

STUDENT PERCEPTIONS OF THE FUKUSHIMA NUCLEAR EMERGENCY

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ABSTRACT

The following investigation is described based on the information consulted on the events generated about the accident at the Fukushima nuclear power plant. It is worth mentioning that the research is a qualitative approach, for the development of this work, students belonging to the Autonomous University of Nayarit, located in the city of Tepic, Nayarit, Mexico, were also interviewed, the objective is to know the opinions given and the perception social of the students, that is to say, they present their own ideas that arise from the interviews, giving expressions about the problem that afflicts the country of the rising sun, since, this shows that human error and the force of nature are evident at any time causing irreparable damage within living environments. However, among the solutions proposed is consultation with governments for the implementation of environmental awareness campaigns towards society, in addition, having security protocols and using other types of mechanisms to successfully face this type of contingency. Thus, it is the responsibility of all nations to contribute with a solution to these types of disasters caused by nature and to know that these types of accidents are latent at any time and place.

Keywords: Contingency, environmental education, Fukushima, pollution, social perception.

INTRODUCTION

It is worth mentioning that Japan has 17 nuclear power plants such as Fukushima I or better known as Fukushima Daiichi. Each plant has a different number of nuclear reactors, making a total of 58 reactors (Azorín, 2011).

A nuclear reactor is essentially a boiler whose heat comes from nuclear reactions. The generated water vapor is transmitted through pipes to a turbine coupled to an electric generator (Morones, 2012). In the 80s and 90s new plants were built, mainly in China, Japan and India, in Japan it was shown that construction can be done in less than four years and on budget (Comisión Federal de Electricidad [CFE], s.f.).

From the above, the accident at the Fukushima nuclear plant, which occurred on March 11, 2011, was a direct consequence of a 9.0 magnitude earthquake and subsequent tsunami, which affected all of Japan and in particular its northeast area, the region of Tōhoku. A cascade of equipment failures in several units of this plant led to the release of radioactive material in the atmosphere and in the sea (Segura, 2019).

As a consequence, radioactive material was released into the atmosphere for days. The iodine and cesium radionuclides emitted from the damaged Fukushima reactors were transported through the Pacific Ocean, crossed North America, and subsequently reached Europe through the Atlantic Ocean (León, s.f.).

Thus, where the unused Fukushima Daiichi nuclear power plant is located, thousands of workers face extreme challenges. The site is still heavily contaminated with radioactivity, direct investigations are ongoing into the interior of the reactor buildings and damaged facilities, and it is impossible to know either the location of any molten fuel part or the state of the reactor (Greenpeace España, 2016).

Fukushima nuclear power plant

Fukushima Daiichi was built in 1971, this nuclear power plant is one of the 25 largest in the world. Its six reactors are numerically denominated from 1 to 6 (Morones, 2012). The Fukushima Daiichi nuclear power plant is located in the city of Okuma, in the Fukushima district in north central Japan on the eastern side of the island (Azorín, 2011), as seen in Figure 1.



Figure. 1. Geographic location Fukushima nuclear power plant, Japan
Source: self made

Likewise, Fukushima disaster took on quite a different appearance from other natural disasters. As described below in detail, the Fukushima disaster has several unique features compared with natural disasters, including an unclear relief process, invisible effects, uncertainty regarding information, distrust towards various experts such as the authorities, and ambiguous losses (Maeda, et al., 2018).

The cause of the Fukushima nuclear power plant accident

The earthquake of March 11, 2011 caused a vibratory movement of the earth that shook the plant's structures, systems and components. A series of tsunami waves followed, one of which flooded the site. The earthquake and related tsunami affected multiple units at the Fukushima Daiichi Nuclear Power Plant (IAEA, s.f.).

When the earthquake occurred, the Fukushima Daiichi plant, like many others in Japan, detected the earthquake and the nuclear reaction stopped in all the reactors that were in operation. The plant reacted correctly to the power outage that followed with the activation of the auxiliary electricity generation systems, which kept the reactors cool until the tsunami washed them away an hour later (Sánchez, s.f.). It is worth mentioning that, the magnitude of the earthquake was 9.0, the greatest in Japan's recorded history. Within seconds of the earthquake, the reactor was shut down in all three operating units with the insertion of control rods (Sugimoto, 2014).

On March 14, 2011, a supposedly more intense hydrogen explosion occurred in unit 3, associated with the steam depressurization, which was accompanied by a fire and could have caused damage to the pressure-suppressing pool (Safety and Environment, 2011). Subsequent

studies of the area have found genetic, biological and morphological aberrations in plant and animal specimens in the surrounding forests (Segura, 2019).

In addition, in October 2015, the results of two studies on children from Fukushima were reported two days apart; one found no detectable internal radiation contamination, while the other found an increased risk of thyroid cancer (Leppold, Tanimoto, and Tsubokura, 2016).

However, in Fukushima prefecture, the number of displaced residents was 86,308 in March 2011, and peaked at 99,205 in June 2011. Additionally, the number of residents who voluntarily moved from Fukushima Prefecture increased from 38,896 in March 2011 to 62,831 in 12 months (Hasegawa et al., 2016).

METHODOLOGY

The following research is of a qualitative type and is defined as the research that produces descriptive data: people's own words, spoken or written, and observable behavior (Quecedo and Castaño, 2002). In other words, they are concerned about the context of events, and focus their inquiry on those spaces in which human beings are directly involved and interested, evaluate and experience (Martínez, 2011).

Study area

To carry out this work, students from the Autonomous University of Nayarit, located in the city of Tepic, Nayarit, Mexico, were interviewed about the problems that Japan has been experiencing in recent years regarding the nuclear disaster caused by the collapsed reactor in the prefecture of Fukushima, Daiichi. It is worth mentioning that the city of Tepic is located in the state of Nayarit, Mexico. The state borders Sinaloa and Durango to the north, Durango, Zacatecas and Jalisco to the east, as seen in Figure 2 (Aregional, 2009).

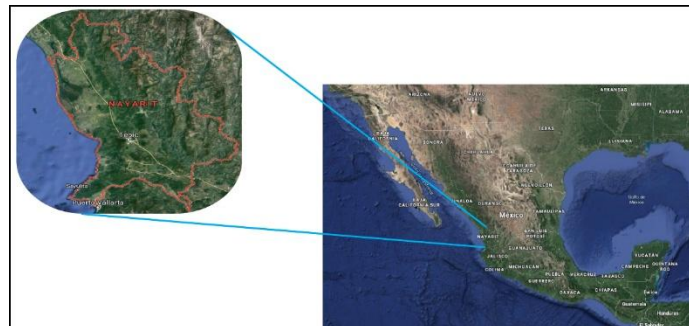


Figure 2. Geographical location of the city of Tepic
Source: self made

Problem Statement

After nine years of the Fukushima accident, are the inhabitants of the west ready to confront such an environmental contingency? Although a great deal of effort has been devoted to nuclear reactor safety issues, nevertheless, very important risk factors remain, such as the “human factor”, and in general, the lack of adequate scientific preparation. technique, difficult to achieve, given the complexity of the systems involved (Garzón and Cavero, 2011). Managing to cause great damage to the environment, and to the human being over the years.

RESEARCH OBJECTIVE

The objective of this investigation starts from two aspects, the first is to know the perception that is had by the students who live in the West in relation to the accident at the Fukushima nuclear power plant, Japan, on March 11, 2011, a cause of an earthquake, it is true that after nine years, every day the nuclear reactor advances with its task that is radioactive contamination, unaware of the problems that it may contract in the future in environmental and social issues, if this is not ended problematic.

The second aspect, they present their own ideas that arise from the interviews, giving opinions about the problem that afflicts the country of the rising sun, from the student's own perspective, since, undoubtedly, it is the responsibility of all nations, contributing with a solution to this type of environmental disaster.

Selection of the Sample

To determine the sample, the non-probability sampling method was used for convenience, that is, it is the one with which the sample units are selected according to the convenience or accessibility of the researcher. In each case, the sampling unit or element is self-selected or has been selected based on its easy availability (Tamayo, 2001). Likewise, the sample taken for this investigation was 41 students.

Gathering Information

For the re-election of the information, a structured questionnaire with open questions was applied, therefore, the questionnaires with open answers provide a wealth of information that is useful especially in the initial phases of a study, the use of this type of questions would be related to the control and filtering of the information traditionally collected (Álvarez, 2003).

Processing of Information

For the process of the analysis of the interviews, the Atlas.Ti program was used, where the steps proposed by González (s.f.) are addressed, for the management and treatment of the collected data.

- The interviews were read and selected in the form of quotations and / or those phrases or words that draw attention or illustrate an idea raised to said problems.
- Likewise, so-called citations must be coded, that is, citations must be grouped into sets or ideas, which will be named as codes and / or categories.
- In this way, once the citations are grouped, the codes / categories relationship is carried out, so that the research results are finally presented.

Once the information has been collected and organized, a report is presented for the corresponding interpretation.

RESULT AND DISCUSSION

Once the questionnaire was applied to the 41 students, the discussion of the results obtained by means of a report is given, where the following codes and / or categories are available, which derive from the opinions given by the interviewed students, presenting a code cloud, created from the Atlas program. Ti, as seen in figure 3.



Figure 3. Code cloud

Source: Own elaboration from the Atlas. Ti program

It is worth mentioning that the largest words are those that predominate with the greatest emphasis on the topic addressed in this research, having the guidelines of the proposals to present with greater importance and priority. In this way, their own ideas and points of view are addressed, giving some possible suggestion or opinion to the problem that distresses the Asian country, in addition to knowing the student's perception regarding the accident at the Fukushima nuclear power plant.

Security protocol

Thus, a protocol, in general terms, is defined as an agreement between professionals who are experts in a certain subject and in which the activities to be carried out before a certain task have been clarified (Basantes et al., 2017). Being more explicit, Fuente (2010) maintains that the "Protocol is defined as a set of norms, traditions, customs and techniques that society and individuals have for the organization of their acts, their coexistence and their internal and external relations".

However, the code and / or previous category is the most predominant answer, obtained through the questionnaire applied to the students for said research, it is worth mentioning that the answers obtained are based on the perception that each student has about the problem caused for the Fukushima Nuclear Reactor, below are the answers on the importance and benefits of implementing safety protocols.

"... it is important that they bear in mind that this accident may occur again and be more cautious since it affects us all as a planet ..."

"... evict all the inhabitants of that place, so that their lives are safe and out of danger..."

"... It would be to carry out an inventory and monitor the waste generated, comply with the regulations so as not to further harm the environment ..."

"... seek help from your government as this pollutes and also hurts the human beings who live there ..."

"... looking for more help to other countries because it is something that if they don't fix it soon it can affect us all ..."

"... ask for help to end this contamination, do a project ..."

"... the plan to counteract this non-reversible damage would be for them to close these types of companies which harm the planet and rearrange personnel in other areas where they can be developed ..."

"... change the silver of Fukushima energy elsewhere that does not do much damage to the environment ..."

In accordance with the opinions given, it is observed that within the suggestions it is disclosed that to prevent future accidents it is necessary to carry out and implement safety protocols, which may be necessary for the protection of human beings and the environment.

New forms of energy

Also, following the order of the cloud of codes, the following category is presented: new forms of energy, energy sources can be classified in various ways according to the criteria used, the broadest classification of which is renewable and non-renewable. The former is those that are consumed at a faster rate than nature can replace them, the latter are sources that can either be replaced when generated by cyclical processes of variable periodicity or are inexhaustible (Posso, 2002). In this way, there are the opinions made by students that the best option to counteract this type of nuclear accident is the search for new forms of energy or to permanently remove the use of nuclear plants.

"... use other ways of seeking energy ..."

"... in order to counter the damage that is already present, the consumption of non-recyclables should be reduced or reused to carry out cleaning campaigns ..."

"... find the best way to shut down and replace nuclear energy, thus permanently shutting down plants ..."

"... replaced by friendly alternative energy sources ..."

"... wind, hydro and solar energy sources ..."

"... reduction of nuclear plants ..."

Cooling system in nuclear reactors

Within the opinions given by the students, it focuses on the use of light water reactors, that is, this type of reactor is mainly used as a very intense heat source to produce other types of useful energy. There are several types of power reactors, the most used being the so-called light water reactors, a name they receive for being cooled and moderated with this fluid (Instituto Nacional de Investigaciones Nuclear, s.f.).

Likewise, the pressurized water reactor is the most widely used type of reactor in the world and has been developed mainly in the United States, R.F. Germany, France and Japan. In this reactor, water is used as a moderator and as a coolant. Cooling water circulating under high pressure carries the energy generated in the reactor core to a heat exchanger (Foro nuclear, 2008).

Therefore, the opinions given by students on the use of water-based cooling are presented.

"... cool the reactors ..."

"use liquid hydrogen or some other substance that helps the cooling ..."

"... to use the water in 200 tons to cool the reactors; it is their way in which they decided to solve it, now in this I believe that 70% of the planet earth is water ..."

"... how to use salt water ..."

"... put some refrigerating chambers in the guiding plant ..."

System to process contaminated water

Within the criteria and knowledge of the students, a proposal was made for a system to process contaminated water, which was implemented in Japan to cope with such an environmental contingency. The last major leak occurred on February 19, 2014, when about 100 tons of radioactive water leaked from one of the tanks (Figure 5). The leak was discovered six hours after starting, so it seems that the water could be prevented from reaching the sea (Castejón, 2017).



Figure 5. View of the radioactive water storage tanks

Source: self made

On February 18, 2016 the Tokyo Electric Company (TEPCO) had increased the storage tank capacity to 625,100 tons, indicating an additional capacity of 12,000 tons added to the storage tanks. A total of 1,106 water storage tanks are currently in place, with 20 additional tanks planned for installation in 2016 (Greenpeace España, 2016).

In this way, the opinions given by the students are presented to the problem mentioned above.

"... high performance system to process highly contaminated water ..."

"... reusing the water by means of water treatment plants ..."

"... substance that counteracts them ..."

"... treatment and look for other ways to look for energy ..."

"... Find an alternative that can replace water and even if it is possible to shut down the nuclear power station ..."

Therefore, the implementation and installation of pipes where the water contaminated by the reactor was diverted were covered with thermal material, this in order to use pumping systems that guarantee the necessary help to reduce such magnitude of the problem. In addition, storing contaminated water may be an option, in addition to draining water, to create another measure that can eliminate the use of water and, in addition, store radioactive water to prevent it from damaging the environment.

As well as the good intentions of the competent authorities are reflected, the problems of radioactive contamination are presented, causing great damage to ecosystems as well as to society itself, which represents a serious danger to the planet.

However, the Tokyo Electric Company (TEPCO) and the Japanese authorities did not react in time and underestimated the problem of radioactive water leakage. Tens of thousands of tons of radioactive water have already been dumped into the ocean without the measures taken being able to prevent it (Castejón, 2017).

From the above, one of many environmental problems arise due to the collapsed reactor.

The alteration and destruction of the habitat, the effects on human health, eutrophication, the decrease in fish populations and other living resources, changes in the flow of sediments, are aspects linked to the fixed and diffuse sources of the contamination produced by activities that take place on land and that due to the effect of water catchment that the hydrographic basins have, generate concentrated effects in the mouths of the rivers in the sea and the surrounding coastal areas (Escobar, 2002).

Therefore, the opinions reflected in the interview applied to the students are presented, this being their responses to such effect of the contamination produced by such contingency.

"... waste to the sea ..."

"...natural disaster..."

"... kill the marine ecosystem ..."

"...environmental pollution..."

In this way, it was possible to observe the importance of conserving such ecosystems on our planet and take the necessary measures to the contingencies that arise from natural disasters causing such effects on one's life.

CONCLUSION

It is possible to conclude that the investigation throws an approximation to certain proposals and opinions given by the students interviewed, it is true that the perception of these people is not far from the reality of what happens in Japan, especially what happens in the nuclear power plant of Fukushima.

This shows that natural events are latent at any time causing irreparable damage, within the proposed solutions, speaking with governments for the implementation of environmental awareness campaigns and having an adequate education of society to disasters and contingencies both natural and created by man, being very useful in all aspects, having security protocols and using other types of mechanisms to successfully face this type of contingency.

Likewise, implementing plants with safety protocols and resistance capacity in search of not putting human beings or ecosystems at risk, probing a clean energy alternative and replacing nuclear energy, from the above, this work is aimed at people in general, they are interested in topics about the environmental contingencies generated by this type of nuclear energy.

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