Regulatory Aspects for Site Selection for Radiological And Nuclear Installations

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Abstract

The purpose of this research is to check in one of the considerations necessary for any new nuclear facility. A previous study that was conducted using a questionnaire reported that general admission to the public , aesthetic considerations, and characteristics associated with the site are able to adequately accept the existence of new nuclear facilities.

The findings of this research revealed that public involvement in the process of site selection and in the design of nuclear power plants, an understanding of their point of view is an important aspect of a participatory approach. An important factor for any new nuclear program is to improve confidence in the energy choices in the future.

A survey was conducted on 1304 adults to, to get the main goal. The study concluded showed that the prevalence of culture of safety reflected on the public acceptance of the site, especially if it takes into account the aesthetic and environmental considerations.

Introduction

The selection of the location of nuclear and radiological facilities, musttake into Consideration the safety culture of the audience.

The public usually prefer to install the nuclear reactor away from populated areas. While the economic consideration may require that the nuclear power plant be near research institutions, and consumers enough to reduce the cost.

To choose the appropriate location of a nuclear and radiological facility, the following aspects should be considered:

- Effects of external events (natural in origin or human induced) occurring in the region of the particular site.
- Characteristics of the site and its environment that could influence the transfer of released radioactive material to persons and the environment.
- population density, population distribution and other characteristics of the external zone and how these characteristics may cause risk to members of the public and the implementation of Emergency Measures.

According tothe application ofsafety considerations (10 CFR Part 100) that must be addressed in the selection of the site, the proposed site, low population density exclusion zone, and demographic should be considered.

The environmental issues to be addressed in site selection are covered by NEPA and include potential impacts from the construction aesthetics, socioeconomics, and environmental impact.

The main determinants for the site are:
- Geographic location.
- Access roads and communication.
- Conditions and environmental and climatic considerations Active.
- Worker population density and economic conditions.
- Study the exact calculation methods used to calculate potential radiation doses leaked as a result of the normal operation and in the event of a radiation leak.

The objective of this researchis monitoring public perception to set up nuclear power plants, and to integrate this final poll to the choice of the location and design of new nuclear plants. The aim is to consider how to determine the public's views on different nuclear plant design options, and how to integrate this important information into the design process. The present work takes a broad approach to determine the public's views on a variety of possible design options for a new nuclear plant. This paper is structured in the following way:the first section is discussionof the research methodthat explores the public's perceptions of design aspects. The research method is a survey using an on-line questionnaire and a subsequent statistical analysis used to capture and analyze the public's views on the design options of nuclear power plants. Our analysis suggests that the public are willing and able to offer an opinion on different aspects of a nuclear design.

For this purpose, a cross-section of the UK population (n = 1304) was surveyed using a set of novel questions developed as part of the research. Most questions had multiple choice options,where respondents could express the intensity of their opinion. While some of the considerations are currently recognized and consulted upon (e.g. environ-mental concerns, waste disposal), others have not received the same level of attention (e.g. protection systems, multi reactor sites, passive versus active systems). The methods presented offer an approach by which the public can beengagged on relevant issues to nuclear design. Though fairly crude, the visual representations and short explanatory text facilitate understanding in a manner that could be applied to other design aspects, militating against the complexity that inevitably complicates public engagement in technical issues and against an expected rise in the number of 'I don't know' answers. Further work is required to ensure that such expressed opinions are a fair representation of the views of the wide range of individual views that coexist within the public. Although care was taken not to bias the results by explicitly outlining tradeoffs between different design options and leading responses, further research using different methods such as semi-structured interviews could beused to understand why specific design aspects were chosen by the public over the alternatives. This would contribute towards a better understanding of underlying factors driving public's preferences for the chosen Design aspects and allowing more definitive conclusions to be drawn on design preferences.

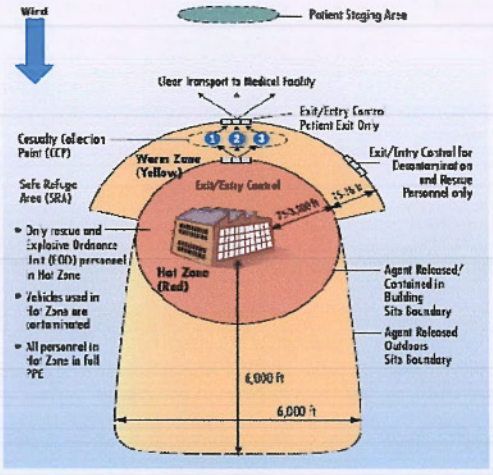

Figure 1: nuclear sitting Zones, Casualty Collection Point (CC P), and Safe Refuge Area (SRA)

Plant location

We were study of the importance of the culture of the population, and aesthetic considerations. We examined many of the layout location for different site. That effect on the surrounding environment, and a safety culture for the population. Access to the standards required for the site selection. In many countries, plants are often located on the coast, in order to provide a ready source of cooling water for the essential service water system. As a consequence the design needs to take the risk of flooding and tsunamis into account. The World Energy Council (WEC) argues disaster risks are changing and increasing the likelihood of disasters such as earthquakes, cyclones, hurricanes, typhoons, flooding. High temperatures, low precipitation levels and severe droughts may lead to fresh water shortages. Failure to calculate the risk of flooding correctly lead to a Level 2 event on the International Nuclear Event Scale during the 1999 blayais Nuclear Power Plant flood, while flooding caused by the 2011 Tōhoku earthquake and tsunami lead to the Fukushima I nuclear accidents.

Land Use and Aesthetics

Locating a nuclear power station adjacent to lands devoted to public use might be unacceptable to local jurisdictions. In particular, locating a nuclear power station, transmission lines or transportation corridors close to special areas administered by Federal, State, or local agencies for scenic or recreational use might cause unacceptable impacts regardless of design parameters. Such cases are most apt to arise in areas adjacent to natural-resource-oriented areas (e.g., Yellowstone National Park) as opposed to recreation-oriented areas such as a national park, forest, wildlife refuge, or recreation areas. Some significant historical and archeological sites might also fall into this category.

The following case study illustrates a fitting example of a problem in visual assessment which joins the working techniques of the profession with the very meaning and origins of the American perception of what qualifies as "pretty."(The Proposed Greene County Nuclear Power Plant).The questions were the main objective and focus of this research. Selection of design aspects to be included in the

questionnaire was determined by analyzing previous researches and focusing on the nuclear issues that caused the public the greatest concern. The findings of previous studies are summarized in following Table.Ridge National Laboratory is conducted an assessment of the projected environmental impacts for nuclear power plant proposedto be built in Greene County.An on-line survey by questionnaire was selected for this work because of the need to consult a reasonably large and representative sample over a relatively short period of time.

Table [1] shows a survey of 1304 adults in the UK was carried out using a questionnaire developed in one of the researches, and employed in this research to reach the primary goal.

Table [1] Summary **of selected demographic characteristics of the sample in comparison with the UK population.[1]**

Question type	Free choice (prompted list)			Free 'open' response	'Agree' with statement		
Source[a]	Ipos MORI (2007)	Ipsos MORI (2010) 2008 data	Ipsos MORI (2010) 2009 data	Butler et al. (2007)[b]	100% Cotton Ltd (2010)	Eurobarometer (2007)	Eurobarometer (2010)
Nuclear waste disposal	45%	36%	35%	24%	86%	50%	49%
Safety	41%	31%	28%	9%	29%	31%	31%
Radiation discharges	44%	36%	24%	4%	50%		
Environmental impact	22%	13%	11%	4%	49%	19%	52%
Terrorism	33%	11%	8%	13%	57%		
Costs of nuclear electricity	15%	7%	7%	13%			
Proliferation						46%	45%

Only the most populous responses (highest percentages) are shown.

[a] Respondents in Ipsos Mori surveys were the UK general public, in Butler et al., UK NGOs and in Eurobarometer, the European public.

[b] Percentage data calculated from figures presented in Section 5 of Greenhalgh and Azapagic (2009).

35–44	245	19	19
45–54	225	17	16
55+	430	33	34
Total	1304	100	100
Sex			
Male	643	49	49
Female	661	51	51
Total	1304	100	100
Region			
Scotland	126	10	9
North East/Yorks/Humber	169	13	13
North West	160	12	12
East and West Midlands	237	18	17
Wales and East of England	183	14	15
South East	311	24	23
Greater London	118	9	13

Table 2 reveals that the design options presented to the public are as clear as possible.

Table [2] the questions used to plot the data in Fig. 1. 'Strongly' and 'tend to' responses are combined to obtain the 'support' and 'oppose'[1]

Study	Question	Answer					
Ipsos MORI (2011)	To what extent would you support or oppose the building of new nuclear power stations in Britain TO REPLACE those that are being phased out over the next few years? This would ensure the same proportion of nuclear energy is retained.	Strongly support	Tend to support	Neither support nor oppose	Tend to oppose	Strongly oppose	I don't know
FoE GfK NOP (2011)	The UK currently has a number of nuclear power stations that are due to be phased out over the coming years. To what extent do you support or oppose the building new nuclear power stations to replace those that are being phased out over the next few years?	Strongly support	Tend to support	Neither support nor oppose	Tend to oppose	Strongly oppose	Don't know
This study	Would you support or oppose the building of new nuclear power plants in the UK? (Q1.5)	Strongly support	Tend to support	Neither support nor oppose	Tend to oppose	Strongly oppose	I don't know

The trends for public support and opposition over the last decade (see also Table 3 for the questions asked). The general trend over the last decade has marked an increase in the support and decrease in the opposition to new nuclear buildings.

Table [3] Percentage of 'I don't know' responses for each question in Section B of the questionnaire (n = 1304) a.[1]

Question	I don't know (%)
Q2.1 What is your opinion about locating any future nuclear plants in the UK further away from the coast, perhaps closer to cities?	22%
Q2.2 How much of a difference would it make to your opinion of nuclear power if you could choose from different design options that 'fit in' more closely with the local environment?	11%
Q2.3 If you were given the choice by a utility company over which towers to use at a power plant to be built in your region, which of the following would best describe your opinion?	21%
Q2.4 Given the same total energy output, how does the idea of having several smaller reactors on one site instead of one large reactor make you feel?	21%
Q2.5 If a new nuclear power reactor were to be built, which of the following would best describe your opinion related to nuclear reactor design?	27%
Q2.6 Which of the following would best describe your opinion about possible protection measures from external impacts?	20%
Q2.7 If both active and passive safety systems are accepted for use on nuclear plants by the independent nuclear safety regulator, which of the following options would you prefer?	32%
Q2.8 If new nuclear plants used 'high integrity' digital computer controls that were certified by the independent nuclear safety regulator, how would you feel?	23%
Q2.9 Do you believe that nuclear fuel should be recycled?	26%
Q2.10 Do you agree or disagree that nuclear weapons material should be used to produce electricity?	17%
Q2.11 It is proposed that nuclear waste be stored underground indefinitely. I believe…	22%
Q2.12 Some of the options in the previous question on waste disposal would require the waste to be moved between sites. This can be achieved by rail, road or sea transportation (or a combination of these). How do you feel about this?	16%

[a] Dark grey shading indicates the highest percentages of 'I don't know' answers.

This is the first questionnaire to attempt to ask the public questions related to nuclear design options.The first 'test' was to find out if the public could answer the questions in a meaningful way. Whilst it is difficult to establish criteria to judge what a 'meaningful' answer is in this context, one criterion which potentially highlights the level of difficulty that participants had in answering the design questions is the proportion of people that answered 'I don't know' for a given question. This is summarized in Table 3. It also seems not surprising that the lowest 'I don't know' percentage (11%) is for question 2.2 which deals with aesthetic design, perhaps the

easiest concept for participants to understand and identify with, all had 'I don't know' responses of slightly higher than 20% (20–23%).

An analysis of the data, broken down by geographic region of North (Scotland, North-West, Yorkshire and Humberside and North-East), Midlands (East and West Midlands, East of England and Wales) and South (South-East, London and South-West) is shown in Table 4. This analysis highlights a limited variability in Somers' D between the regions, which are arguable because the geographic areas used in the breakdown are too large and incorporate too many different communities to allow a more granular analysis. However, it is not possible to carry out a more localized analysis with this data set as sub-samples in the breakdown which are too small to allow meaningful statistical analysis.

Table [4] Somers' **D for relationships where geographic region shows a substantial difference (>25%) in value a.[1]**

Relationship	North	Midlands	South
Industrial favourability decreasing (Q1.2) and plant aesthetics making less difference (Q2.2)	0.194	0.291	0.231
Support for new build decreasing (Q1.5) and plant aesthetics making less difference (Q2.2)	0.199	0.291	0.214
Belief in nuclear being low carbon decreasing (Q1.7) and dislike of nuclear fuel recycling increasing (Q2.9)	0.254	0.312	0.222
Industrial favourability decreasing (Q1.2) and dislike of recycling weapons material increasing (Q2.10)	0.396	0.266	0.418
Technical understanding decreasing (Q1.3) and dislike of recycling weapons material increasing (Q2.10)	0.231	0.117	0.261
Support for new build decreasing (Q1.5) and dislike of recycling weapons material increasing (Q2.10)	0.433	0.303	0.473
Level of perceived risk posed by nuclear power decreasing (Q1.6) and dislike of recycling weapons material decreasing (coding scale is increasing hence negative relationship) (Q2.10)	−0.283	−0.206	−0.260
Knowledge of the nuclear industry decreasing (Q1.1) and the perceived safety of nuclear transport decreasing (Q2.12)	0.190	0.192	0.323
Belief in a clear solution for waste decreasing (Q1.8) and the perceived safety of nuclear transport decreasing (Q2.12)	0.429	0.273	0.308

[a] Dark grey shading highlights statistically significant results (Somers' D >0.2 or <−0.2 and $p \leq 0.05$).

In Table 5, the younger respondents showed the weakest relationship between independent and dependent variables, and the older respondents the strongest.This is particularly obvious in the relationships associated with questions on nuclear waste disposal, and nuclear transport. The Reverse is observed for the question on site location, where the responses provided by the young seem to have stronger relationships than those provided by the older people.

Table [5] Somers' **D for relationships where age group shows a substantial difference (>25%) in valuea.[1]**

Relationship	16–34	35–54	55+
Belief in a clear solution for waste decreasing (Q1.8) and the proximity of nuclear plants to cities decreasing (Q2.1)	0.236	0.247	0.136
Technical understanding decreasing (Q1.3) and plant aesthetics making less difference (Q2.2)	0.165	0.283	0.286
Support for new build decreasing (Q1.5) and plant aesthetics making less difference (Q2.2)	0.130[b]	0.304	0.269
Industrial favourability decreasing (Q1.2) and nuclear fuel recycling being a bad idea increasing (Q2.9)	0.148	0.256	0.360
Support for new build decreasing (Q1.5) and nuclear fuel recycling being a bad idea increasing (Q2.9)	0.194	0.296	0.375
Technical understanding decreasing (Q1.3) and recycling weapons material being a bad idea increasing (Q2.10)	0.260	0.160	0.232
Level of perceived risk posed by nuclear power decreasing (Q1.6) and recycling weapons material being a bad idea decreasing (coding scale is increasing hence negative relationship) (Q2.10)	−0.241	−0.201	−0.295
Industrial favourability decreasing (Q1.2) and belief in the viability of underground disposal of nuclear waste decreasing (Q2.11)	0.249	0.355	0.385
Support for new build decreasing (Q1.5) and belief in the viability of underground disposal of nuclear waste decreasing (Q2.11)	0.248	0.284	0.375
Level of perceived risk posed by nuclear power decreasing (coding scale is increasing hence negative relationship) (Q1.6) and belief in the viability of underground disposal of nuclear waste increasing (Q2.11)	−0.117[b]	−0.259	−0.354
Belief in nuclear being low carbon decreasing (Q1.7) and belief in the viability of underground disposal of nuclear waste decreasing (Q2.11)	0.149	0.257	0.225
Belief in a clear solution for waste decreasing (Q1.8) and belief in the viability of underground disposal of nuclear waste decreasing (Q2.11)	0.287	0.425	0.295
Support for new build decreasing (Q1.5) and the perceived safety of nuclear transport decreasing (Q2.12)	0.365	0.497	0.498
Level of risk posed by nuclear power decreasing (coding scale is increasing hence negative relationship) (Q1.6) and the perceived safety of nuclear transport increasing	−0.256	−0.395	−0.462

The results of the survey are consistent with recent studies that have noted a diversity in public opinion – a 'mixed image' about nuclear with some areas of entrenched opinion (notably safety and waste) that transcend the nuclear industry. It is perhaps not surprising that the design issues that most evoked consensus revolves around safety and environmental risks. Overall, the findings indicate that the design preferences expressed by the public are largely consistent with the current approach taken by design engineers.

However, disparities exist between the public's view and the designs of new nuclear build relating to aesthetics. This is at odds with the response received to whereby a significant proportion (32%) of the public would prefer multiple smaller reactors.Interestingly, by exploring the relationship between answers, further analysis revealed that the public's views are based on and influenced by a range of factors. There is an evidence of weak asymmetric relationships between some design preferences and participant's familiarity with, and existing views on, nuclear power and the nuclear industry. For example, our analysis shows that both unfamiliarity with the nuclear industry, and opposition to new nuclear build, are correlated (weakly) with negative perceptions of proliferation and issues around waste.

These results lend some support to the findings of previous studies that have identified knowledge, awareness and discourse image framing to be important factors. Furthermore, people with environmental concerns about nuclear power also hold negative perceptions of nuclear proliferation and waste. Previous studies have shown that reservations from an environmental perspective are deeply entrenched: evidence from the UK suggests that support for nuclear amongst people with higher environmental values is only "reluctantly" given, and only then when other preferred options have been exhausted.

Conclusion:

In this assessment of the aesthetic impact of a proposed nuclear power plant, the historical foundation of concepts of scenic beauty played a major role. The meaning and quality of several particularly outstanding views became the ultimate focus in studying the visual impact of the plant. This research concluded that building the power plant in this location would entail an unacceptable, negative aesthetic impact. This finding was the basis for the final environmental statement.Building this plant is denied. Un precedent in the history of the nuclear power industry.

Our findings suggest that policy and decision making related to new nuclear buildings should seek to understand and account for the various factors behind the public's perception of nuclear power. Transparency and stakeholder participation in the decision making process is crucial and this study indicates that integrating views of the public in nuclear powerplant design is one contributing mechanism. Further work is also needed on how to integrate such information into the existing engineering procedures to aid design of socially more acceptable nuclear plants.

The location of a power plant has many impacts that are of interest to the local community. There are both advantages and disadvantages to be considered. Measures of local interest and concern include the public support to a particular site. Generally, a site where the public attitude is positive or supportive may be preferred.

The purpose of power plant pollution regulations and emissions limits is to avoid harm to public health and the environment. The concern is elevated for nearby populations.

The study concluded that the spread of a culture of safety reflected on the acceptance of the site, when the site surrounding populations, especially if the site takes into account the aesthetic and environmental considerations.

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الجوانب التنظيمية لاختيار موقع للمنشآت الإشعاعية والنووية

ناديه محمود سراج
هيئة الرقابة النووية والاشعاعية

الملخص

الغرض من هذا البحث هو التحقق من أحد الاعتبارات الهامة لاى منشأة نووية جديدة . وهو تقبل الجمهور والاعتبارات الجمالية ,من خلال دراسة سابقة أجريت باستخدام الاستبيان,اشارت الدراسة إلى أن القبول العام للجمهور والاعتبارات الجمالية , والخصائص المرتبطة بالموقع قادرة على نحو كاف لتقبل وجود المنشآت النووية الجديدة.

وتساهم النتائج التي توصلنا إليها إلى ان إشراك الجمهور في عملية اختيار الموقع وفي تصميم محطات توليد الطاقة النووية .هو جانب هام من نهج تشاركي يهدف إلى تحسين الثقة في حكم خيارات الطاقة في المستقبل, والعامل المهم لأي برنامج بناء نووي جديد هو فهم وجهة نظر الجمهور. وكما هو الحال في العديد من البلدان قد أجري الاستطلاع استبيان على1304 من البالغين للوصول إلى الهدف الأساسي.

وخلصت الدراسة إلى أن انتشار ثقافة الامان انعكس على قبول الجمهور للموقع، وخاصة إذا كان يأخذ الموقع بعين الاعتبار الاعتبارات الجمالية والبيئية.