

Section **C** (**Nuclear power plants/radiations/radioactive waste disposal**)

No.	Question	Answer	**Next**
C1	Have you ever heard the words "nuclear radiations" or "radioactivity"? *(any of them)*	Yes 1 No 2	C2 C5
C2	Where did you hear about them? **(Show List A1)**	Textbooks 1 Teachers 2 Radio, Tv. 3 Newspapers, magazines 4 Internet 5 Schoolmates, friends 6 Your family 7 Others 8	C3
C3	What "nuclear radiations" means for you? *(Please do not influence!)*	---------- ---------- ---------- ---------- ---------- ---------- ----------	C4
C4	From the listed items, with which are you associating the nuclear radiations? **(Show List C4)**	Nuclear weapons 1 Nuclear power plants 2 Medicine 3 Research 4 Other ---------- None 5 I don't know 99	C5
C5	Have you ever heard the words "radioactive waste" or "nuclear waste"? *(any of them)*	Yes 1 No 2	C6 **C13**
C6	Where did you hear about them?	Textbooks 1	C7

	(Show List A1)	Teachers 2 Radio, Tv. 3 Newspapers, magazines 4 Internet 5 Schoolmates, friends 6 Your family 7 Others 8	
C7	In your opinion, what is the major difference between the common waste (as the garbage) and the radioactive waste? *(Please do not influence!)*	---------- ---------- ---------- ---------- ---------- ---------- ----------	C8
		I don't know 99	C8
C8	Have you ever heard something about repositories for radioactive waste or nuclear waste?	Yes 1	C9
		No 2	**C13**
C9	How much would you be concerned if a radioactive waste repository were built close to your town? **(Use the scale C9)**	Very much 1 Much 2 Medium 3 A little 4 Not at alll 5 I don't know 99	C10
C10	How far from your house should be placed a repository in order do not have an effect on your life? **(Show List C10)**	10000 km 1 1000 km 2 100 km 3 10 km 4 1 km 5 I don't know 99	C11
C11	Let's try to compare the radioactive waste to the classic waste (pollutants from industry or other fields of the economy). In your opinion, which of them are the most dangerous? **(Show List C11)**	Nuclear waste 1 Classical waste 2 Both of them, equally 3 None 4 I don't know 99	C12
C12	In order do not produce an environmental pollution and do not jeopardize the human health, which are, in your opinion, the most important conditions requested for such a repository? **(Show scale C12 and List C12)**	To be built very deep in the earth ---- To be very well isolated by natural and artificial barriers ----- To be permanently guarded ----- To have an automatic surveillance --- To be placed in an unpopulated area - Others_____ I don't know 99	C13

C13	Which of the following dangers could be associated with a nuclear power plant? **(Show List C13)** (*Tick all that apply*)	Radiations released during normal operation 1 Other pollutant released during normal operation 2 Nuclear accident 3 Nuclear explosion 4 Terrorism 5	C14
		None 6 I don't know 99	C16
C14	How severe is the danger from each one? **(Show scale C14 and List C13)** *(Introduce 99 where no response)*	Radiations released during normal operation ☐ Other pollutant released during normal operation ☐ Nuclear acci ☐ Nuclear explosion ☐ Terrorism ☐	C15
C15	In your opinion how likely is it that will happen? **(Show scale C15 and List C13)** *(Introduce 99 where no response)*	Radiations released during normal operation ☐ Other pollutant released during normal operation ☐ Nuclear acci ☐ Nuclear explosion ☐ Terrorism ☐	C16
C16	Which of the following dangers could be associated with a radioactive waste repository? **(Show List C16)** *(Introduce 99 where no response*	Radiations and materials released during operation 1 Water and soil contamination during normal operation 2 Water and soil contamination during accidents 3 Water and soil contamination after thousands years 4 Other pollutant released in normal operation 5 Human or animal intrusion 6 Terrorism 7 Hazards 8 Other …….. 9	C17
		None 10 I don't know 99	**Section D**

C17	How severe is the danger from each one?	Radiations and materials ☐ ☐ ☐	C18

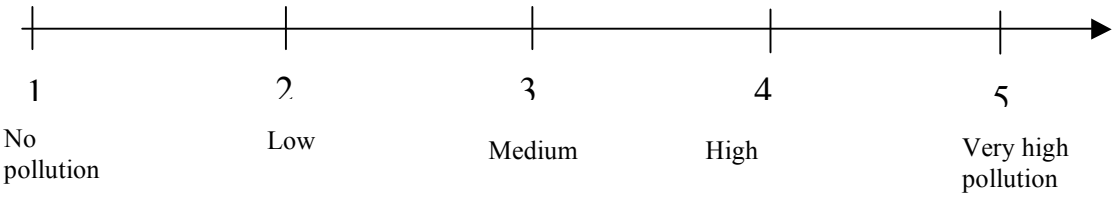
	(Show scale C14 and List C16) *(Introduce 99 where no response)*	released during operation Water and soil contamination during normal operation Water and soil contamination during accidents Water and soil contamination after thousands years Other pollutant released in normal operation Human or animal intrusion Terrorism Natural hazards	
C18	In your opinion how likely is it that will happen? **(Show scale C15 and List C16)** *(Introduce 99 where no response)*	Radiations and materials released during operation ☐ Water and soil contamination during normal operation ☐ Water and soil contamination during accidents ☐ Water and soil contamination after thousands years ☐ Other pollutant released in normal operation ☐ Human or animal intrusion ☐ Terrorism ☐ Natural hazards ☐	Section D

Section **D** **(Demographics)**

D1	Are you?	Boy 1 Girl 2	D2
D2	Year of birth	19……	D3
D3	How many members has your family?	----------	D4
D4	The mother's profession is:	----------	D5
D5	The father's profession is:	----------	Stop

Thank you!

SCALE B2



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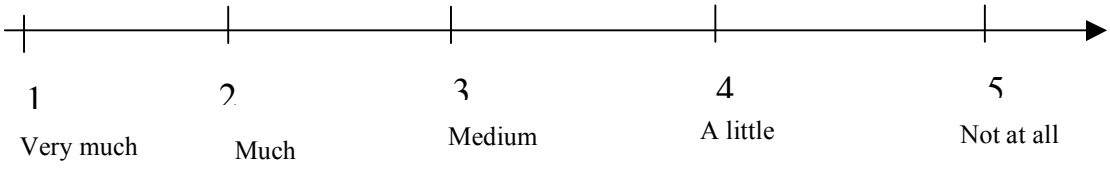

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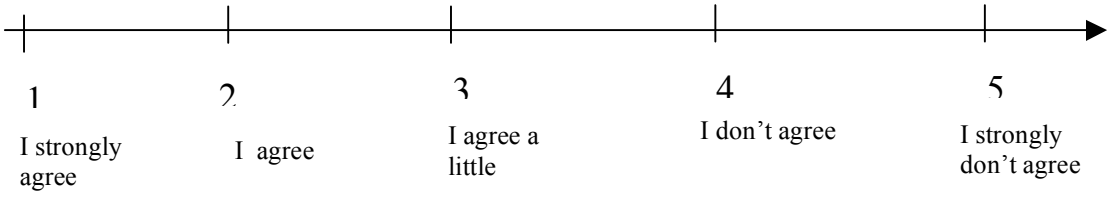

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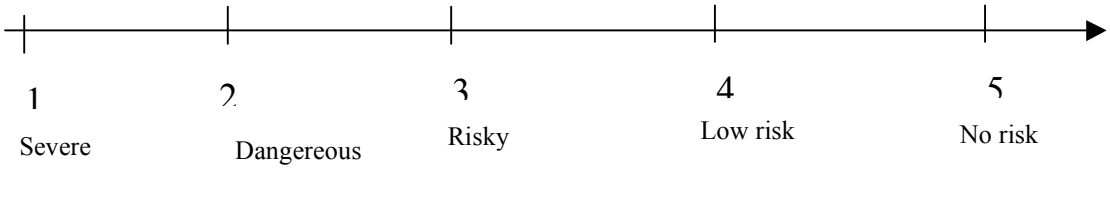
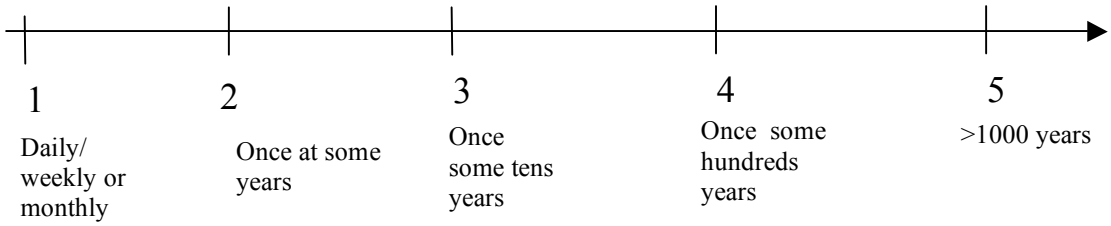


SCALE C15



LIST A1,

Textbooks	1
Teachers	2
Radio, Tv.	3
Newspapers, magazines	4
Internet	5
Schoolmates, friends	6
Your family	7
Others	8

LIST A4

Daily	1
2-3 times per week	2
Weekly	3
Less than weekly	4
Never	5

LIST B1

Hydropower plants	1
Coal fired plants	2
Gas fired plants	3
Oil fired plants	4
Nuclear power plants	5
Solar power plants	6
Wind powered plants	7
Geo-thermal power plants	8
Bio-mass power plants	9

LIST B5

Piteşti	1
Bucureşti	2
Cernavodă	3
Drobeta Turnu-Severin	4
Feldioara	5
----------	6

LIST C4

Nuclear weapons	1
Nuclear power plants	2
Medicine	3
Research	4
Other ----------	

LIST C10

10000 km	1
1000 km	2
100 km	3
10 km	4
1 km	5

LIST C11

Nuclear waste	1
Classical waste	2
Both of them, equally	3
None	4

LIST C12

To be built very deep in the earth
To be very well isolated by natural and artificial barriers
To be permanently guarded
To have an automatic surveillance
To be placed in an unpopulated area
Others_____

LIST C13

Radiations released during normal operation	1
Other pollutant released during normal operation	2
Nuclear accident (=loss of control of the plant resulting in radioactive contamination of surrounding environment)	3
Nuclear explosion	4
Terrorism	5

LIST C16

Radiations and materials released during operation	1
Water and soil contamination during normal operation	2
Water and soil contamination during accidents	3
Water and soil contamination after thousands years	4
Other pollutant releasing in normal operation	5
Human or animal intrusion	6
Terrorism	7
Hazards (earthquake, volcano, asteroids, etc.)	8

ANNEX B-Questionnaire – Post Educational Evaluation (Measurement for Influence of the Nuclear Information in Knowledge and Attitudes)

Sectiunea **A**(**Energie -alternative**)

Nr.	Întrebare	Raspuns
A1	Care dintre centralele electrice din listă există în România? (*Mai multe raspunsuri posibile)*	Hidrocentrale 1 Termocentrale pe carbune 2 Termocentrale pe gaz 3 Termocentrale pe petrol 4 Centrale nucleare 5 Centrale solare 6 Centrale eoliene 7 Centrale geotermale 8 Centrale pe biomasa 9 Nu stiu 99
A2	Fiecare alternativa de producere a energiei are anumite **avantaje**. Precizati pentru fiecare alternativa avantajele conform notatiei de pe lista urmatoare: Regenerabilitate Lipsa emisii CO2 sau alti poluanti Pret mic pentru energia produsa Functionare la nivelul de putere dorit, pe termen lung Sursa concentrata de energie	Hidrocentrale 1 2 3 4 5 Termocentrale 1 2 3 4 5 Centrale nucleare 1 2 3 4 5
A3	Fiecare alternativa de producere a energiei are si anumite **dezavantaje**. Precizati pentru fiecare alternativa dezavantajele conform notatiei de pe lista urmatoare: 1 Neregenerabilitate (se epuizeaza combustibilul) Poluare (CO2+alti poluanti chimici) Riscuri in minerit Deseuri radioactive Functionare dupa capriciile vremii Distrugere echilibru ecologic pe suprafete intinse	Hidrocentrale 1 2 3 4 5 6 Termocentrale 1 2 3 4 5 6 Centrale nucleare 1 2 3 4 5 6

Sectiunea **B** (**Radioactivitate**)

B1	Cu care dintre elementele din listă asociezi radiațiile nucleare? (*Mai multe raspunsuri posibile)*	Natura (Cosmos/Pamant/Soare) 1 Bombe/arme 2 Centrale nucleare 3 Medicina 4 Cercetare 5 Nu stiu 99
B2	Radiatiile nucleare sunt? (*Mai multe raspunsuri posibile)*	Periculoase in doze mari 1 Periculoase in orice doza 2 Folositoare in medicina, industrie , etc. 3 Total nefolositoare 4 Nu stiu 99

Sectiunea **C** (**Centrale nucleare**)

C1	Care dintre urmatoarele pericole pot fi asociate cu o centrala nucleara? (*Mai multe raspunsuri posibile)*	Emisia de radiații în timpul operării normale 1 Emisia altor poluanți în timpul operării normale 2 Accident nuclear 3 Terorism 4 Deseuri radioactive 5 Nici unul 6 Nu ştiu 99

C2	Cât de grav consideri că este fiecare dintre aceste pericole? Acorda o nota între 1 şi 5 gravității pericolului: 1 extrem de grav — 2 grav — 3 asa si asa — 4 putin — 5 deloc grav	Emisia de radiații în timpul operării normale ☐ Emisia altor poluanți ☐ Accident nuclear ☐ Terorism ☐ Deseuri radioactive ☐

Sectiunea **D** (**Deseuri radioactive**)

D1	Daca in apropierea localitatii tale s-ar construi un depozit de deseuri radioactive, cât de mult te-ar deranja acest lucru? (*Un singur raspuns)*	Foarte mult 1 Mult 2 Aşa şi aşa 3 Puțin 4 De loc 5 Nu stiu 99
D2	Care ar fi distanta, intre un depozit de deşeuri radioactive şi casa ta, de la care ai incepe sa te ingrijorezi? (*Un singur raspuns)*	1000 km 1 100 km 2 10 km 3 1 km 4 Nu ştiu 99
D3	Încearcă să compari deşeurile radioactive cu cele clasice (poluanți produşi de către industrie şi alte sectoare ale economiei). In opinia ta care dintre deşeuri sunt mai periculoase? (*Un singur raspuns)*	Deşeurile nucleare 1 Deşeurile clasice 2 Ambele 3 Nici unele 4 Nu ştiu 99
D4	Pentru ca un depozit de deşeuri radioactive sa nu polueze mediului si sa nu afecteze sanatatea populatiei un depozit trebuie să îndeplinească nişte condiții. Precizează cât de importantă este fiecare condiție din listă, după parerea ta. 1 Foarte Important — 2 Imp. — 3 Asa si asa — 4 Putin — 5 Deloc imp.	Sa fie la mare adancime ☐ Sa fie izolat de mediu prin bariere naturale si artificiale ☐ Sa fie pazit permanent ☐ Sa fie intr-un loc nepopulat ☐

D5	Care dintre urmatoarele pericole le poți asocia cu un depozit de deşeuri radioactive? (*Mai multe raspunsuri posibile)*	Emisia de radiații în timpul operării normale 1 Contaminarea apei si solului în timpul operării normale 2 Contaminarea apei si solului în timpul accidentelor 3 Contaminarea apei si solului după sute de ani 4 Intruziune umana 5 Terorism 6 Catastrofe naturale (vulcani, cutremure, etc.) 7

D6	Cât de grav consideri că este fiecare dintre aceste pericole? Acorda o nota între 1 şi 5 gravității pericolului: 1 — 2 — 3 — 4 — 5 extrem grav asa si putin deloc de grav asa grav	Emisia de radiații în timpul operării normale ☐ Contaminarea apei si solului în timpul op. normale ☐ Contaminarea apei si solului în timpul accidentelor ☐ Contaminarea apei si solului după sute de ani ☐ Intruziune umana ☐ Terorism ☐ Catastrofe naturale (vulcani, cutremure, etc.) ☐

Sectiunea **E** (**Statistici)**

E1	Baiat Fata	1 2
E2	Din cate persoane e compusa familia ta?	
E3,4	Profesia mamei: Profesia tatalui:	---------- ----------