Grey Literature Matters: The Role of Grey Literature as a Public Communication Tool in Risk Management Practices of Nuclear Power Plants

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Abstract

In 2010 about 60 countries expressed interest to the International Atomic Energy Agency (IAEA) in launching nuclear programs. 29 countries with existing programs are planning to expand their nuclear capacity. With the Three Mile Island, the Chernobyl and Fukushima nuclear accidents it has been shown that the consequences of a catastrophic nuclear accident are huge and therefore adequate risk management is crucial.

The general objective of risk management in relation to nuclear power plants is the planning to minimize the impact of any nuclear catastrophe. Risk communication towards the intended public is a vital part in the risk management approach. The question to be answered in this article is to what extent scientific information is provided by the nuclear industry, responsible governments and ngo's like IAEA as a communication tool in order to keep the public informed as to minimize the risks of a nuclear catastrophe. Is there a "best" option? Differences between countries with existing nuclear programs will be evaluated in their public information policies. The method of the study employs a literature survey and a qualitative evaluation.

Introduction

The issue of the use of nuclear energy is hotly debated in the last fifty years. In 2010, 60 countries expressed interest to the International Atomic Energy Agency (IAEA) in launching nuclear programs. 29 countries with existing programs are planning to expand their nuclear capacity. Despite the Fukushima disaster the IAEA projects a growth from the present 432 operating nuclear power reactors to more than 500 in 2030.[1] Most of the growth will occur in countries that already have operating nuclear power plants, such as China and India.

On one hand there is the promise of an almost inexhaustible source of energy in an age where the demand for energy is higher than ever. On the other hand we have witnessed a reality check: nuclear accidents that have happened at Three Miles Island, Chernobyl and Fukushima.

These events led to the strengthening of public concerns about vulnerability and the heightened awareness of risks on nuclear power. It questions the nature of the relationship between the public perception of risk and the way nuclear organizations deal with risks.

The term risk communication was first used in the United States at the end of the 80s.[2] According to the American Nuclear Regulatory Commission risk communication "is an interactive process used in talking or writing about topics that cause concern about health, safety, security, or the environment."[3] Risk communication according to the US National Research Council can be successful "if it raises the level of understanding of relevant issues or actions for those involved and satisfies them that they are adequately informed within the limits of available knowledge."[4] The focus of this paper is the examination of several conditions under which grey literature is provided by nuclear regulators and industry together with other categories of information constituting a body of knowledge intended to inform the public in the context of nuclear risk communication. Four conditions of nuclear risk communication are considered: the sociological concept of *risk society*, the issue of public awareness, the role of public trust and knowledge in relation to public attitude and nuclear power.

Risk society

In his book entitled *Risk society. Towards a new modernity* the German sociologist Ulrich Beck argues that the developed world finds itself in a transitional phase, evolving from an industrial society towards a risk society.[5] In his view creating some much wealth also means creating risks due to the growing complexity of a technology driven society. The dangers involved concern the effects of modernization and consumption patterns of prosperous societies resulting in risks on different scale and type like those of toxic waste, global warming and nuclear radiation.

In the present situation no scientific agreement or a shared public understanding on the definition of risk exists.[6] In general risk can be defined as: the probability of harmful consequences, or expected loss of lives, people injured, economic activity disrupted (or environment damaged) resulting from interactions between natural or human induced hazards and vulnerable conditions.[7]

To avoid or prevent risks developed societies introduced risk-institutionalized methods and activities for monitoring perceived risks as risk management practices. This development is defined by Beck as a 'reflexive modernization of risk'.[8] As a result risk management as an organizational discipline has grown considerably in the last decades resulting in consideration of risks at a global level with events as Chernobyl, Fukushima, global warming, climate change, terrorism and hazards like tsunamis. These experiences have led to the globalization of the meaning risk and as such have intensified the public awareness for risks. The emergence of the risk society is based on a growing influence of technology. In these circumstances science is becoming more and more important as a tool to inform the public and public policy. Since the formulation of the Millennium Development Goals (MDG)[9] in 2000 by the United Nations to address global problems related to hunger, poverty, and other emergency situations, science explicitly is expected to fulfill an essential contribution in achieving the objectives in order to improve human welfare.[10]

Within this perspective science pursues social objectives and puts itself into the position of being a public interest science. Another relevant example for making the connection between science and

its use for public understanding is the way the US Federal Emergency Management Agency (FEMA) makes the connection between science and the objectives to improve the capability to respond to disasters by providing technical guidance and tools targeted for mitigating multi-hazard events by means of The Building Science Branch.[11] This organizational unit takes care of publishing different types of grey literature like the Security Risk Management and Natural Disaster Series Publications.

The issue of public awareness

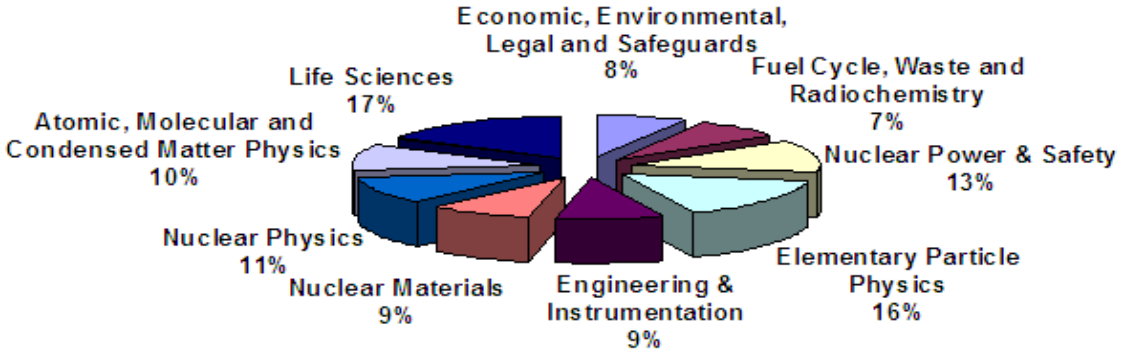
Already in 90s, during the International Decade for Natural Hazard Reduction, there was a strong focus on raising public awareness in combination with information action towards natural hazards with the objective to reduce vulnerability and making communities more resilient.[12] Policies of raising public awareness about nuclear power are related to technological hazards and as such can be observed sociologically as failures of techno-social systems.

After the accidents at Three Miles Island and Chernobyl there was a building stop of nuclear power plants in a significant number of countries, but as it turned out, the present issue of climate change and energy security was a cause for a 'nuclear renaissance'[13] in search of the ideal energy mix. The Fukushima accident however didn't trigger a cancellation for new build programs. Most countries with a nuclear installed base deem nuclear energy necessary in the future for building energy security. This puts risk communication in a strategic position as a tool to inform the public as the nuclear industry and regulators are in need of public support. From this perspective there is a need to understand the values, preferences and the way the recipients of risk communication comprehend risks in relation to the knowledge they already possess in dealing with vulnerabilities.[14]

The public is especially dependent on media coverage as this is the dominant force in shaping the public perception of nuclear power.[15] The American sociologist Gamson provides a model in which the discussion in the media about nuclear power is perceived as an issue culture produced by

general audience media. The discussion on nuclear power is wrapped up in what is called a media package that gives meaning to an issue as how to think about it and reasoning devices that justify what should be done about it.

The question is how can grey literature as scientific information contribute to public awareness? One of the most important instruments available in the knowledge network of the peaceful uses of nuclear science and technology is the International Nuclear Information System (INIS) operated by the International Atomic Energy Agency (IAEA) in Vienna, the leading information system in the nuclear field.[16] It contains 3.3 million bibliographic descriptions and over 600.000 full text documents. Since early April 2009 INIS has been free to Internet users. It covers a broad range of subjects and issues.



The free availability of scientific information on nuclear power by the Open Access principle from INIS is one step in a positive direction. It cannot to be expected to answer all questions related to risk issues. A higher transparency may improve risk communication but the scientific and technical information is difficult to understand for a large audience as a study in 2008 from the EU Commission has shown.[17] There is a challenge to make the category of grey literature related to nuclear power more understandable for citizens. This doesn't mean any downgrading of quality of information but it shows the need for scientists to be aware of how to communicate to the public.

Both scientists - including scholars of grey literature - and the media have a role and responsibilities in the chain of information that connects author to recipient. Journalists and other public communication specialists need to understand how to frame the technical and social issues related to the use of nuclear power because the public - as the recipient at the end of the chain of information - is a heterogeneous group with different perceptions. These perceptions are based on variables like gender, education difference, and difference in using information channels. From this perspective science has to adapt itself to levels of public communication to be adequate. Social media can be used as a tool for risk communication. The disaster sociologist Quarantelli considers it important that public awareness strategies focus on group levels rather than individuals because of its effectiveness.[18] Within this group level it is important to identify key groups as a reference group for those without knowledge. With the use of social media it is relative easy to focus on communities and groups as a means to mobilize scientific knowledge. However there can be no effective risk communication related to nuclear power if the key ingredient, e.g. public trust is missing.

Public trust

The Nuclear Energy Agency Committee on Nuclear Regulator Activities established[19] in 2000 the Working Group on Public Communication (WGPC)[20] to promote public trust internationally at a time that a majority of the general public opinion in the US and in Europe was opposed to the use of nuclear power. According to L.J. Keen, president of the Canadian Nuclear Safety Commission the regulator image had to be built on public trust and on "credible, unbiased – and frank – source of information".[21] Also it was advised that regulators needed to integrate social concerns into their risk assessments.[22] With this statement WPGC anticipated on research that showed that perceived risks are influenced by the lasting image of historical events and the possibility of future events. The WPGC is also well aware that satisfying public opinion claims as trust and credibility is a priority for nuclear regulators and the associated industry. It is their task for providing the necessary risk

information to deal with hazard situations, which has become more difficult after Fukushima. It is the randomness of such nuclear accidents that triggers public fear[23] not the degree of probability that accidents will happen.

A report on Europeans and nuclear safety (2009) found that a large portion of 47 % of the European public opinion considers nuclear risk underestimated.[24] The report states that European citizens are extremely conscious of the importance of safety and protection. It also shows that the influence from past events like Chernobyl as a destructive force of nuclear power had a lasting effect on the discussion on the use of nuclear power plants in the future.[25]

In a Eurobarometer 2008 survey from the European Commission European citizens' attitudes to nuclear waste were examined in the 27 Member States.[26] The knowledge from Europeans how to manage nuclear waste appeared to be limited. It shows that respondents in countries with nuclear power were generally more knowledgeable than those from countries without nuclear power and also tend to be more in favour of nuclear energy. Most trusted is information from independent sources about the way radioactive waste is managed. Scientists are perceived as the trustworthiest source of information about nuclear waste management (40%) together with non-governmental organizations (38%), followed by international organizations working on peaceful uses of nuclear technology (32%). Information given by the nuclear industry is mainly trusted by respondents in countries that have operational nuclear power plants.

Recent public opinion data however indicates that in general a cultural gap exists between scientists and the public. A number of scholars believe that public confidence in science nowadays is weakening, as the public is skeptic about the ability of scientists and technology "to identify and solve society's fundamental challenges".[27] The fact that not only science itself but also the genre of grey literature is being questioned, as in the case of the publication of the Intergovernmental Panel of Climate Change 2007 report on global warming, is significant.[28]

A number of statements in this report were legitimately challenged as they were based on non-peer reviewed literature. However some statements on the nature of grey literature were incorrect. One

scientific journal noted that a statement in the IPCC report, related to the melting of the Himalayan glaciers, "was drawn from non-peer-reviewed findings, known as "gray literature".[29] In another situation an American member of Congress noted the "IPCC's use of "gray literature" to promote a particular objective" indicating it as "non-peer reviewed literature".[30]

These observations about the IPCC report harms the sensitive position of science and grey literature as it becomes politicized instead as it was intended to de-politicize the issue of climate change. Also in combination with observations from a 2009 Pew Research Center report that indicates that 49% of adults in the United States agree that human activity is producing global climate change compared to 84% of scientists makes the gap between the public and science more visible.[31]

The IPCC issue serves as an example how complicated it is to position grey literature in the context of risk communication. Public trust in science is being jeopardized as the public awareness about climate change is experienced as high-profile case and of great concern just as it is in the case of nuclear power.[32]

Nuclear power, the role of knowledge and public attitude

The 1950's and early '60s were characterized by an almost unlimited optimism about the use of nuclear energy in the sense that "electric energy would be too cheap to meter".[33] The reasons for supporting nuclear power in the beginning of the 70s in Europe and the US were the uncertainty related to the first energy crisis in 1973 and the wish to be less dependent on oil.[34] Gradually there was less support for nuclear power. The support dwindled after the accident of Three Mile Island in 1979. Also the fear for a potential nuclear war caused an increase in opposition. These developments challenged the nuclear industry to change public attitude toward more pro-nuclear. In the US national advertising campaigns and other attempts by the nuclear industry and the Committee for Energy Awareness tried to label the use of nuclear power with an idea of technological progress in relation to economic growth. This approach proved not to be very successful.[35].

The first model the nuclear industry used in dealing with the public's perception on nuclear power was the linking of knowledge and public attitude to nuclear risk perception. In the 70's the technical community was convinced that citizens in general were poorly informed on the issue of nuclear power. In their view opposition resulted from ignorance so the more knowledge the public had about nuclear energy the more public confidence would be generated.[36] This hypothesis has been tested in various studies. Kuklinski, Metlay and Daniel found that a majority of the people lacked knowledge about nuclear power[37]. Research dating from the 70s indicates that informed citizens supported nuclear development more than uninformed citizens did.[38] Kasperson et al. concluded in 1980 that there is no decisive empirical evidence that more education and information will change the opinions of those having little or no knowledge about nuclear energy.[39] A European Commission survey from 2008 comes to the conclusion that those with little education are more likely to be opposed to nuclear energy.[40] In general they are not convinced about the manageability of nuclear power.[41]

These studies show that it is not clear how people decide what reasons there are for a calculated choice in favour of or against the use of nuclear energy. Core values like the orientation to technology or political views seem to provide the key for making a choice. Knowledgeable citizens evaluate the issues around nuclear energy more in ideological terms as uninformed are less inclined to see the wider range of consequences. Both groups decide in very different ways.

There are some important other insights. Tichenor, Donohue and Olien observed that the use of information from different channels into society has an uneven effect on knowledge of people.[42] Those who were able to reach a higher level of education show the ability to get a to a more knowledgeable level than those with fewer years of schooling. They have better reading abilities. This leads to "knowledge gaps" between the high and low educated. Providing more information is going to widen the knowledge gap that exists between people with low and high levels of education. In risk communication it is significant to provide for information that can be comprehended by the least educated.[43] Yim and Vaganow report contradictory effects of providing more information

towards public acceptance. Only in the situation that provided information matches the core values of the recipients and there is a relation of trustworthiness information provision can be effective.

The accidents at Three Mile Island and Chernobyl nuclear power caused a wave of negative information that was 'social amplified' as the public response was based on fear and distrust.[44] The Chernobyl accident did affect the European public opinion stronger than the American public opinion that already was very negative toward nuclear power. The lack of information emergency plans made it impossible to keep the public and media informed in an adequate way. E.g. in France and Belgium no timely information was provided about possible negative effects of Chernobyl. At that time this was in sharp contrast with the views of some officials from the US and Soviet Union who believed that a serious accident was impossible. This attitude prevented a clear judgment on the situation how much information is needed for estimating risks. The situation in Chernobyl and the information flow was even worse where authorities responded too slow and failed in providing information on radiation levels. The lack of openness causes suspicion with the press and public. Despite the general distrust at the time perception of risks have shifted. From 2005 we can witness an increasing support for nuclear energy[45] as it is connected as a potential solution to the energy security situation and the issue of climate change. This choice by public opinion is based on the notion that nuclear energy has disadvantages but can play a supplementary role in the energy mix to battle climate change. This has been coined 'the reluctant acceptance discourse'.[46] Also this resembles the Gamson model of a media package, a discours strategy reframing the necessity of nuclear power. In the debates since the late 1990s energy security and climate change have been justifications for what has been dimed as a nuclear renaissance with the relativisation of nuclear risks in the light of a dangerous climate change.[47]

The role of grey literature

Fukushima has made the public aware it needs to be better informed by the national Nuclear Regulatory Organizations (NRO). In 2010 as a whole 49% of the European citizens felt 'not very well informed' and 25% say they are not informed at all regarding safety issues.[48] There is a need for more information on topic of nuclear safety. 63% share the conclusion that the general audience media do not offer enough information to make it possible for citizens to draw their own conclusions about risks and safety involved.

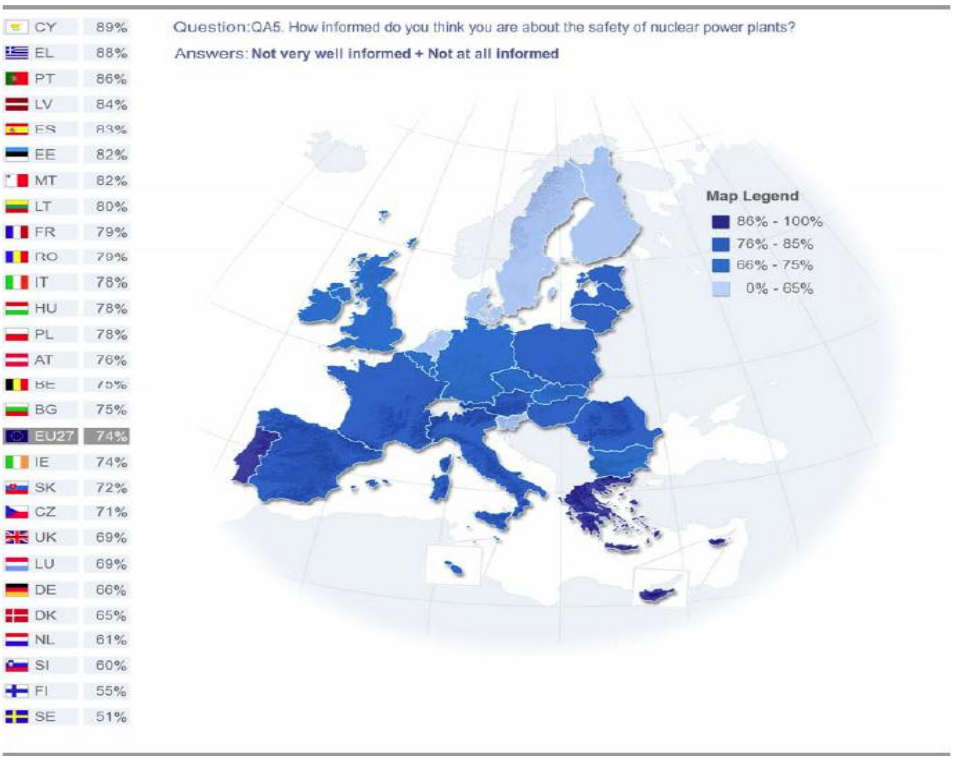


Figure 1 How informed do you think you are about the safety of nuclear power plants. Source : Eurobarometer, nr. 324

This shows the need for greater transparency on the issue of nuclear safety but also the need enhance the availability of grey literature and other types of scientific information through a wider variety of dissemination channels. Another need is the establishing of a legal framework for monitoring international transparency in making different types of information available. The WPGC surveyed member countries on transparency practices. Since 2006 all members of the Organisation for Economic Co-operation and Development (OECD) have Freedom of Information

Acts that give the public rights of access but transparency can be different in these countries. The greatest problem is to balance openness and need for security. Other challenges lie in satisfying the public in the need for information. Social media can play an important role as the Fukushima accident proves. On March 11, 2011 when the Fukushima nuclear reactor blew its top Twitter was used as data source for crisis communication after more than 500 million tweets about Fukushima's radioactivity.[49] All tweets with information about *Radioactivity*, *Pollution cloud*, *Fukushima* and similar topics were monitored all over the world through the Google Realtime system and the origin of the tweets geographically located. Can we consider this as an example of sharing grey literature by new information channels? Anyway it shows the enormous potential of effective risk communication through social media in relation to nuclear power. Another interesting observation is made by the WPGC that social media have increased the difficulty for Nuclear Regulators to manage crisis communication in terms of speed and accuracy. Despite Web 2.0 innovations traditional outlets will be maintained. All NRO's have websites and will use them in the event of a nuclear crisis supplying official information. In the case of an emergency 10 out of 17 countries will continue to use these regulary websites to communicate with the public, updating them with official information and public service messages related to the emergency.

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[7] Many definitions of the term risk exist. A more scientific and less descriptive definition would perceive risk as the likelihood of an event multiplied by a series of consequences ranging from mild to catastrophic (risk = probability x consequence).
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[9] See: <http://www.un.org/millenniumgoals/>.
[10] The International Council for Science states that: "Each nation must have a source of independent, credible, and timely advice to government policymakers and the public on critical issues involving science and technology."
[11] See: <http://www.fema.gov/rebuild/buildingscience/>.

[12] A/54/497 International Decade for Natural Disaster Reduction: Successor Arrangements. Report of the Secretary-General, 1 November 1999. Available at: <http://www.eird.org/fulltext/SG-report/SG-report-nov1999-eng.pdf.> Also See: Resolution adapted by the General Assemblee, A/55/L2, United Nations Millennium Declaration, 18 sept. 2000. Par. III, last item. Later the United Nations Millennium Declaration stated explicitly the access to information and communication technology as one of the instruments for raising awareness towards disasters. "To ensure that the benefits of new technologies, especially information and communication technologies, in conformity with recommendations contained in the ECOSOC 2000 Ministerial Declaration, are available to all." <http://www.un.org/millennium/declaration/ares552e.pdf>.

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The CNRA is responsible for the program of the Agency concerning the regulation, licensing and inspection of nuclear installations with regard to safety. <http://www.oecd-nea.org/nsd/cnra/cnra-mandate.html>.

[20] <http://www.oecd-nea.org/nsd/cnra/wgpc.html>

[21] OECD/Nuclear Energy Agency, p. 14. L.J. Keen, president of the Canadian Nuclear Safety Commission stated: "Public confidence must mean that the regulator's image is one of being a credible, unbiased – and frank – source of information. It means having a willingness to acknowledge uncertainties and the limits of our technical understanding."

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