

## **Information Strategy of Nuclear Training Center Ljubljana in the Area of Radioactive Waste Management - 8250**

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### **ABSTRACT**

Slovenia has plans to build a repository for low- and medium-radioactive waste by 2013, the location in the very neighborhood of nuclear power plant is almost chosen, but the final approval hasn't been granted yet. The main obstacle is public opinion. Public information activities are therefore vitally important. One of the most important players in this area in Slovenia is Nuclear Training Center in Ljubljana. Though its main task is training of nuclear professionals, it has a significant role in dissemination of knowledge about radioactivity and nuclear technology also among general public.

Public information is focused on youngsters. Almost one half of every generation of schoolchildren in Slovenia visits the Information center yearly and in May 2007, we have celebrated the 100,000th visitor since its opening. Live lectures, exhibition, publications and laboratory demonstrations are offered. To measure the opinion of youngsters about nuclear power and get a feed-back for our activities about 1000 youngsters are polled every year since 1993 using the same basic set of questions.

The paper describes the information strategy, types of lectures and information materials, permanent exhibition with the most important exhibits. Furthermore, the results of yearly polls of our visitors and comparison with relevant Eurobarometer polls are presented.

### **INTRODUCTION**

Slovenia has one nuclear power plant, a Westinghouse PWR that is located in Krško in southeastern Slovenia, close to the border with Croatia. Slovenia and Croatia share the ownership of the plant 50:50. NPP Krško started commercial operation in 1983, in the year 2000 the steam generators were replaced and last year the turbine was replaced. Both these upgrades increased the output power to current 696 MW<sub>e</sub>.

Despite more than two decades of operation of nuclear power plant, Slovenia still does not have a final repository for any type of radioactive waste. So far the operational waste from the nuclear power plant and the spent fuel is stored at the NPP site, and waste from all other sources (industry, medicine and research) is stored at the interim storage facility on the location of research reactor TRIGA in the vicinity of Ljubljana.

The first attempt to find a location for a low and intermediate radioactive waste was in the years 1990 to 1993 and it was based exclusively on technical exclusion criteria. Socially, this attempt could be characterized as a typical DAD (Decide-And-Defend) approach and it failed completely, mainly because of lack of public participation.

In the following years the Slovenian Agency for radioactive waste management did not actively search another location, but the emphasis of its activities was on public acceptance. During this period the Nuclear Training Center Ljubljana got actively involved in the information activities on the topic of radioactive waste [1].

A new search for radioactive waste repository started around 1999. This search used so called "mixed mode" approach, i.e., a combination of technical screening and volunteer sitting. This approach started with cabinet investigations and rough technical screening of the territory, followed by strong public involvement and the negotiations with the local communities. Probably the most important issue in this aspect was a financial compensation for the hosting community (2.3 million € when the repository will be operational), but public information was nevertheless a critical element of activity also during this period.

In 2005, the Agency for radioactive waste management received eight applications from local communities, but soon this number decreased to three and today only two communities remain candidates for the repository. Both communities are in the very neighborhood of the Nuclear power plant Krško. It is planned that the site will be chosen next year but because we will have parliamentary elections in the fall of 2008, it might well happen that the decision will be taken after the elections, i.e., sometimes in 2009. The original target year for the start of operation of the repository is 2013, but if the decision about the site is postponed, the construction might be delayed, as well.

## **NUCLEAR TRAINING CENTER LJUBLJANA**

The Nuclear Training Center Ljubljana was established in 1989 as a organizational unit of the Jozef Stefan Institute, leading research institution in the country. The main mission of the Nuclear Training Center is training of control room operators and other technical staff of the nuclear power plant, as well as specialists from other organizations (regulatory body, technical support organizations, Agency for radioactive waste management) in the area of nuclear technology. In the year 2000 a full-scope simulator was installed in Krško NPP, and since then only the first, theoretical part of the training takes place in the training center in Ljubljana. Furthermore, we organize also courses in radiation protection and international courses in collaboration with the International Atomic Energy Agency, European Union, U.S. Nuclear Regulatory Commission, Department of Energy and some others.

In addition to training of professionals, we have at our premises also an information center about nuclear technology. The geographically favorable location in the center of the country, pleasant local environment, neighborhood of scientific facilities, ample parking space and good transport connections are quite attractive for groups from everywhere in the country. Public information activity started in 1993 and in May 2007 we welcomed the 100,000th visitor in the nuclear information center. In the last years we receive around 8000 visitors per year. As our visitors are mainly elementary and high school pupils, we can estimate that almost one half of each school generation visits our information center. The information center is based on a permanent exhibition in the basement of our building, as well as a large lecture room where most of the groups listen to a lecture before visiting the exhibition.

## THE INFORMATION STRATEGY

There are five mainstays of our public information and communication activities: lectures, permanent exhibition about nuclear technology, laboratory demonstrations, publications and a web page.

Our visitors can choose between three lectures. The first one is mainly about nuclear power plant technology and importance of nuclear power for global climate and security of supply in today's world. Nuclear waste is included in this lecture as a necessary effect on harvesting nuclear energy. The second lecture is mainly about radioactivity as a natural phenomenon and radioactive waste as a by-product of human activities. The topic of the third lecture is nuclear fusion: the physics, the technology (ITER) and the prospects. Here again, radioactive materials are mentioned in the context that the overall activity and especially the half-life will be significantly lower than in the case of nuclear fission, but even in the quite distant fusion technology we will have to deal with radioactive waste. Because our visitors range from elementary to high school, sometimes college, the lectures are designed to be highly adaptable.

We have also prepared several workshops for youngsters, special courses for teachers and twice the International summer school for BEST (Board of European Students of Technology) members.

The exhibition on almost 500 m<sup>2</sup> basement space consists of information panels, exhibits, instructive computer games, mock-ups etc. Visitors show the most interest for the "human powered electricity" (a bicycle connected to an alternator powering - without any simulation - an increasing number of light bulbs). Other important exhibits are: a barrel for the radioactive waste disposal, mockups of surface and underground radioactive waste disposal repository, an interactive map of all NPPs around the world, the mockup of NPP Krško control room in 1:2 scale, a mockup of NPP Krško reactor pressure vessel, a mockup of fuel element, a complete never used core barrel of the TRIGA reactor, and several types of radiation protection equipment. More interested visitors are offered a tour of the research reactor TRIGA and/or the interim storage facility that is also on our location.



**Fig. 1: The exhibition at Nuclear information center Ljubljana**

Adjacent to the exhibition is the radiation demonstration laboratory, where we show simple experiments with  $\alpha$ ,  $\beta$ , and  $\gamma$  radiation, their range, shielding etc. The most impressive is the

"sucking radiation from the air", i.e., using a vacuum cleaner to collect radon daughters on a filter paper and measuring its activity with a Geiger counter. These demonstrations are usually the highlight of the visit, because the visitors can see that radiation is natural, that it is around us, and that we can be protected from intensive radiation sources (e.g., radioactive waste) by shield and distance.



**Fig. 2: The radiation demonstration laboratory**

Every visitor can take also information materials. The most appreciated is the 64-page bilingual Mini Encyclopedia of Nuclear Energy, which is actually a paper version of the complete exhibition. It is quite popular among the youngsters because it is a good source of information for homeworks and projects. A dozen information leaflets about radiation and radioactive waste were also published, as well as mockups of fuel pellets, indicating their energy content.

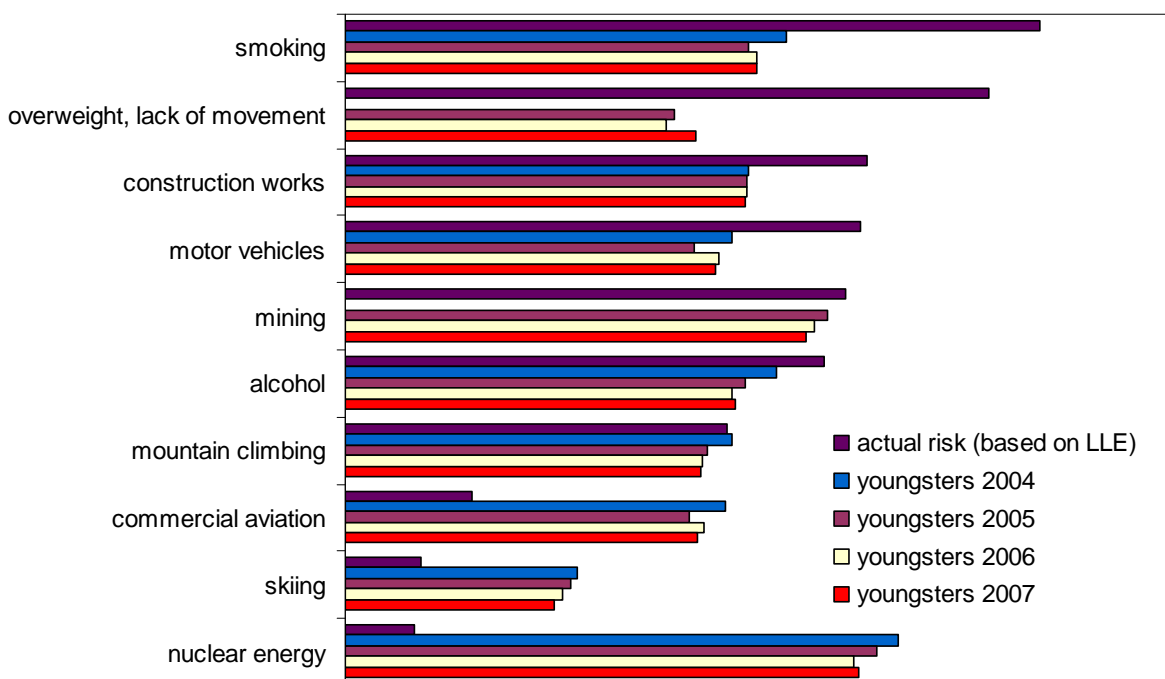
An important segment of our information activity is also web page, [www.icjt.org](http://www.icjt.org). It contains basic information about nuclear energy, pictures of the exhibition, copies of information panels, invitation to visit the information center, and answers to frequently asked questions. We receive new questions quite often, and readers are directed to an already published similar question, or a new answer is included in the FAQ set.

## PUBLIC OPINION POLLS

During springtime, when we get the most visitors, some 1000 visitors are polled [2]. Since the establishment of the Information Center in 1993 we use several basic questions derived from the early public opinion research of the Faculty of Social Sciences in Ljubljana twenty years ago [3] and supplementing them as needed. Polling of the youngsters is done strictly at the beginning of the visit (before any information is conveyed) to obtain unbiased opinions based on the knowledge from everyday life. The poll is not representative for the general public of Slovenia. Youngsters may have more relaxed attitudes toward different risks than adults but their positions reflect opinions they hear in their families and media information. The trends that we monitor over the years are more indicative than absolute numbers.

Results of the 2007 poll are based on 1031 questionnaires. They are presented in the form of graphs and comments to the questions in the questionnaire. Examples of questions and comments are divided into groups, as indicated by the titles of subheadings.

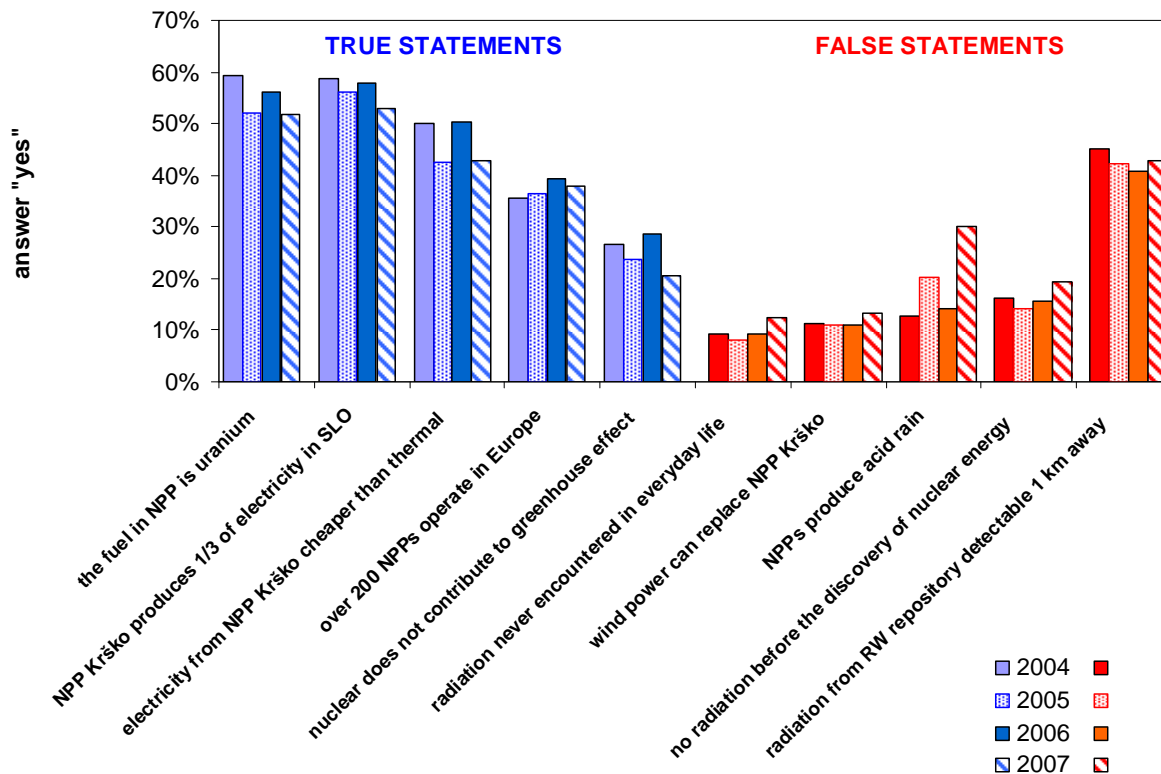
### General questions about risks, environment and acceptability



**Fig. 3: Ranking of human activities by perception of risk**  
(Actual risk based on calculated Loss of Life Expectancy)

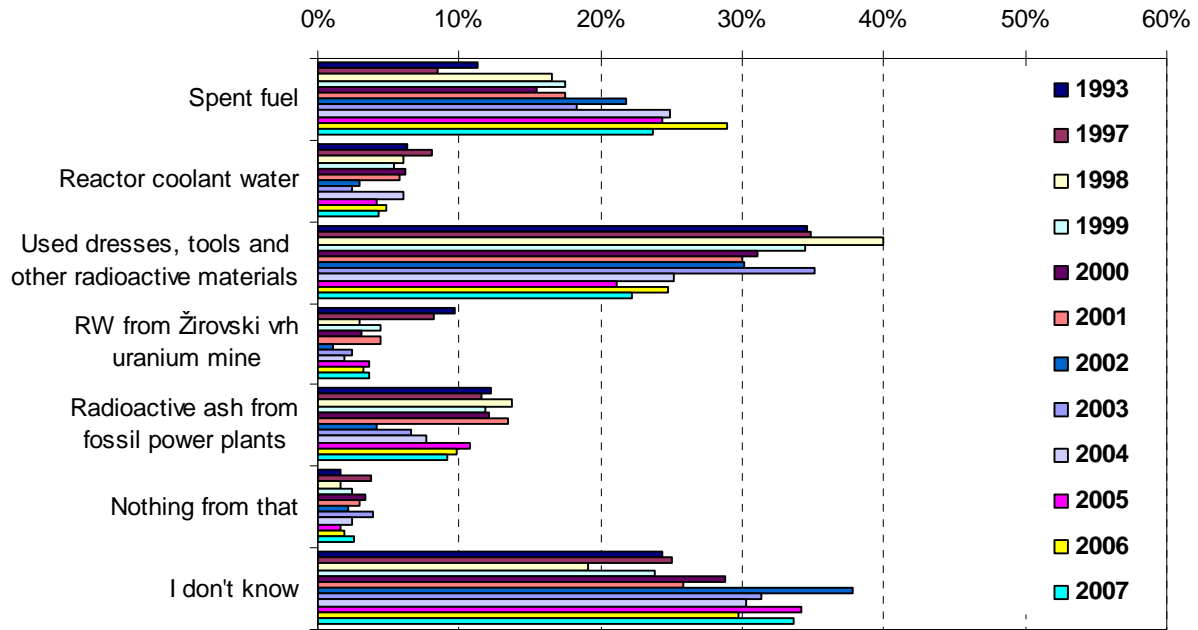
Youngsters in Slovenia consistently rate nuclear energy as the greatest risk among human activities that span a wide range of statistically measured risks. This perception is similar in most countries, but it is surprising that risks like smoking, alcohol, traffic etc. are rated reasonably well as compared to risks based on Loss of Life Expectancy [4].

## Understanding some basic facts of nuclear energy, radiation and radioactive waste



**Fig. 4: Agreement with the statements**

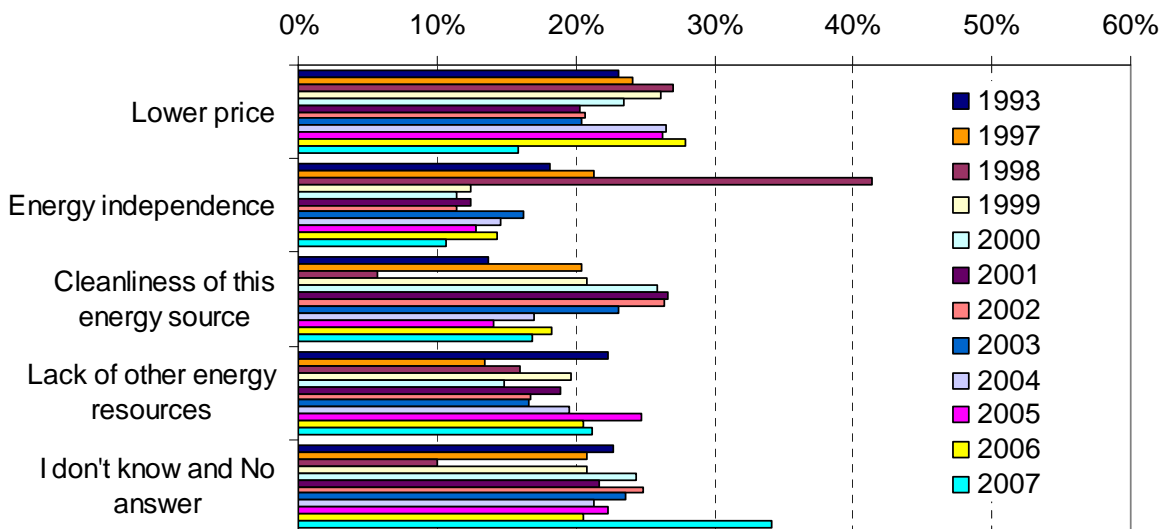
The results of the poll are disappointing. Some 40% of the respondents believe that radiation from RW repository can be detected 1 km from the site, just 20% of the respondents know that nuclear energy does not contribute to the greenhouse effect. There is practically nothing about nuclear energy and radioactivity in the elementary school curriculum in Slovenia. Beneficial environmental effects of nuclear energy and facts about radiation are the least understood because they never appear in the media (in positive sense) which covers mostly political, economical or nuclear safety related dimensions of NPP Krško.



**Fig. 5: What will be stored in the LLRW repository? (One answer allowed)**

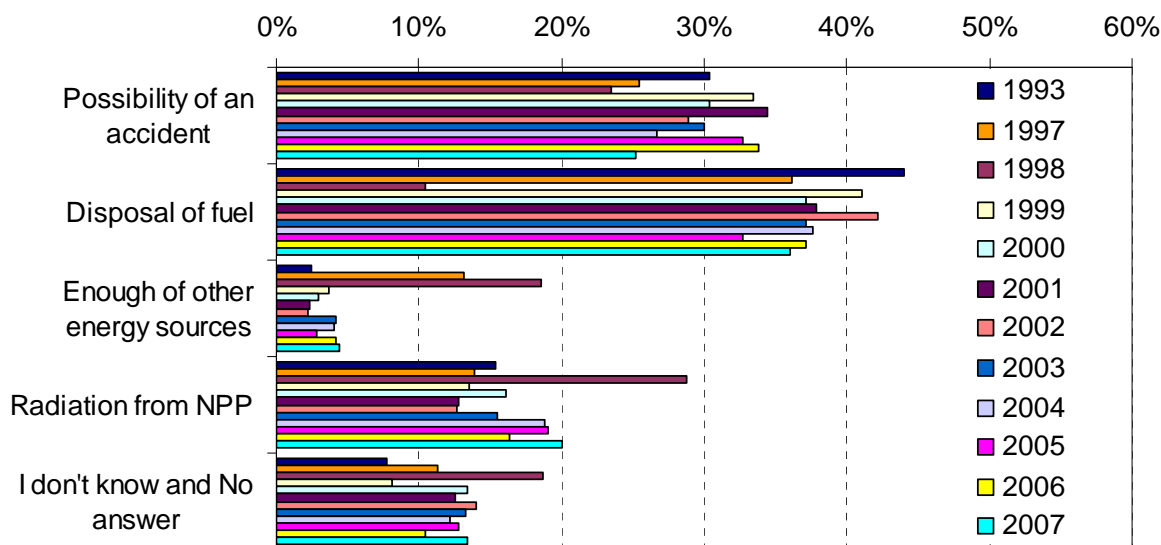
In the last few years the sum of answers for “spent fuel” and “used dresses, tools and other radioactive materials” is almost constant at about 50%. This is an indication that roughly half of the respondents are vaguely aware that it is mainly radioactive waste from the nuclear power plant that will find its place in the repository. About one third of respondents don’t know and the share of correct answers in the last years is disappointingly low.

**Opinions about production of nuclear electricity in Slovenia**



**Fig. 6: What are the reasons for the use of nuclear energy? (Only one answer allowed)**

The amount of scatter from year to year for this question is quite high and it is hard to see any definitive trend. None of the options really stands out except “Energy independence” in 1998 (for political reasons) and “I don’t know” in 2007.



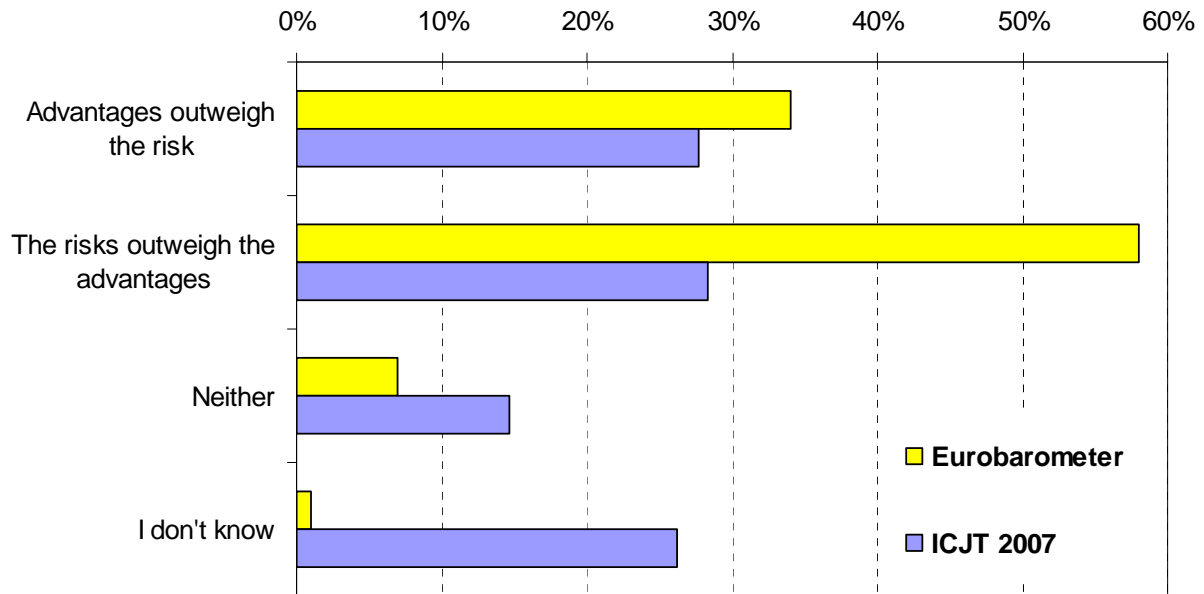
**Fig. 7: What are the reasons against the use of nuclear energy? (One answer allowed)**

Youngsters see disposal of spent fuel and possibility of an accident as main reasons against nuclear energy. This corroborates the result from Fig. 2 where 40% of the respondents think that radiation is detectable 1 km from a radioactive waste repository.

**Comparison with Eurobarometer poll for Slovenia**

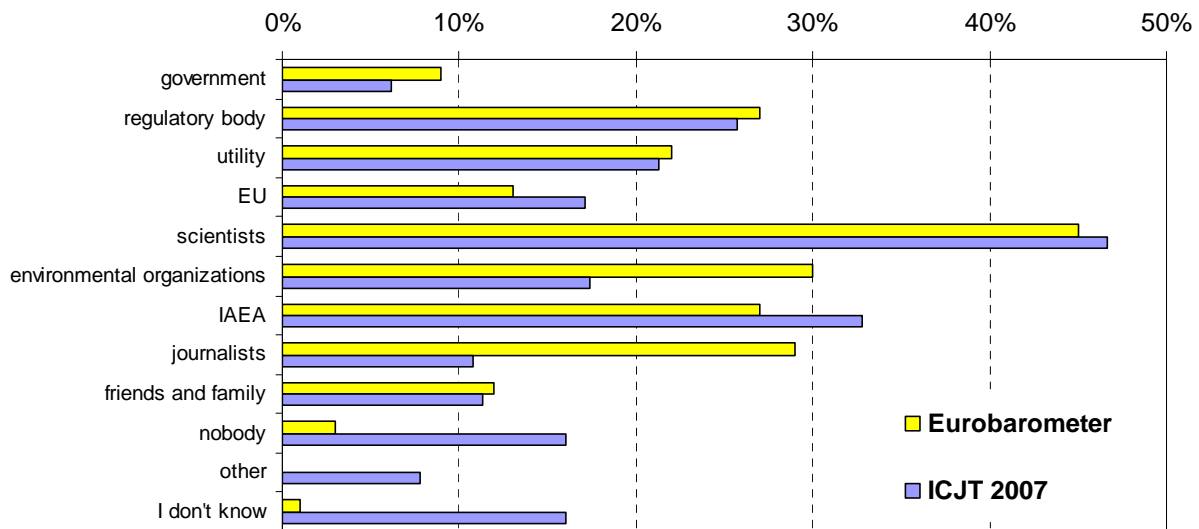
For the year 2007 poll we added two questions from the Eurobarometer 2006 poll [5] to our standard questionnaire. The goal was a comparison of the Eurobarometer poll for the general public with the youngster’s poll.





**Fig. 8: What is your general opinion about nuclear energy?**

The results of Nuclear training center (ICJT) poll clearly deviate from the Eurobarometer 2006 results for Slovenia. Youngsters in Slovenia have a more moderate view of the risk of nuclear energy than the general public in Slovenia according to Eurobarometer. These and some other results of Eurobarometer are puzzling because actual public acceptance in Slovenia seems to be appreciably higher.



**Fig. 9: Which 3 of the following would you trust most to give you information about nuclear safety?**

Ignoring the answers “nobody” and “don’t know”, the most notable difference between the Eurobarometer 2006 and ICJT 2007 poll is that the youngsters trust environmental organizations and journalists appreciably less than the general public trusts them.

## CONCLUSIONS

Nuclear training center Ljubljana is an important player in informing public on nuclear energy and radioactive waste issues. The mainstays of information strategy are lectures, permanent exhibition about nuclear technology, laboratory demonstrations, publications and a web page. Almost one half of one school generation visits the information center yearly.

An opinion poll is performed every year among visitors before any information is conveyed. The main results of the poll are:

- Risk of nuclear energy is overrated as compared to risks in everyday life.
- Comprehension of nuclear energy, radiation and radioactive waste is poor and even seems to be getting worse from year to year. The underlying reason is probably not just the deficient school curriculum but also a waning interest in natural sciences and technology among the youngsters.
- Disposal of spent fuel and possibility of an accident remain major obstacles against the use of nuclear energy.
- The comparison between the Eurobarometer and ICJT poll shows that youngsters see less risk in nuclear energy and trust environmental organizations and journalists less than the general public.

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