Risk, Trust and Place:
A mixed methods investigation into community perceptions of a nearby nuclear power station

Dan Venables

Ph.D.

Cardiff University

August 2011

Abstract

Recent UK government policy advocates the expansion of nuclear power, and indicates that any new nuclear power stations will be built mostly at existing 'nuclear' sites where it is apparently assumed that broad community acceptance will be encountered. This thesis investigated community perceptions of an existing nearby nuclear power station at three locations, through a mixed-methods design incorporating a Q-Method study (n=84) and a household survey (n=1,327), and with additional reference to an existing qualitative dataset. The thesis aimed to provide a detailed description of how such communities live with nuclear power. Specifically, it investigated (a) the main community points of view on the nearby nuclear power station; (b) the dimensionality of trust between communities and the power station; (c) the associations between risk perceptions, trust, sense of place, and residential proximity to the power station, and (d) the factors associated with community support for new nuclear build in the nearby area.

Four points of view were identified. These were broadly consistent across study locations but also reflected some site-specific concerns. The dimensionality of trust between the nuclear power station and nearby communities was found to comprise separate Affective and Cognitive components. It was concluded, however, that the primary influences, both on public perceptions of the risks associated with the existing nuclear power station, and on community attitudes towards the building of a new one, were related to perceptions of place.

This thesis provides a contemporary insight into some of the ways that communities live in close proximity to a nuclear power station. Its theoretical and applied implications are discussed in the context of psychological theory and recent UK energy policy.

For my mother, who supported me for all of her life.
So much has happened since then.
I wish I could tell you about it.

Acknowledgement

Thanks to everyone who helped me, directly or indirectly, with this project. In particular, thanks to my supervisors Nick Pidgeon, Karen Henwood, and Wouter Poortinga for their advice, guidance and comments. Thanks to Peter Simmons, for advice on Q-Method, to Nick Smith and Chris Jones, for assistance with data collection and survey management, and to Pete Randerson, for advice on statistics. Thanks to Karen Parkhill, for advice on qualitative methods, and for listening to all of my gripes. Thanks to Michael Bowdery, for allowing me to spend time on the thesis after I left the University. Thanks to my parents, for their unerring support, and to my Dad, for proofreading the thesis. Most of all, thanks to Elaine, for marrying me, for giving me Bryn, Cerys and Caian, for being a fantastic mother to them, for supporting my parents when they needed it most, and for being there through my darkest days.

Contents

Tables

Boxes

Figures

Abbreviations

Main abbreviations used	
LWSTR	Living with Socio-Technical Risk: A Mixed-Methods Approach
B&S	Beneficial and Safe
T&D	Threat and Distrust
RA	Reluctant Acceptance
TNPW	There's No Point Worrying
SVS	Salient Value Similarity
SoP	Sense of Place
PSSoP	Power Station Related Sense of Place
CO_2	Carbon Dioxide

The Independent, 25.02.09

Chapter 1 Background

1.1 Introduction

For a long time, the civil nuclear power industry has appeared to be in near terminal decline across many parts of the globe. In the UK, most of the 19 currently active nuclear reactors are nearing the end of their operational lifetimes, and by 2023, only one will remain (www.world-nuclear.org). The contribution from nuclear power to the UK electricity supply has steadily fallen from 19% in 2006, to 15% in 2007, and to 13.5% in 2008, and continues to decline. However, climate change emission reduction targets, together with concerns about the security and continuity of electricity supplies, have recently forced a reappraisal of the future of nuclear power. Recent policy initiatives have framed nuclear power as part of the solution to these problems. The Climate Change Programme (DETR, 2000), for example, espoused the intention to move Britain towards a low carbon economy, with possibility of a major contribution from nuclear power as a negligible producer of CO_2. Such moves are controversial, however. UK opinion remains divided on the issue of nuclear new build, and recent polls report that nuclear power is the least preferred of all energy sources (Pidgeon et al., 2008; Spence et al., 2010). The ability of nuclear power to assist in the reduction of CO_2 emissions has also been disputed, as once construction and decommissioning processes are accounted for, the 'carbon saving' of nuclear power, although considerable when compared to conventional coal fired stations, it is itself negligible when compared to 'renewable' alternatives such as wind turbines or tidal power (DTI, 2006; Pidgeon et al., 2008). Nevertheless, the Sustainable Development Committee recently considered that there was clear scope for nuclear power to contribute in some way towards CO_2 reduction if only in a relatively minor way (SDC, 2006). The role, or 'reframing' (Pidgeon et al., 2008) of nuclear power as part of the UKs strategy for future climate change mitigation was reiterated and confirmed in subsequent policy documentation (DTI, 2006, 2007), and recent government policy has proposed that new nuclear power stations should form a part of the future 'energy mix' (DBERR, 2008). Moves therefore continue to be made in preparation for what is now termed a 'nuclear renaissance' (DECC, 2010). Accordingly, transmission connection agreements have been made in advance of possible new build at some potential sites and the nuclear construction company Areva has said that if planning procedures were sufficiently expedient it could build new nuclear plants in the UK by 2017.[1]

The issue of building new nuclear power stations is therefore once again high up on the public policy agenda in the UK and many other countries. However, while the current debate about nuclear energy policy is not as polarised as it was in the 1980s and 1990s (Pidgeon et al., 2008), the assumptions underlying new build proposals have been strongly contested by some environmental groups and academic commentators. Nuclear power still faces major uncertainties in relation to its economics, worries about accident risks and nuclear arms proliferation, and the need to find long-term solutions for radioactive waste storage and management.

1.2 Siting new nuclear power stations

Aside from technological and economic uncertainties, the siting of new nuclear power stations, as well as new large-scale renewable energy schemes, and technologies such as carbon capture and storage will also depend on the responses of affected publics. This includes national

[1] As reported at: www.world-nuclear.org December 2010.

dispositions but also, and perhaps more importantly, the positions adopted in communities which are either asked, required, or volunteer to host such facilities. An understanding of the dynamics of public acceptability in relation to the issue of siting new nuclear power stations therefore represents an important contemporary challenge for the environmental social sciences.

In the UK, a report commissioned by the DTI on siting issues for new nuclear build (Jackson & Jackson, 2006) made it explicitly clear that the preferred locations for any new nuclear power stations would be those with existing power stations. Since then, Areva has expressed an interest in sites at Bradwell, Dungeness, Sizewell, Oldbury, Wylfa and Hinkley Point (www.world-nuclear.org, 2010). In January 2009, four candidate sites were named by the Nuclear Decommissioning Authority: Sellafield, Bradwell, Oldbury and Wylfa (BBC News, 23rd January 2009; *see also* www.nda.gov.uk), and additional new build also appeared very likely at Sizewell and Hinkley Point (www.world-nuclear.org, 2010). Eventually, a total of 11 sites were considered as part of the government's Strategic Siting Assessment process, ten of which were considered potentially suitable and listed in the Government's draft nuclear National Policy Statement in November 2009. Sites were due to be finalised, following public consultation and Parliamentary scrutiny, late in 2010, although an announcement on this has yet to be made at the time of writing. However, some of the most recent reports focusing on the UK skills base necessary for the proposed new build programme suggest that six twin-reactor power stations are likely to be built in the UK by 2025 (Cogent-SSC, 2010), and it was announced in October 2010 that three sites from the initial candidate list had been ruled out (Dungeness, Kent; and Braystones and Kirksanton in Cumbria) (*The Guardian*, 2010).

The selection of these existing ‘nuclear’ sites for the proposed new build programme reflects the characteristics of those locations, including factors such as their relatively remote locations, well-developed power transmission capabilities and other related infrastructure, and access to large volumes of cooling water. There is also, however, an apparent assumption that existing ‘nuclear communities’ will be more accepting of new build. This expectation stems from the existing relationships, in many cases built up over two generations, between a nuclear power facility and those living close by.

At a critical time in the potential renaissance of UK nuclear power, there is, however, little contemporary data describing the ways people living at existing civilian nuclear sites understand nuclear power and how, as a result of their experiences, they might perceive and conceptualise its risks. Gaining an insight into such factors should facilitate more informed policy decisions, as well as better considered risk communications and public engagement processes. Similarly, from any community’s point of view, it is important that research is conducted that assists in the process of articulating and communicating the full spectrum of local views, beliefs and concerns to policy makers, irrespective of whether individuals support or object to nuclear power.

This thesis, a mixed-methods examination of the relationships between communities and nearby nuclear power stations, is conducted at three UK sites being forwarded as potential locations for new nuclear build. The broad conceptual and methodological bases for the thesis were provided by ‘*Living with Socio-Technical Risk: A Mixed-methods Approach*’ (Pidgeon et al., 2008a), a 5-year project funded primarily by the Social Contexts and Responses to Risk (SCARR) priority network of the Economic and Social Research Council (ESRC). It is the only contemporary in-depth study of such ‘host’ communities and it is also, therefore, the first research project to study such communities since the recent new build programme was proposed. It combines qualitative and quantitative methods, and places particular emphasis on local community risk perceptions, trust relationships, and perceptions of place. Overall, this thesis aims to provide a comprehensive overview of how these communities live with nuclear power.

Chapter 2 Literature Review

2.1 Overview

This chapter reviews a broad range of literature relevant to this thesis. First, overviews of the historical and political backgrounds to nuclear power in the UK and US are presented. These sections show how the politics of nuclear power and the historical occurrence of major accidents have laid the foundations for public mistrust and perceptions of risk, and illustrate how fluctuations in these can be traced over time in opinion polls. Subsequently, overviews of the psychological literatures relating to risk perception and public trust are presented, with particular emphasis paid to studies examining these in relation to nuclear power. The third main area of literature to be considered in this chapter relates to the associations between proximity (to a nearby hazard), perceptions of risk, and sense of place. Finally, the chapter closes with a review of some of the most important previously conducted in-depth studies of community relationships with a nearby nuclear power station, and the implications of these for the design of the present thesis.

2.2 Nuclear Power in the UK, 1956-present

Nuclear power stations generate electricity through the process of fission, whereby uranium atoms are split in a nuclear reactor, releasing large amounts of energy. The nuclear reaction is used to heat water, and the resultant steam is used to drive turbines and produce electricity. In early British designs this involves heating CO_2 by circulating it through the reactor: the hot CO_2 is used to boil water, and the resultant steam drives the turbines. In recent water cooled reactors, the water serves both as a medium to create steam and also as a ‘moderator’, which is used to slow down and control the fission process as part of the reactor’s normal operation. In theory, reactor designs assure safety through incorporating various systems with the capacity to shut the power station down completely in case of an emergency. However, public perceptions of nuclear power are tied closely to the history of the technology, particularly in relation to the political motives behind the early development programmes, and its past safety record.

The first commmercial nuclear reactor in the world was constructed at Calder Hall, Cumbria, UK in 1956. Initial public reactions were overwhelmingly positive (Tweena, 2006), with nuclear power forwarded as the solution to industrial air pollution and a means of allaying concerns about the security of energy supplies. However, the grounds for public mistrust were already in place (Tweena, 2006). Despite its outward presentation as an electricity generator, the primary function of Calder Hall was to produce plutonium for nuclear bombs, and the generation of electricity was officially regarded only as a ‘by-product’ of the weapons development programme (Hall, 1986, p43). This objective was reflected in the type of reactor chosen, the British Magnox design, which is efficient at producing plutonium, but relatively poor at producing domestic electricity supplies (Gowing, 1974). Eventually, twelve nuclear power stations were built in the UK, all of the Magnox type, and further grounds for potential public objection had become manifest in various setbacks experienced during the construction programme such as completion delays and cost increases resulting from over optimistic forecasts (Tweena, 2006). Further programmes were initiated in 1964 and 1970, which again experienced construction delays and spiralling costs (Greenaway et al., 1992). The turning point in the UK nuclear energy debate was arguably when British

Nuclear Fuels Limited applied for permission to expand its reprocessing facilities at Windscale in order to deal with waste from overseas (Tweena 2006). Consequently, the tabloid newspaper, the *Daily Mirror*, suggested that the UK was becoming 'the world's nuclear dustbin' (Williams, 1980). This gave an embryonic anti-nuclear movement significant media exposure for the first time. There followed an anti-nuclear tabloid campaign, public debate, and consequently a public enquiry (HMSO, 1978), although the Windscale application was ultimately approved (Williams, 1980; Tweena, 2006).

A further programme of nuclear build in the UK came in 1979, again with energy security forwarded as the primary motivation. Public mistrust in the motives behind nuclear power was again evident, however, with some commentators arguing that the promotion of nuclear power was, at least in part, a political move designed to remove power from striking coal miners (Hall, 1986). In addition, and arguably for the first time on a national and international basis, public perceptions of risk in relation to nuclear power were widespread after the explosion at Three-Mile Island in 1979 (see section 2.3.2). Despite these public concerns, the UK new build programme pressed ahead, with ten new UK reactors proposed, the first to be located at Sizewell, in Suffolk. However, the siting process for this reactor was criticised for its inflexibility and accommodation of only minor gestures to the opponents of the programme (Kay, 2001), and the building of the other proposed reactors was then suspended while the industry was privatised (Tweena, 2006). This exposed nuclear power to greater transparency and a need for cost-effectiveness, which further hindered progress and alerted both investors and public to the potential limitations of nuclear power as a viable business model

(Tweena, 2006). Then, the major accident at Chernobyl in 1986 served to further heighten public anxieties and mistrust of nuclear power.

In addition to these existing reservations, any contemporary new build programme will also have to reassure the public in relation to the fact that there is still no long-term solution to the issue of radioactive waste storage and management[2]. As a result, high-level radioactive waste (in the form of spent fuel) will be stored on-site at any new nuclear power stations. This arrangement is officially presented as an 'interim' measure until a national repository can be established (www.world-nuclear.org), but as no such site has yet been identified, such supposedly short-term arrangements are in fact likely to last for a significant period of time (Blowers, 2010). Overall, it can therefore be argued that the civilian nuclear power programme in the UK to date has been characterised by siting controversies, general public mistrust, high public perceptions of risk, and poor performance in relation to economic and business-related factors (Pidgeon et al., 2008b).

2.3 Nuclear Accidents

The greatest stimuli of public objection and concern in relation to nuclear power are probably a small number of well documented accidents. Two of these are well-known: the accident at Three Mile Island in the US in 1979, and the explosion that occurred in the former Soviet Union, now Ukraine, at Chernobyl in 1986. In the UK, there was also a less well-known major

[2] The majority of waste in the UK is a legacy of the early development work, rather than recent electricity production, although there is a significant amount of this also. Solid low level waste is currently stored at a repository at Drigg, Cumbria, but there is presently no permanent solution to the problem of intermediate and high level waste, which at the time of writing is stored mostly at Sellafield. In 2006, the UK government's advisory body, the Committee on Radioactive Waste Management (CoRWM) recommended deep geological disposal for these forms of waste, with the siting of repositories made on the basis of community agreement, with incentives offered for volunteering to host such a facility. However, no suitable sites have yet been identified (www.world-nuclear.org, 2010).

incident at Windscale in 1957. All of these incidents were avoidable, as each was largely the result of human error (Arnold, 1995). Such incidents illustrate how, despite seemingly foolproof technological safeguards, things can, and do go wrong at nuclear power stations.

2.3.1 Windscale

On the 10th October 1957, one of the nuclear reactors at Windscale caught fire during a routine maintenance operation. The cause of the fire has never been fully established and may never be known, but it is generally accepted that human error played a significant role in the incident (Arnold, 1995). These included failures of knowledge, the use of equipment for purposes it was not designed for, and a lack of adequate instrumentation. Further, Arnold (1995) suggests that staffing was deficient, channels of communication were poor, organisation procedures were inadequate, and management was ineffective. From a technical perspective, the explanation considered most likely for the accident was that one of the heating processes was applied to the reactor both prematurely and too quickly (Arnold, 1995). This caused one or more fuel cartridges to fail and ignite, leading to a fire which quickly spread. It was largely unknown what remedial action to take. At first, cooling fans were turned on, but these further fanned the flames. Personnel then pushed fuel elements away from the burning channels to avoid the fire spreading further. Carbon dioxide was later pumped into the core of the reactor, but again this had no effect. Eventually, the fire was extinguished with water, but this in itself was a risk, as it was thought that the addition of water to the fire could have caused a release of carbon monoxide and hydrogen, and consequently an explosion. It was agreed, however, that the risk was necessary as this was the last resort (Arnold, 1995). In the event, there was no explosion, and the fire was extinguished relatively quickly. The initial rush of water, however, caused a rush of radioactive steam and gases up the stack and into the atmosphere.

A major environmental catastrophe was therefore averted, but nevertheless, the incident had come close to causing serious consequences on a wider scale. Regardless, a radioactive plume extended from the top of the pile, which drifted south east over England and Western Europe (Arnold, 1995). Most of the radioactive oxidised uranium had been held by filters on the chimney stacks, but some had fallen on the site. In addition, large quantities of radioactive water had accumulated on site after it had been drained from the reactor core. Eventually, it was established that radioactive contamination levels in the surrounding areas were below emergency levels, and that any remaining hazards would be a result of radioactivity entering the food chain. Subsequently, local milk was found to be contaminated, and all consumption was halted within 200 square miles of the plant. It was estimated that 260 people developed thyroid cancer as a result of the incident, and further, a relatively high number of children in surrounding areas continue to suffer from leukaemia (Holdstock & Barnaby, 2003). It is now generally agreed that the accident was the result of human error, and also that it could have been a lot worse (Wakeford, 2007).

2.3.2 Three Mile Island

On the 28th March, 1979, a failure occurred in the main water pumps at the nuclear power station at Three Mile Island, Pensylvania, USA. This prevented the steam generators (which cooled the reactors) from functioning properly, and the sequence of events caused the reactor to automatically shut down. A consequence of this was that the water pressure in the system increased. A valve was therefore opened, which was designed to close again when reduced water pressure had been achieved. However, it did not close, and instrumentation available to the plant operators indicated that the valve had closed when in fact it had not. Consequently, cooling water continued to drain away from the reactor core, which began to overheat (World Nuclear Association, 2001).

Confusion followed, as operators assumed that sufficient coolant remained in the core. In fact, there was no direct information available on this: coolant levels in the reactor core were gauged by a device located further down the system, where the pressure was high, because water was flowing into it from the stuck valve. In fact, because the pressure appeared to be rising, operators were concerned that the pressure may get too high and rupture the cooling system. They therefore reduced the flow of coolant still further, making matters even worse (World Nuclear Association, 2001). The result was that components of the reactor core began to melt. However, the containment structure of the reactor was not breached, and a massive release of radiation into the environment was therefore avoided (United States Nuclear Regulatory Commission, 2009).

There were further complications however: radioactive gases, which had built up in an auxiliary building, leaked into the environment as they were moved to gas decay tanks (World Nuclear Association, 2001), and in addition, a large hydrogen bubble had formed inside the reactor. As there were concerns that this might explode, pregnant women and pre-school age children within 5 miles of the plant were advised to leave the area, and widespread panic followed. Information was misreported by the media, eventually resulting in a 'weekend exodus based not on what was actually happening at Three Mile Island but on what government officials and the media imagined might happen' (Williams, 1982, p.50).

The root causes of the accident were again, therefore, largely due to human error and design flaws. Officially, the incident was blamed on poor control room instrumentation coupled with an inadequate emergency response by the plant operators, due to inadequate training (World Nuclear Association, 2001). The cleanup operation took approximately 12 years and cost around $973 million (World Nuclear Association, 2001). Although around 2 million people received a negligible dose of radiation, it was officially concluded that there were no measurable adverse health effects to the general population from the incident (United States Nuclear Regulatory Commission, 2009). However, others have argued that the long time lag between radiation exposure and cancer diagnosis has meant that earlier studies have failed to fully detect the long-term consequences of the incident. Wing et al., (1997), for example, report significant increases in cancer incidence, especially lung cancer and leukaemia, in areas estimated to have been in the pathway of radioactive plumes from the power station in 1979.

2.3.3 Chernobyl

Probably the most infamous and certainly the worst ever nuclear accident occurred at Chernobyl, on 26th April 1986. The incident caused an explosion that breached the containment structures of the reactor, contaminating an area of roughly 400 square miles immediately around the plant, and causing a radioactive plume that trailed across a wide area of Europe.

Human error was again at the centre of the problem (Breakwell, 2007). Plant operators were attempting to conduct a series of tests designed, ironically, to improve safety. These required the reactor to be run at reduced power, which had the effect of making the reactor unstable. It was known that running the reactor at below 20% of its maximum power was dangerous. However, the operators reduced output to 1%, and then stabilised the reactor at 7%. In doing so, they turned off many of the automated safety procedures, including the system for automatic emergency shutdown (Reason, 1987; World Nuclear Association, 2008). Operators eventually attempted to shut the reactor down manually, but during this procedure, a peculiarity of the design led to a power surge which caused two explosions. The reactor then caught fire and burned for 9 days, which was the main cause of radioactive release into the environment (World Nuclear Association, 2008). Approximately 5½ million people lived in the areas subsequently considered contaminated, and acute radiation sickness, psychiatric disorders, and clinical levels of anxiety were experienced by many individuals living in communities immediately adjacent to the plant (Lee, 1995). The original death toll was officially recorded as 49, but approximately 4,000 thyroid cancer cases have been attributed to the accident, and even official theoretical projections of the long term effects of the incident predict an additional 4,000 late-in-life cancer deaths amongst the plant operators who assisted in the aftermath of the incident (World Nuclear Association, 2008).

These accidents show that things can, and do go wrong at nuclear power stations, including those situated in politically stable Western countries. They show that when mistakes are made at nuclear power stations, the results can be both international and catastrophic, and they illustrate that the possibility, either of human error or unforeseen design problems, can never be completely discounted. Such incidents are likely to lead sections of the public to question the safety of nuclear power, to lack confidence in the nuclear industry and plant operators to run nuclear power stations safely, or to simply regard nuclear power as a high risk technology. Such perceptions are clearly evident in opinion polls, which the following sections of this literature review will examine.

2.4 Public Perceptions of Nuclear Power in the UK and US: Survey Results

Numerous surveys have assessed levels of public support and opposition to nuclear power from the 1970s to the present day. Such figures are imprecise because of variations in samples and sampling techniques, questionnaire design, and the precise wording of relevant questions. They do, however, sketch broad shifts in public opinion over time, and allow the overarching impacts of international incidents such as nuclear accidents to be broadly assessed.

In both the US and the UK, initial opinions of nuclear power were extremely favourable. The first signs of public concern appeared in the 1950s when the technology became linked with nuclear bombs, following the initial tests (Dalquist, 2004). Consequently, when the first US nuclear power station went online in 1957, it faced local opposition from unions and environmental groups (Dalquist, 2004). Various surveys were conducted over the next 20 years, and the first comprehensive reviews of these show that through the seventies, there was growing discontent with nuclear power amongst the American public (Melber et al. 1977; Nealey et al., 1983), with opposition to the building of new nuclear power stations standing at around 50-55% from 1976-8 (Rosa & Clark Jr, 1999). In contrast, in the UK, the 20 years following WW2 have been described as a period of acquiescence, during which nuclear power was presented, and apparently accepted, as a necessity (Tweena, 2006). Williams (1980) argues that there was a general culture of trust towards authority in the UK at that time, such that there was little in the way of dissent towards the nuclear programme in the 1950s-60s despite the events at Windscale (1957), which caused only a marginal fall in public support (Dalquist, 2004).

In contrast to the lack of public response to the fire at Windscale in the UK, the accident at Three Mile Island (TMI) in 1979 had a profoundly negative impact on public opinion in the USA (Freudenbnerg & Baxter, 1984; Eiser et al., 1995). Following the incident, public support for nuclear power fell from around 50% to 39% (Rosa & Clark, Jr, 1999), and then to less than 30% in subsequent years. Opposition rose steadily throughout the 1980s, and after a brief spike after Chernobyl in 1986, continued along a similar trajectory (Rosa & Clark Jr, 1999; Eiser et al 1995). In the UK, support for the construction of new nuclear plants fell from approximately 57% in 1978 to 37% in 1980 (Dalquist, 2004). The subsequent accident at Chernobyl in 1986 then had a profound effect on UK attitudes, where opposition rose from 68% to fully 80% immediately after the incident (van der Pligt, 1992).

Since the the late 1980s, public support in the US has, however, been steadily increasing. Dalquist (2004) describes the 1990s as a period of ambivalence, although strong opposition to new build continued to be evident amongst nearby communities (Rosa, 2005). At the end of the 1990s, industry-sponsored polls suggested that 51% of respondents supported the building of new nuclear power stations, and 68% considered that nuclear power should play an important future role in the US energy mix (Bisconti Research, 2001). The latter figure rose to 71% in 2003 (Rosa, 2004). Recent (industry sponsored) US polls have suggested that the majority of Americans now favour nuclear power, with 67% showing overall support (32% strongly favour), and just 10% strongly opposed (Bisconti Research, 2004). Independent polls, however, have continued to show overall opposition (Bolsen & Cook, 2008). For example, Whitfield et al., (2009) suggest that only 42% of Americans would accept nuclear power even if there was an energy shortage.

In the UK, objection to nuclear power has also decreased steadily throughout the 1990s and 2000s (Knight 2005; Grove-White et al., 2006; Spence et al., 2010). The year 2004 was regarded by the nuclear industry as a significant moment, as one national poll showed that more people reported a favourable than unfavourable attitude towards nuclear energy for the first time since continuous tracking had begun in 1999 (Knight, 2005; McGowan & Sauter, 2005; Tweena, 2006; Grove-White et al., 2006). However, other evidence suggests that UK public opinion remains divided: of 17 recent public opinion polls and studies reviewed by the Parliamentary Office of Science and Technology (2007), 3 showed an overall conditional support, 8 showed a split opinion, and 6 had an overall negative result. Interestingly, a poll by Accenture (2008) reported that whilst only 33% of people in the UK thought that an increase in nuclear power should be considered in order to reduce reliance on fossil fuels, 53% thought that the UK should increase its nuclear power generating capacity. Such discrepancies illustrate the influence of wording and context on questionnaire responses. Significantly, however, the same poll found that 30% of respondents felt that they had become more positive to nuclear power in the preceding 5 years.

The most recently available UK data (Nuclear Industry Association, November 2010) suggests that around 40% of the UK public are favourable towards the nuclear energy industry, with 17% unfavourable. The same poll suggests, however, that approximately 70% of the population support an energy mix that includes nuclear power, illustrating that there is a difference between public *favourability* and *acceptance*. The survey by Spence et al., (2010) confirms that favourability towards nuclear power remains low, and that concerns remain in up to half of the population. Research suggests that these anxieties are driven by a lack of confidence in arrangements for the disposal and storage of waste, concerns about decommissioning, the availability of better or preferable energy solutions, and a perceived lack of safety associated with nuclear power stations (Accenture, 2008; Spence at al., 2010). In general, therefore, surveys suggest that there is continued public ambivalence towards nuclear power in the UK and US (e.g. Gallup, 2007; Rosa, 2004, 2007; European Commission, 2007; Spence et al., 2010; Nuclear Industry Association, 2010). However, there is also a general trend towards greater acceptance of nuclear power in both countries.

2.5 Risk Perceptions and Nuclear Power

This literature review has so far outlined some of the historical and political reasons why trust and risk perception are central to the study of public attitudes towards nuclear power. The following sections now focus on the study of perceived risk. First, the issue of how risk can be defined and measured is discussed. Next, studies that have sought to identify the factors that may influence risk perception are reviewed, and this is followed by a review of the literature investigating the bases of individual and group differences in perceived risk. Although drawing on literature on risk perception in general, the following sections place particular emphasis on studies of risk in relation to nuclear power.

2.5.1 Objective and subjective approaches to conceptualising risk

Although familiar and broadly understood as a concept, definitions of risk vary considerably across subjects and disciplines. The objective approach, generally adopted in engineering, seeks to formally define risk in terms of the probability of an accident, multiplied by its consequences or losses (see Vlek & Keren, [1991] for a series of formal definitions of this nature). However, the act of weighting relevant variables inevitably requires human judgement, or subjectivity (e.g. Fischhoff, 1989; discussed in detail in Pidgeon et al., 1992, p.99-7), and even experts have been shown to be overconfident in their assessments of risk (Hynes & Vanmarcke, 1976; Henrion & Fischhoff, 1986). This makes the 'objective' approach to defining risk inherently problematic.

2.5.2 Community risk perceptions

A further potential problem with the objective approach to defining risk is that such estimates may be at odds with the risk perceptions of members of the public. Research shows that such perceptions, at least in relation to technological risks, are often high, despite expert assessments to the contrary (e.g. Cutter, 1993). This is because technical approaches to quantifying risk tend to fail to appreciate the combinations of political, societal, psychological and cultural factors which influence socially constructed public risk perceptions (Eiser et al., 1995). Baxter & Eyles (1999) argue that the disparity between local understandings of risk and official accounts is less about the difference between actual (defined) and perceived (lay-defined) risk, and more about the different languages used by each group. In part, this relates to the different meanings and associations a risk object may have to different people or groups. For example, a technological facility may simply be a hazard to an outsider, but for a person living nearby, it may represent a source of employment, something that keeps rental prices low (or high), or a source of annoyance or pollution. Risks may therefore relate to altogether different factors when comparing lay and expert assessments. Experts may refer, for example to mortality rates, whilst the public may be referring to risks that relate to social aspects of life in the local area such as jobs, place, or social relations (Wynne, 1992). Thus, for those living in so-called ‘faulty environments’ (Irwin et al., 1999), perceptions of a hazard are placed in the context of everyday life, and the hazard itself is invariably just one part of a larger set of influences and concerns such as employment, housing, crime, local facilities and local schools.

Public understandings of risk are therefore often based on ‘lay’ or ‘contextual’ knowledge, also referred to as ‘popular epidemiology’ or ‘citizen science’, which is formed as local publics identify clues from whatever sources are available, and piece them together in order to make sense of a given situation (Brown 1992; Irwin, 1995; Layton et al., 1993). Community settings have therefore been likened to contextual ‘arenas’ in which local risks are perceived and acted upon (Fitchen et al., 1987). Within them, local actors, stakeholders, and rule enforcers interact with political institutions, social groups and the general public, and ‘issue amplifiers’ such as the media (Renn, 1992; Kasperson et al., 1988). There are, therefore, many factors that can potentially influence the complex process of community risk understandings. These include the nuisance it is perceived to cause; lay familiarity with the contaminant; and whether the contaminant is regarded as originating from within the community. The issue of whether community leaders appear to be concerned about the risks may also be significant, as is public trust in local officials (Fitchen et al., 1987). These are some of the 'complex social and cognitive processes whereby the public make sense of environmental issues' (Irwin et al., 1999, p.1312), within which the social experience of risk is influenced not just through direct experience of the hazard but also by 'the local socio-political context and prevailing social values' (Baxter & Eyles, 1999).

Viewed through this lens, some authors have argued that local perspectives are not simply representative of a knowledge deficit. However, neither should they be reified: 'smoke' plumes emanating from chemical industry chimneys, for example, are invariably just steam (Irwin et al., 1999). But regardless of the accuracy of community perceptions of risk, there are practical reasons why they should be taken seriously. High levels of concern amongst affected communities can have serious economic and social consequences for those involved. For a proposed facility, such concerns can lead to costly siting processes and construction delays, and the consideration of public concerns in siting deliberations can help ease this through helping to legitimise external perceptions of the decision making process (Irwin et al., 1999). More importantly perhaps, perceptions of risk may lead communities themselves to experience significant negative impacts on psychosocial health (Sider, 1994; Taylor et al., 1991; Marko et al, 2009; Elliott et al., 1997). In terms of public health and related constructs, public perceptions of risk may therefore matter more than official estimates (Wakefield et al., 2001). In the context of current UK energy policy, it is therefore important that research attempts to understand how existing nuclear power stations are perceived by nearby communities, and also how such communities may react to the building of a new nuclear power station in the nearby area. This thesis therefore aims to identify and describe the perspectives on nuclear power that are present amongst communities situated in very close proximity to an established nuclear power station, and also to explore the factors associated with community support and objection to new nuclear build at some of the locations nominated by the UK Government as candidate sites for new nuclear power stations.

2.5.3 Other factors thought to influence risk perceptions

In general, early investigations of risk perception showed that qualitative influences, such as perceived controllability, voluntariness of exposure, and familiarity are involved in risk judgements (Pidgeon et al., 1992). Some research has suggested, however, that nuclear power holds a unique fear for the public. Slovic et al., (1980; also Slovic, 1992) famously conducted a principle components analysis of 18 characteristics of various risk objects which revealed a 'Dread Risk' factor, associated with nuclear power only, relating to perceptions of uncontrollability, fear, 'newness' and also the inequitable distribution of risks. Whilst other threats such as nerve gas, warfare and terrorism were feared to a similar degree to nuclear power, the latter was uniquely 'dreaded', as none of the former were additionally considered to be as new or unknown. Attempts to replicate the study have typically found two similar factors, and sometimes a third relating to the number of people exposed (Pidgeon et al, 1992), and other studies have generally confirmed that nuclear power may elicit unique feelings of dread (e.g. Gardner & Gould, 1989, Slovic, 1992; Sjoberg, 2004a). However, some studies have reported that neither dread nor newness are significant in explaining the risks associated with nuclear waste (Sjoberg & Drottz-Sjoberg, 1994), and Sjoberg (2000) points out that opposition to nuclear power persists, even though it is no longer a 'new' risk. In addition, Gardner & Gould (1989) suggest that although the qualitative dimensions of risks can explain a significant amount of the variance in 'need for regulation' judgements, a large proportion remains unaccounted for, suggesting that there must be additional factors contributing to overall perceptions of risk.

An alternative approach to explaining risk perceptions is via heuristics and biases – the best known of which are probably representativeness, availability and anchoring (Sjoberg, 2000). *Representativeness* relates to the idea that when experienced in person, a single event is subsequently regarded as 'typical' of the technology (Yim & Vaganov, 2003). Personal experience of the international after-effects of the Chernobyl explosion may therefore lead one to regard such accidents as being typical of nuclear power. *Anchoring* causes perceptions of the probability of an event to be adjusted on the basis of the value or perceived significance of the information available (Yim & Vaganov, 2003). Sjoberg (2000) argues that *Availability* (Tversky & Kahneman, 1973, 1974) is the most important heuristic for understanding risk perceptions. The Availability heuristic suggests that when considering a current, potentially risky situation, the more readily one is able to recall a past example of that risk, the riskier the present situation is perceived to be. For example, most people can easily recall at least one or two major nuclear catastrophes, but they cannot recall examples of dam failures, even though significant numbers of fatalities have been associated with such incidents (Inhaber, 1982). A similar pattern is seen in public estimates of the risks of nuclear power and radioactive waste, which are regarded as extreme and unacceptable, compared to the lesser known risks of radon, which are seen to be very low (Slovic, 1996).

2.5.4 Individual and group differences in risk perceptions

One of the important principles demonstrated by studies examining heuristics and biases is that perceptions of a hazard depend not just on its characteristics, but also on differences between perceivers, who can vary markedly in the levels of risk they attribute to the same source. Dietz (2001) argues that it is these differences, which can occur both across individuals and social groups, which cause environmental conflict. This understanding has led some research to adopt the concept of 'multiple publics': the idea that different sections of society may attribute different levels of risk to the same risk source (Pidgeon et al., 1992).

Some studies, for example, have found that socio-demographic characteristics are associated with differences in risk perceptions. Fischer et al., (1991) found that younger respondents (i.e. students) tend to emphasise the environmental risks and concerns related to a hazard, whilst older people are more concerned with health and safety risks. Successive studies have also reported an association between judgements of risk and gender, whereby women consistently perceive greater levels of risk than men in relation to the same hazard, express more concern at a given level of risk, and are less likely to participate in risky behaviours. This is particularly the case with 'high risk' technologies such as nuclear power, and the difference appears to be greater in studies considering local as opposed to national or global issues (see reviews by Davidson & Freudenberg, 1996; Byrnes et al., 1999; Hitchcock, 2001; Venables & Pidgeon 2007).

Other studies have shown that attitudes towards nuclear power vary across individuals and social groups. For example, Otway & Fishbein (1976) found that respondents who were strongly 'for' or 'against' nuclear power tended to agree on the risks, but disagree about its benefits. The same authors (1977) found that whilst 'pro-' and 'anti-' nuclear respondents' evaluations of the positivity or negativity of the characteristics of nuclear power were similar, they differed in the extent to which they considered them to be applicable to the technology. Subsequently, Otway et al., (1978) found that perceived benefits were considered to be more important amongst those who were 'pro' nuclear, whereas perceived risks were considered more important amongst those who had an 'anti' nuclear position. Similar results were reported in subsequent studies (Eiser & van der Pligt, 1979; Woo & Castore, 1980; van der Pligt et al., 1982). Collectively, these studies suggest that there is an *interaction* between hazard characteristics and individual differences: groups of attributes of a hazard can contribute either positively or negatively to overall attitudes, depending on the values or belief sets of the individual (Otway & von Winterfeld, 1982). Moreover, individuals with different attitudes appear to attribute different levels of importance, salience, or value to different aspects of nuclear power, in accordance with their prior beliefs (van der Pligt, 1992; Eiser et al., 1988; Eiser et al., 1995). Thus, Sjoberg (2000) suggests that rather than directly reflecting socio-demographic variations or heuristics, individual differences in risk perceptions may be related to differences in attitudes, of which risk perceptions are an expression. Differences in risk perceptions have also been linked to values, an organisational system thought to determine attitudes and behaviours (Olsen & Zanna, 1994). van der Pligt (1992) reports that individuals with pro-nuclear attitudes stress values such as the importance of scientific advancement and modernisation, whilst those with anti-nuclear attitudes are more concerned with decreased materialism and improved social welfare. Similarly, Sjoberg (2000, 2004b) suggests that values relating to ‘interfering with nature’ and ‘morality’ may be of particular importance in relation to perceptions of nuclear power. However, other research has found that values and general beliefs have only an indirect effect on attitudes towards nuclear power. Whitfield et al (2009) suggest that the impact of personal values on attitudes to nuclear power is partially mediated by perceptions of risk and also by trust in nuclear organisations. The relationships between values and attitudes towards nuclear power therefore remain unclear, and indeed, public values, and their associations with nuclear power may have developed with cultural and societal changes since the initial studies were conducted some 20 years ago.

As stated previously, one of the main aims of the present thesis is to identify and describe the main points of view amongst nearby communities in relation to living with nuclear power. Previous research, as described above, suggests that these broad perspectives are likely to incorporate a wide range of factors, including: people’s perceptions of the qualitative characteristics of the nearby nuclear facility; the perceived importance or ‘weightings’ assigned to these (Eiser et al., 1995); ‘rules of thumb’ (heuristics), biases and rationalisations; and value positions in relation to nuclear technology. In addition, they are also likely to reflect trust in the institutions responsible for the regulation, management, and day to day running of nuclear power stations. The following sections of this literature review examine trust and its role in relation to risk perceptions and attitudes towards nuclear power in more detail.

2.6 Trust

Trust is a fundamentally important psychological concept which has applied relevance to a broad range of areas including psychology, anthropology, sociology, economics, political science, and the study of organisational behaviour (Lewicki et al., 1998; Sheppard & Sherman, 1998; Bhattacharya et al., 1998). Broadly described as 'a foundation for social order' (Lewicki et al., 1998, p.438), trust is regarded as an essential contributor to cooperative behaviour between organisations, institutions, and individuals (Jones & George, 1998), and is thought to play a key role in critical social processes (Bhattacharya et al., 1998) such as the reduction of social complexity and uncertainty (Luhmann, 1979; Barber, 1983; Earle & Cvetkovich, 1995), effective collaboration, and the harmonious functioning of social interactions (e.g. Lewicki et al., 1998; Tyler & Degoey, 1996). Trust in the institutions responsible for the management and safety of nuclear power is therefore likely to be an important aspect of community relationships with a nearby nuclear power station.

2.6.1 Trust and Perceived Risk

It is generally agreed that public perceptions of risk are affected by levels of trust in risk management institutions (Poortinga & Pidgeon, 2003), and that public trust is important in determining societal acceptance of new technologies (e.g. Flynn et al., 1993; Cvetkovich & Lofsted; 1999; Dunlap et al., 1993; Frewer, 1999; Slovic, 1993)[3]. Trust is thought, at least in certain circumstances, to regulate risk perception, such that when trust is high, institutional risks are perceived as either lower or more acceptable (e.g. Siegrist et al., 2005; Flynn et al., 1992; Siegrist et al., 2005). A lack of trust has been associated with increased public risk perceptions in relation to a wide range of hazards including: chemical facilities (Jungermann et al., 1996); food-related hazards (Bord & O'Connor, 1990; Simmons & Wheldon, 2000; Poortinga & Pidgeon, 2004; 2006); biotechnology (Siegrist et al., 2000); hazardous waste (Groothius & Miller, 1997); and the foot and mouth crisis in the UK in the early 2000s (Poortinga et al., 2004a).

Low public trust has also been associated with greater levels of public opposition, higher levels of perceived risks, and greater concern in relation to nuclear waste repository siting (Pijawka & Mushkatel, 1991/1992; Bord & O'Connor, 1992; Flynn et al., 1992; Freudenberg, 1993; Bassett Jr et al., 1996). Cross-cultural evidence suggests that trust may be of particular importance in determining the acceptability of nuclear power (Slovic et al., 2000). It is therefore likely to play an important role in community relations towards an existing nuclear power station, and also in public attitudes towards locally situated new build (e.g. Ibitayo & Pijawka, 1999).

2.6.2 Public Trust and Nuclear Power

For the historical reasons discussed earlier, the nuclear industry faces a major challenge in gaining the trust of a sceptical public. However, in addition to

[3] An important distinction can be drawn here between *institutional trust (*trust in impersonal organisations)*, interpersonal* trust (i.e. between people), and *social* trust (trust in others in general). Notably, different 'types' of institution may be trusted to greater or lesser degrees. Numerous studies have found that sources of information such as doctors, Non-Governmental Organisations such as 'green' groups, and the 'quality' media tend to be more highly trusted than government departments or the 'industry' (*reviewed in* Poortinga, 2004).

well-documented nuclear accidents, the public image of the nuclear industry has been further affected by a number of recent controversies. In the UK, for example, quality control data, in relation to reprocessed nuclear fuel exports, were found to have been falsified at Sellafield (*The Independent*, 1999; *see* Breakwell, 2007). In the US, where public trust in the nuclear industry has historically been low (Lofsted, 2001), the nuclear industries were recently perceived to have emphasised cost-cutting over safety with regard to the decommissioning of the Yankee Rowe and Maine nuclear power stations, and to have misled the public on the siting of the proposed waste repository at Yucca Mountain (Lofstedt, 2001; Farber & Weeks, 2001).

Questions also persist over the economic viability of nuclear power (Lofstedt, 2001; Breakwell, 2007). Other issues relate to the lack of a UK skills base; timescale, with regard to construction times and the future progression of climate change; and the supply of high grade ore (Ravetz, 2008). Perhaps the most important of these uncertainties is the issue of the costs of, and responsibility for long-term waste storage (Farber & Weeks, 2001). This issue was recently highlighted in the US when a reprocessing plant at West Valley, New York, was shut down, leaving behind 600,000 gallons of radioactive sludge, which was managed only via a federal bailout costing many millions of dollars (McGowan, 2001). Ravetz (2008) therefore argues that uncertainties in relation to new nuclear power stations 'are so great as to render it uncompetitive in any realistic assessment' (p.24).

If the nuclear industry is to gain widespread public confidence, it will need to demonstrate it can overcome these difficulties. However, new build proposals also require public trust at a local as well as national level. This raises an additional set of issues, as many of the potentially negative impacts of nuclear power are limited to the nearby area and therefore, arguably, affect the lives of local people only. For example, radioactive water was discharged into the sea at Chapelcross, Scotland in 1999 (BBC News, September 1999). Radioactive water was found to have leaked into the ground at both Bradwell and Hinkley Point in 1982 (an incident for which Magnox Electric were fined £100k), and radioactive water was recently found to have leaked into the ground at Bradwell over a period of 14 years from 1994-2008 (BBC News, February 2009). Although the leaks at Bradwell and Hinkley Point were contained on-site, it seems likely that they may have raised concerns amongst nearby communities in relation to the potential contamination of local water supplies. Another largely local concern is the long-standing possibility of a link between nuclear power stations and elevated rates of cancer, particularly childhood leukaemia, in local communities. Although historically dismissed by proponents of nuclear power as representing natural fluctuations, the publication of quality studies suggesting such a connection is making this possibility increasingly difficult to dismiss (e.g. Ewings et al., 1989; Kaatsch et al. 2007).

Despite these potential threats, however, it is also clear that many communities co-exist with nearby nuclear power stations relatively harmoniously, and over long periods of time. For some sections of nearby communities at least, trust is therefore likely to be high. Trust is therefore expected to feature strongly in relation to some of the community points of view on nuclear power that this thesis aims to identify and describe. In addition, this thesis also aims to examine in detail the levels of, and structure of trust between different segments of nearby communities, and also between local people and three of the institutions responsible for nuclear safety: the local plant operators, the nuclear industry, and the government's regulation of nuclear power.

2.6.3 Defining Trust

Trust is difficult to define from an empirical point of view (Johnson, 1999). It has been variously described as fuzzy, dynamic and complex (Chang et al., 2005), and a conceptual quagmire (Metlay, 1999) that has been defined differently by almost every study in which it has been investigated (McKnight & Chervany, 1996). Metlay (1999), however, argues that while trust cannot be defined precisely, 'one knows it when one sees it', implying that the imposition of operational definitions of trust are not only problematic but also unnecessary. Indeed, as with the concept of risk, many studies have not defined trust at all (e.g. Shapiro, 1987; Cvetkovich & Lofstedt, 1999).

Nevertheless, there are common elements to the definitions that have been proposed by various authors. Essentially, there appears to be agreement that trust is founded on a set of expectations between parties (i.e. the truster and trustee). The condition of trust appears to be fulfilled when the intentions, motives, or behaviours of the trustee are perceived to be in accordance with those expectations. In this context, trust appears to enable social interaction when the involved parties do not possess full knowledge of each other (e.g. Earle & Cvetkovich, 1995; Siegrist et al., 2003).

Trust may also be defined as involving positive expectations of another's conduct, and distrust as involving negative expectations. This has led some authors to regard trust and distrust as separate concepts which do *not* fall at opposite ends of a continuum. This means that in theory at least, it is possible for two parties to simultaneously trust and distrust each other. Based on this assumption, Lewicki et al., (1998) present a conceptualisation of trust consisting of two separate dimensions, leading to a four-condition model (i.e. low trust-low distrust; low trust-high distrust; high trust-low distrust; and high trust-high distrust). The latter condition is interpreted by those authors as representing ambivalence, which can be related, for example, to literature suggesting that simultaneous expectations of benefit and harm may coexist (Nacci et al., 1973). A later study (Poortinga & Pidgeon, 2003) reports empirical data supporting this conceptualisation. Those researchers found that trust was represented by two factors representing 'General Trust' and 'Scepticism'. In contrast to Lewicki et al., however, Poortinga & Pidgeon interpret the 'high trust-high distrust' condition as representing 'Critical Trust', a form of reliance within which a healthy scepticism is retained, situated on a continuum at a point somewhere between uncritical acceptance and complete rejection (Pidgeon et al., 2003; Poortinga & Pidgeon, 2003).

2.6.4 Conceptual Approaches

The situation is further complicated by the existence of a number of different conceptual approaches to the study of trust. Within risk research, Poortinga & Pidgeon (2006) identify and describe three main approaches. First, the Dimensional approach aims to split trust into its core components such as honesty, competence and integrity (e.g. Renn & Levine, 1991; Kasperson et al, 1992a; Frewer et al., 1996; Poortinga & Pidgeon, 2003). Second, the Salient Value Similarity (SVS) approach holds that individuals are generally not sufficiently informed to make detailed judgements relating to trust in a given institution, and therefore tend to fall back on heuristics pertaining to the degree of perceived similarity between the values of the trust object and those of the observer (e.g. Earle & Cvetkovich, 1995; Siegrist et al., 2000; 2001). Third, the Associationist view contends that acceptability and behavioural intentions may be driven primarily by a general affective evaluation, rather than trust *per se* (Slovic et al., 2002a; Eiser et al., 2002; Poortinga & Pidgeon, 2005; 2006). Finally, the recent Trust, Confidence and Cooperation (TCC) Model (Earle & Siegrist, 2007) permits perceptions of ineffective risk management to be taken into account in determining levels of trust, as good or bad performance of an institution has been shown to affect levels of trust, despite presumably stable value matches between the truster and the target (e.g. White & Eiser, 2006; 2007). (Earle & Siegrist, 2008; Earle et al., 2007; Siegrist et al., 2003). The TCC model also draws a distinction between confidence and trust. Confidence is regarded as a background variable: the 'normal mode of operation' (Earle et al., 2007, p.5), experienced as a positive mood, and based on familiarity and perceptions of performance. In contrast, trust is an option based on social relations and shared values, which is chosen in the *absence* of confidence. Some authors, however, consider trust and confidence to be interchangeable terms which differ only in their semantics (e.g. Poortinga, 2004; Metlay, 1999). Likewise, this thesis draws no specific distinction between the two concepts. Rather, it adopts the Dimensional approach, but also considers the implications of SVS and the Associationist view of trust within the Dimensional framework. These three approaches are now described in detail.

2.6.4a The Dimensional Approach

This thesis conceives of trust via the Dimensional framework, which, as described previously, views it as a multidimensional construct. Previous research has, however, reported conflicting results in relation to the dimensions that comprise trust. Renn & Levine's (1991) review of the literature identified five core components of trust: competence (technical expertise); objectivity (lack of bias in information); fairness (taking all relevant points of view into account); consistency (the predictability of arguments and behaviour); and faith (a perception of 'good-will' in the source). Kasperson et al, (1992a) however, identified four dimensions: commitment (to the goal or obligation); competence (the ability to perform relevant roles correctly); care (concern for the trustees); and predictability (consistent behaviour). Mayer et al. (1995) proposes three dimensions: ability, benevolence and integrity. Peters et al., (1997) also identified three dimensions: knowledge and expertise; openness and honesty; and concern and care, whilst Mishra (1996) identified four (competence, openness, concern, and reliability). Other authors have suggested that trust is a simpler, two-dimensional concept. For example, Jungermann et al (1996) found that the concept was best explained by honesty and competence. Frewer et al., (1996), examining the structure of trust with regard to food-related hazards, concluded that trust consists of a broad general component (including competence and care), and a second dimension reflecting vested interests (including integrity). The differences between these studies are likely to reflect a range of inconsistencies between studies, including variations in methodology, study design, characteristics of the sample, and the nature of the trust target.

More recently, both Metlay's (1999) study of trust in the US Department of Energy and the study by Poortinga and Pidgeon (2003) both report just two dimensions. However, Metlay's study of trust in the US Department of Energy found that trust is comprised of a set of affective beliefs and competence, whilst Poortinga & Pidgeon, who examined public perceptions of trust in government risk regulation across a range of hazard domains, found (broadly in line with Frewer et al.) that trust was comprised of a broad general component (General Trust), and Scepticism (negatively valenced items relating to credibility, reliability and integrity). There are a number of possible explanations for the conflicting results of these two studies. First, they may reflect cross-cultural differences between British and American samples. Second, the survey populations differed in the degree to which they were familiar with the institution under evaluation (participants in Metlay's study had participated in a year-long exercise relating to the management of radioactive waste, whilst Poortinga & Pidgeon used a representative sample of the British public). Third, Metlay examined trust in a specific government department, whilst Poortinga & Pidgeon looked at trust in the UK government in general. Thus, in Metlay's study, participants were likely to have had specific, stable attitudes pertaining to the management of radioactive waste, whilst those in the study by Poortinga & Pidgeon may have expressed their trust in the broader system of risk governance.

In the present thesis, the dimensionality of trust between local communities and three of the institutions responsible for nuclear safety is contrasted: (1) the plant operators at the nearby power station, (2) the nuclear industry, and (3) the government's regulation of nuclear power. It is anticipated that the dimensionality of trust between a nuclear plant and nearby communities, reflecting high levels of familiarity with the nearby power station and its personnel, will be consistent with the results of Metlay's study, and will therefore structured according to Cognitive and Affective considerations. In contrast, it is expected that the dimensionality of trust between such communities and the less familiar and relatively distant institute of government risk regulation of nuclear power will reflect considerations of General trust and Scepticism (i.e. it will be consistent with the results of Poortinga & Pidgeon's study).

2.6.4b Individual and group differences in the dimensionality of trust

The Associationist view (Eiser et al, 2002) regards trust largely as a reflection of the prior attitudes of the truster (e.g. Eiser et al., 2002; Poortinga & Pidgeon, 2006). Consistent with this, Earle et al., (2007), argue that judgements of trust are likely to be more specific when a hazard is personally important to an individual. In addition, Johnson (2007), reports evidence that the criteria used in trust judgements (in relation to wetlands management) may vary across judges. Given the highly contentious and divisive issue of nuclear power in local communities, it was expected that significant variations in trust-related evaluative criteria would be evident across a range of 'local' attitudes to nuclear power. In the present thesis, it was therefore anticipated that the dimensionality of trust would vary across groups of individuals holding a range of different attitudes to the nearby nuclear power station.

2.6.4c Importance of Salient Value Similarity (SVS)

The SVS approach to trust argues that trust will be greater if an institution is perceived to hold values that are both salient and similar to one's own (Siegrist et al., 2000; Poortinga & Pidgeon, 2006). Siegrist et al., (2000) suggest that considerations of trust are based on perceptions of SVS when knowledge is insufficient; if there is an absence of detailed information that would otherwise enable informed trust judgements to be made; or if an individual lacks a sufficiently technical background to make informed decisions. SVS is therefore a strategy or heuristic, adopted in order to reduce complexity and facilitate an expedient and cognitively efficient judgement of trust. However, an additional possibility relates to the idea that shared group membership is an effective way of signalling trustworthiness (Earle et al., 2007). In circumstances where a nearby institution constitutes a major provider of economic and social opportunities, and is therefore a significant aspect of local people's everyday lives, the institution may become integrated into valued social networks amongst individuals who live nearby. In such circumstances of high familiarity and social integration, where a power station is perceived as a positive contributor to the nearby community, it is therefore possible that SVS may become *more*, rather than less important in determining trust-related evaluations of that institution. This possibility is also investigated in this thesis.

2.7. Sense of Place and the Proximity Effect

A final set of considerations thought to influence local experiences of risk relate to the concepts of (a) Sense of Place (SoP), and (b) residential proximity to the power station. Beginning with the former, these concepts, and their relevance to this thesis are discussed in detail in the following sections of this literature review.

2.7.1 Sense of Place

Sense of Place (SoP) relates to the idea that a location can develop meaning. It relates to both the physical aspect of that locality and the socially constructed meaning that it has for an individual, and it therefore stands for both an object and a way of looking at it (Cresswell, 2004). Pred (1983) refers to SoP as a perceived quality of life, specific to a particular place and time. It is, therefore, formed around 'the resonance of a specific location that is known and familiar, replete with human histories and memories' (Lippard, 1997, p.7), and also relates to both past and future events (Lippard, 1997). Thus, whereas transient spaces may be described as 'non-places' because they lack the characteristics to which enduring social and affective relationships might be developed (Augé, 1995), an old village, steeped in history, might be described as 'authentic' (Cresswell 2004). This is because SoP, as opposed to knowledge about a place, is thought to accumulate over long periods of time (Tuan, 1977). Places are thought to assume meaning as individuals construct their own reality within the environment in which they operate (Massey, 1993; Anderson, 2004; Nash et al., 2009). Identification with a place therefore grows through psychological investment and repeated encounters over time, such that an individual gradually accumulates a set of meanings for that place, which themselves help to provide a sense of self and belonging (Nash, 2008). Place therefore relates to the symbolic character that a physical setting has for an individual or group. However, such meanings are fluid within ongoing cultural and societal processes, and may also be multiple, in that a place may have as many meanings as there are individuals in that place, but it may also have shared, or collective meaning to communities[4]

[4] It is important to note that 'community' is a highly contested concept (Williams, 1983). Edelstein (1988) refers to 'contaminated communities' as any residential area exposed to pollution or threat, regardless of political, social or geographic environment, on the basis that a shared identity is generated amongst those who are affected. Whilst it is not possible to establish the boundary of the potential threat posed by a nuclear power station, a similar approach is taken in this thesis. The term is used pragmatically, to refer to specific settlements (or residential neighbourhoods) situated within 8 miles of a nuclear power station, and also to describe the existence of social networks within those areas (i.e. a 'sense of community'). It is recognised, however, that the term has political connotations and should not be related to unrealistic and idealised notions of homogeneity and social cohesion within clearly delineated areas (see e.g. Mah, 2009).

(Stedman, 2002). Places may also be intentionally assigned meaning for political reasons as individuals attempt to gain power over a place by defining what, or who, is appropriate for that setting (van Patten & Williams, 2008; Nash et al., 2009), and can therefore become particularly important in situations of land use conflict (Nash et al., 2009). This is because land is typically considered a fungible resource by planners and developers who eschew the 'mosaic of meanings' that places can have for local communities (Henwood & Pidgeon, 2001). For the latter, a place may hold rich meanings relating to nature, culture, history, myth and environmental concerns (Henwood & Pidgeon, 2001; O'Brien, 2005; Nash et al., 2009). In situations of land use conflict, therefore, economic compensation, which is often offered, is not always enough when it is heritage and investment in the land, or 'irreplaceable values' (Boholm & Löfsted, 2004, p20; Kopytoff, 1986) that are at stake from industrial development (Wester-Herber, 2004; Nash et al., 2009).

2.7.2 Place Identity

In addition to SoP, environmental psychology refers to two other related concepts: place identity and place attachment. The former, place identity, despite epistemological tensions over how it should be conceptualised, is thought to be comprised of four core processes (Dixon & Durrheim, 2004). First, there is general agreement that place identity relates to a deep seated familiarity with the environment, referred to as 'rootedness' or 'insideness' (Rowles, 1983; Relph, 1976). Second, a physical environment may facilitate self-coherence, self-worth and self-expression (Korpela, 1989), for example through the restorative properties that a place can hold in enabling individuals to get away from everyday routines or provide spiritual fulfilment (Korpela, 1992; Korpela et al., 2001). Third, there is some kind of psychological investment with a physical setting that grows over time and is revealed through expressions such as ‘feeling at home’. Finally, a material environment can become a vehicle for self-expression, for example, through the personalisation of a space, such as one’s home[5]. Home can also be conceived at a collective level, for example, through places that symbolise national values or serve as historical referents that emphasise continuity and distinctiveness of self (Dixon & Durrheim, 2004; Twigger-Ross & Uzzell, 1996).

2.7.3 Place Identity and Self-Identity

Various researchers have suggested that landscape and place, as a representation of shared experiences, memories, and collective identification (e.g. Rose, 1995; Simmons & Walker, 2004) can contribute significantly to social identity (e.g. Boholm & Löfsted, 2004; Lovell, 1998; Bender, 1993; Hirsch & O’Hanlon, 1995). Thus, in environmental psychology, place identity is generally used to represent the importance of a physical setting in the formation of an individual’s self identity, of which place identity is a subdomain (Wester-Herber, 2004). Self identity, in this context, refers to ‘an internal, subjective concept of oneself as an individual’ (Knez, 2005, p208), which is subject to the consequences of evaluating, assimilating and accommodating the social world over time (Breakwell, 1986). In contrast, place identity relates to ways in which sense of self is regulated by the individual’s experience of

[5] Whilst some authors (e.g. Bachelard, 1994; Cresswell, 2004) have discussed the idea of home as an intimate or ideal place with associated memories, this view has been criticised (e.g. Rose 1993) as failing to consider that home is not always an idealised source of positive memories, and instead can be associated with factors such as domestic drudgery and abuse.

the physical environment (Wester-Herber, 2004). Bonaiuoto, et al., (2002) therefore describe place identity as 'that part of people's identity which is based on or built upon the physical and symbolic features of the place in which people live' (p.636). It refers therefore to an emotional attachment to a place which helps to define who one is (Prohansky et al., 1983; Chow & Healey, 2008).

2.7.4 Place Attachment

Place attachment, a term which is sometimes used interchangeably with place identity (e.g. Brown & Werner, 1985), is 'the affective relation or emotional bonds that people have with places that they live' (Bonaiuoto et al., 2002; p.636), 'the feelings that people develop towards significant places in their lives' (Hernandez et al., 2007, p.310) or 'the affective link that people establish with specific settings where they tend to remain, and where they feel comfortable and safe' (Hildago & Hernandez 2001; Hernandez et al., 2007, p.310). Attachment to place is normally associated with positive community evaluations, suggesting that a weak sense of community may limit the extent to which an individual is likely to identify with, or become attached to it (Wakefield et al., 2001). It refers, therefore, not just to the physical aspects of a place (Hernandez et al., 2007), but also to important social networks and relationships (Altman and Low, 1992; Moore, 2000). Various researchers (e.g. Twigger-Ross & Uzzell, 1996; Moore, 2000; Knez, 2005; Hernandez et al., 2007) have suggested that place attachment may develop before place identity, and it is therefore sometimes seen as being subsumed by place identity (Altman & Low, 1992; Chow & Healey, 2008). Some authors, however, regard both place attachment and identity as sub-dimensions of the overarching concept of SoP (e.g. Hay, 1998). This thesis draws on literature relating to both concepts, but focuses on the general relationships between people, place, and risks. Therefore, rather than attempting to explore empirically the conceptual distinction between place attachment and identity, this thesis employs SoP as a broad construct which is assumed to incorporate elements of both concepts (Simmons and Walker, 2004). The term 'SoP' is therefore used in this thesis to refer to the connections between local people and the immediate landscape via personal and collective memories, histories, meanings, concerns, and local cultures (Henwood & Pidgeon, 2001; O'Brien, 2005; Nash, 2009).

2.7.5 Sense of Place: Measurement

Some authors, (e.g. Bonaiuto et al., 2002; Twigger-Ross & Uzzell, 1996; Wester-Herber, 2004; Knez, 2005; Twigger-Ross et al., 2003; Vignoles et al., 2000) have described a 4-process model of place identity (based on the work of Breakwell, 1986; 1992; 1993), composed of: *Distinctiveness* (the degree to which a place defines an identity that is unique or distinct from other identities, e.g. a 'city' versus 'country' person); *Continuity*[6] (the extent to which place identity represents continuity of self over time; 'a referent to past selves and actions' - for example, living in a place that was occupied by one's ancestors) (Twigger-Ross & Uzzell, 1996, p.207). *Self-esteem* (living in a place that reinforces or reflects one's values and norms, such that the place provides positive feedback to the individual) (e.g. Korpela, 1989); and *Self-efficacy* (the extent to which a place facilitates, or at least does not hinder one's chosen

[6] Place-referent continuity refers to the maintenance of contact with specific places that are of importance or emotional significance to the individual. Place-congruent continuity refers to the maintenance of congruity through alternative places with similar characteristics (e.g. continually living near to the sea, or moving from one busy city to another) (Twigger-Ross & Uzzell, 1996)

lifestyle) (Twigger-Ross & Uzzell, 1996). Drawing on the previous quantitative work in this area (Bonaiuto et al., 2002; Twigger-Ross & Uzzell, 1996; Wester-Herber, 2004; Knez, 2005), this thesis attempts to quantitatively measure SoP in communities situated very close to a nuclear power station.

2.7.6 Sense of Place and community attitudes towards new nuclear build in the nearby area

As discussed previously, prior research suggests that views of a nearby nuclear power station are shaped by a range of local influences such as trust relationships; knowledge of local incidents; media reporting; and the perceived contribution of the power station to the social life of the community (see e.g. Fitchen, et al., 1987; Baxter & Eyles, 1999; Irwin et al., 1999; Williams et al., 1999). These studies suggest that local people's attitudes towards a nearby hazard are based largely on broad perceptions of the facility in the context of the local geography, both social and physical (*c.f.* Whitfield, et al., 2009). The phenomenon is demonstrated in previous qualitative studies, which suggest that facilities such as the Sellafield nuclear complex in Cumbria or the Allied Colloids chemical plant in West Yorkshire represent positive aspects of local identity to some segments of the community, but alien objects that do not 'belong' in the wider rural landscape to others (Macgill, 1987; Wynne et al., 1993 [2007]; Simmons & Walker, 2004). These studies therefore suggest that perceptions of place may play an important role in relation to community attitudes to a nearby nuclear facility, and also with regard to community support for, or opposition to the building of a new nuclear power station in the nearby area. In this thesis, an exploratory analysis is conducted to investigate this possibility.

2.7.6 The Proximity Effect

Proximity refers, in this context, to the distance (whether actual or perceived) between one's place of residence and a potential hazard[7]. A substantial body of research has noted a relationship between proximity to a potential hazard and perceptions of risk and/or concern. For example, in the case of new developments involving hazardous or stigmatized technologies, proximity to the proposed site is associated with higher levels of objection or concern (e.g. Boholm & Löfsted, 2004; Lima, 2004; Lima & Marques, 2005; Vorkinn & Riese, 2001). A different pattern is typically seen, however, in relation to established facilities (van der Horst, 2007). In such instances, evidence shows that proximity tends to be associated with lower levels of concern and greater acceptance (e.g. Maderthaner et al, 1978; Williams et al., 1999; Freudenberg & Davidson, 2007; Baxter & Lee, 2004; Bisconti Research, 2005; 2007a,b; EDF, 2010; Burningham & Thrush, 2004; Wakefield & Elliot, 2000; Mah, 2009; Bush et al., 2001). This phenomenon, known as the 'proximity effect', is particularly relevant to this thesis. This is because, as discussed previously, any new nuclear build in the UK is likely to be sited at locations that already host nuclear facilities. Although there are practical reasons for this, there is also an apparent assumption that new nuclear build proposals will encounter less resistance (or greater support) at such communities. In other words, it seems that current policy on the siting of new nuclear power stations in the UK assumes the presence of a proximity effect. However, in the UK at least, there is little in the way of supporting evidence for this. In addition, with reference to

[7] There is, however, significant variation across studies in relation to what is regarded as 'proximate', making comparisons between them difficult. For example, the term has been used to describe relatively large geographical distances (e.g. 50 miles in Greenberg's 2009 study) to as little as 10 miles (e.g. Bisconti Research, 2007a; 2007b).

the two types of relationship described above, it is unclear how the risks of a new nuclear development will be perceived amongst communities that already host an established facility. One of the aims of this thesis is therefore to examine whether there is greater support (or lower objection) to new nuclear build amongst communities situated close to an existing nuclear power station, compared to the most recent nationally representative figures.

In addition, this thesis aims to explore the reasons for the proximity effect, which are not fully understood. One possibility is that in the case of new developments, expressions of objection and concern are based on feelings of uncertainty, distrust, and perceived lack of control, rather than concern about exposure to the perceived risks of the proposed facility *per se* (Wakefield & Elliot, 2000). In the case of established facilities, apparently lower levels of perceived risk and public concern may be associated with increased familiarity, which may lead, over time (and in the absence of major accidents) to lower levels of perceived risk and more positive attitudes (e.g. Lima, 2004; Lima & Marques, 2005; Greenberg, 2009; Parkhill, et al., 2010). Supporting evidence for the familiarity hypothesis can also be seen in polls showing cross-national variation in support for nuclear power (e.g. Botella et al, 2006). Typically, such polls report that almost all of the countries with the lowest levels of support for nuclear power are non-nuclear states.

Other researchers have suggested, however, that the proximity effect may be due to the perceived economic and social benefits of a facility to local people (e.g. Blowers and Leroy, 1994; Hecht, 1998; Williams et al., 1999; Burningham & Thrush, 2004). This view suggests that an awareness of the contribution made by a facility to the local economy leads local communities to downplay its potential as a source of harm. Local people may therefore display low concern as a result of adopting coping strategies, such as refusing to think about the facility, having faith that all is well, or denying the threat (e.g. Baxter & Lee, 2004, Luginaah et al., 2002; Freudenberg & Davidson, 2007). The economic benefits hypothesis is supported by Krannich et al, (1993), who report that communities most likely to benefit economically from the proposed waste storage facility at Yucca Mountain in the USA generally express fewer safety concerns than those that are less likely to benefit. However, in such economically deprived communities, it may be that the need for *any* new development is driving support for nuclear power (Krannich et al., 1993; Baxter & Lee, 2004). Indeed, the explanatory power of perceived economic benefits is often relatively low, and studies have generally found that perceived risks outweigh the effects of perceived benefits (Brody & Fleishman, 1993; Desvousage et al., 1993; Dunlap et al., 1993; Slovic et al., 1993). In addition, some research has suggested that the public are more concerned about the negative economic impacts of a nuclear power station than its potential benefits (Kraft & Clearey, 1993). The relationship between expressed concern and perceived economic benefits therefore remains unclear (Baxter & Lee, 2004).

Other studies have explained the proximity effect in terms of the management of cognitive dissonance (Festinger, 1957; see e.g. Maderthaner, 1978; Bickerstaff & Walker, 2001). In this context, cognitive dissonance theory suggests that the simultaneous perception that there are risks associated with a nearby nuclear power station, combined with an inability to move away from the area leads to an uncomfortable 'dissonant' cognitive state. To resolve this, affected individuals unconsciously reduce the level of threat that they associate with the nearby facility.

An alternative explanation comes from some qualitative studies investigating communities and nearby hazards, which have noted that people and places, when situated close to polluting or hazardous industry, are sometimes subject to stigmatisation by outsiders. Stigmatisation refers to the idea that geographical areas, communities, individuals, and/or products can in some way become regarded as blemished, tainted or undesireable (e.g. Edelstein, 1988; Wester-Herber, 2004; Gregory & Satterfield, 2002; Walker et al., 1998; Bush et al., 2001; Flynn et al., 2001). Thus, Bush et al., (2001) suggest that the place identity of people living in the polluted industrial area of Teesside is stigmatised, which causes them to be socially discredited by those living outside the area. The study by Wynne et al (1993 [2007]) illustrates the concept well. Individuals living close to the reprocessing plant at Sellafield felt stigmatised at two levels. First, they inhabited an area with arguably abnormally high levels of cancer in the local population, and second, they saw themselves as being regarded by outsiders as being submissive and dependent to the extent that they were the only community in the UK prepared to tolerate the presence of a storage facility for nuclear waste. Stigmatisation has also been noted amongst nuclear industry workers: in France, machine operators who were regularly exposed to radiation were regarded as 'permanently unclean' (EDF, 1961). Some authors have argued that a complex range of social, economic, and technological factors lead to stigmatisation or perceptions of spoiled place (Bush et al., 2001), whilst others have argued that all that is required is a perception that what is 'right' or 'natural' has in some way been violated (Gregory et al., 1995). Consistent with this, nuclear power is thought to produce extreme stigmatisation, which, in addition to the above, has also been has been connected to general public mistrust and disappointment in the technology (Gregory et al., 2001).

Some research has noted, however, that stigmatised objects are sometimes subject to social negotiation and contestation (Satterfield, 1996) to the extent that a community may, by concentrating on the positive aspects of such a development, come to regard it as something worthy of defence or celebration (Simmons & Walker, 2004). Thus, the perception that one is subject to stigmatisation by outsiders may, superficially at least, have the effect of increasing the outward pride of the affected community, and having a positive effect on community identity, unity and cohesiveness (Bickerstaff & Walker, 2001; Baxter & Lee, 2004). Referred to by Bickerstaff & Walker (2001) as a 'neighbourhood halo effect', such stigmatised communities often appear to be reluctant to acknowledge high levels of pollution in their area, and perceive the immediate area to be less polluted than other nearby communities (Bickerstaff & Walker, 2001; Wynne et al., (1993 [2007]).

Collectively, these studies suggest that Sense of Place (SoP), as a positive feeling of attachment to, or identification with a location, may be heightened in communities situated close to stigmatised industries. This has important implications for the proximity effect, because research also notes that individuals who identify strongly with an area or place often appear to avoid either acknowledging the despoilment of that place, or the potential risks that may be associated with it (e.g. Bonauito et al., 1996; Kaltenbourn, 1998; Bickerstaff, 2004; Bush et al., 2001; Bickerstaff & Walker, 2001; Walker et al., 1998; Wakefield et al., 2001). Previous studies also suggest that those with a weak SoP are more likely to attribute negative aspects of the locality to the immediate environment (Bickerstaff & Walker, 2001; Wakefield et al., 2001;

Burningham & Thrush, 2001). Some qualitative studies have therefore noted the possibility that SoP may act in some way to regulate local people's experiences of risk (Bush et al., 2001; Simmons & Walker, 2004; Burningham & Thrush, 2004; Bonaiuto et al., 1996). In the present thesis, it is therefore anticipated that expressions of SoP are likely to form an important aspect of some local people's points of view on the nearby nuclear power station. In addition, a quantitative investigation of the possibility that SoP may act to regulate community experiences of risk in the settlements most proximate to the nuclear power station is undertaken. Although suggested by a number of previous qualitative studies, few previous quantitative studies have investigated this possibility, and, to the author's knowledge, none in relation to an established nuclear power station.

2.8 Previous research: case studies

The final sections of this literature review discuss the most significant previous in-depth studies of communities situated very close to nuclear facilities. These were conducted at various locations in England, France and the US. The results and conclusions of these studies are described, and particular attention is paid to the strengths and weaknesses of their respective methodologies. It is argued that the methodological approach taken in the present thesis represents an innovative, as well as appropriate and useful way of researching community relationships with a nearby nuclear power station.

2.8.1 Sellafield (Wynne, Waterton & Grove-White, 1993 [2007])

The report by Wynne et al. on public attitudes to the nuclear industry at Sellafield explored the local public's opinions towards, and relationships with the nearby nuclear industry. The study found that the presence of BNFL constituted a dominant economic position which brought a range of jobs, economic multipliers and sponsorship for local activities to the local area. This led to a situation described as a 'dependency syndrome' (p.3), in the context of which, local people buried a broad range of anxieties and personal ambivalence about Sellafield. Local acceptance therefore appeared to be founded on a fatalistic acceptance of the locally dominant industry and its associated risks, in the absence of alternative choices. Trust in the nuclear industry was generally low, in part because the industry was perceived by local people to withhold information on radioactive discharges and leaks – the impression of certainty and total control conveyed by the industry actually seemed to undermine its credibility in the eyes of local people. In addition, proposals to build a low- to medium-level underground waste repository in the area were not popular, suggesting that even in isolated areas that are used to, and dependent on nuclear power, radioactive waste storage may still be seen as undesirable.

This case study has a number of important implications. First, it suggests that nuclear power, as the dominant economic force in an isolated area, is accepted, or tolerated, at least in part due to the dependence of local people on the facility. Second, it suggests that even in areas that host existing nuclear facilities, it should not be automatically assumed that new build will be considered desirable or acceptable by local people. Third, it provides a good example of local stigmatisation in relation to nuclear power. In this case, feelings of humiliation connected not just to the presence of the nuclear industry, but also to a sense of isolation and neglect related to a lack of opportunities in employment, education and training.

The study was purely qualitative in design, with the results based on 12 focus groups conducted with individuals selected to represent a cross-section of the local population. The methodology was well-suited to the aims of the study, which was able to capture the subtleties and complexities of community opinions. It also avoided quantitative presuppositions about factors such as what is meant by risk. However, the use of an entirely qualitative methodology also means that the study was heavily reliant on researcher interpretation. It is also limited by the extent to which the findings can be generalised to the broader local population, and the absence of quantitative data precludes the investigation of statistical trends and associations between quantitatively measured variables. In addition, although the report was updated in 2007, the main research phase was published in 1993, and is therefore almost 20 years out of date (at the time of writing). Contemporary accounts of the relationships between communities and nearby nuclear facilities are therefore required.

2.8.2 Cap la Hague (Zonabend, 1993)

Francoise Zonabend's qualitative study was also conducted some 15 years prior to this thesis, at communities situated close to la Hague, the world's largest spent fuel reprocessing plant (www.atomicarchive.com). A second nuclear facility is situated nearby at Arsenal, and there is also a nuclear power station nearby at Flamanville. The area is particularly isolated, described as being 'a peninsular on a peninsular' (p.13), and is sparsely populated. Zonabend argues that the dangers associated with nuclear power were suppressed by local communities in a form of ‘amnesia’ (p.123). In her interviews, it appeared that the active considerations of risk were avoided through diversionary tactics and strategies of language, whilst conversational slips hinted at ‘muted fear’ (p.124). Black humour was seemingly used to help nullify anxiety with regard to certain features of the site: the box in which patients lie to have gamma radiation dosage measured was referred to as ‘the coffin’, and a nearby mound of earth was sometimes referred to as ‘the tomb of the cancer victims’ (p.123). Zonabend concludes that suppressed fear and anxiety permeated society at all levels, and could be detected through ‘rumours and silences…subversion of words and objects…and processes of symbolisation’ (p.123). Thus Zonabend argues that the outward confidence of local people was in fact underpinned by deep-seated anxieties and fears about the nearby nuclear facilities.

Zonabend’s study has been influential, but it is also subject to a number of limitations. First, the details provided in relation to the sample and research method are vague. Zonabend claims to have conducted over 150 interviews with a broad range of local residents, but details of the sample were otherwise not recorded. Interviews were mostly unstructured, were inconsistent across participants, and were conducted largely on an *ad hoc* basis. In addition, through being confined to a single (qualitative, or interpretive) methodology, the study is subject to the general limitations of that approach[8]. In particular, it seems, in Zonabend’s study, that almost all of the responses and behaviours of the interviewees are read as revealing the same muted anguish and

[8] Interpretive accounts of risk have the advantage, over quantitative approaches, of potentially providing ‘richer results and more realistic information’ (Coolican, 1999, p.63). However, through relying on researcher interpretations of discourse, some authors regard such accounts as potentially less reliable and more subjective (see e.g. Coolican, 1999; Hyman, 1992; Campbell, 2004).

underlying anxiety, to the extent that one is left wondering what could possibly have been said or done to avoid the imposition of this interpretation.

2.8.3 South West England (Eiser et al., 1995)

A quantitative example of the study of community attitudes towards nuclear power is provided by Eiser, van der Pligt & Spears (1995), who conducted a series of surveys covering a number of areas of South West England. At the time (the late 1980s), plans were being made to build a new generation of nuclear reactors in the UK. The study aimed to examine attitudes towards nuclear power in a number of small communities spread across the region, which were likely to be affected by the proposed programme of new build. It was found that communities generally expressed both strong opposition and support towards nuclear power, and also that people generally had rational reasons for their opinions. In particular, those who supported the building of new nuclear power stations in the local area emphasised the perceived benefits of new build, such as economic factors and improved infrastructure. Importantly, however, those who opposed nuclear power did not deny these benefits. Rather, they regarded them as unimportant, being of lesser consequence than the negative impacts that they perceived to be most important. 'Pro-' and 'anti-nuclear' positions were therefore not polar opposites: people with different attitudes placed different weightings and values upon specific aspects of the issue such as local jobs, pollution, infrastructure improvements, and accident risks.

Although quantitative in design, qualitative research was conducted prior to the main study, in order to inform the design of the questionnaire. The inclusion of a qualitative element in the research design is important because it facilitated the identification of a wide range of community views which were subsequently incorporated into the main quantitative phases. Therefore, although not strictly a 'mixed-methods' approach, the initial qualitative phase was used to enhance the validity of the main quantitative stages. The details of the sample in these latter phases varied according to the sub-study, but typically involved acceptable sample sizes of 300-400 with high response rates of around 70% (see e.g. Eiser et al., 1988; van der Pligt et al., 1986). However, like the studies described previously in this chapter, Eiser et al's research was conducted some 20 years prior to this thesis and may not reflect contemporary public attitudes to nuclear power. In addition, it did not explicitly investigate the relationships between attitudes to nuclear facilities and residential proximity to them. Furthermore, the present thesis attempts build on this previous work by identifying a range of subtle but cleary defined community points of view on a nearby nuclear power station.

2.8.4 Diablo Canyon (Hill, 1992)

The Q-Study by Hill (1992) was conducted to investigate the processes by which citizens responded to policy choices in relation to the construction of the Diablo Canyon nuclear power plant in the US. Q-Methodology is a technique used for identifying and differentiating between shared viewpoints amongst a given group of individuals (Brown, 1980; McKeown & Thomas, 1988) and is explained in greater detail in subsequent sections of this thesis (Chapters 3&4).

The Diablo Canyon site is a twin reactor site on the California coast, which also stores high level nuclear waste. The location for the facility was chosen in 1966, and construction of the plant lasted fully 20 years. Despite stimulating the local economy, it also, however, resulted in significant economic and social costs. For example, construction costs rose substantially as work progressed, and the influx of workers caused congestion in the housing market, with the result that affordable housing became scarce for longer term residents. The majority of residents initially supported the building of the power plant, but opposition increased over time. Then, in 1973, it was found that the plant had been located within 3 miles of an earthquake fault line, and in 1981 it was found that the building work intended to strengthen the reactor to withstand seismic activity had not been properly implemented. Consequently, large scale civil disobedience resulted in hundreds of arrests (Hill, 1992, p.118).

Hill used Q-Methodology to assess public opinions on various aspects of the political debate, including perceptions of the environmental, economic, health, energy supply, and social impacts of the power station. A random sample of 147 people living within 25 miles of the power station completed the sorts. It was found that supporters of the power plant generally expressed high levels of trust in relation to the government and business; considered that consultation procedures had been fair and just; felt a relatively high level of personal control with regard to the power station and its consequences; considered the power station to be safe; and felt that the plant would reduce the nation's dependence on foreign energy. In contrast, opponents of the power plant were relatively distrusting of the government and the nuclear industry, and regarded the power plant as a relatively high risk.

Hill's study demonstrates the value of Q-Methodology in assessing public attitudes towards nuclear power. However, investigating community perspectives on the nearby power station, and their relationships with it, were not the foci of Hill's study. In actuality, the research was concerned with assessing the extent to which the lay public drew upon the arguments of political veterans in discussing a salient social issue. The subject of nuclear power was chosen only because it was a significant social and political concern which would motivate citizen engagement and enable social process theory to be studied. Therefore, Hill's study asks an entirely different set of research questions to the present thesis.

2.8.5 Sellafield (Macgill, 1987)

The final case study to be described here is the study of communities situated near to the nuclear facilities at Sellafield by Macgill (1987). Macgill's study was primarily concerned with the responses of local communities to the apparent connection between the nearby nuclear installations and elevated incidences of childhood leukaemia and other cancers in the local populace. Although the subsequent enquiry (Black, 1984), concluded that these claims could be neither categorically dismissed nor proven (Pomiankowski, 1984), the 'extraordinarily high' local cancer incidence at Sellafield continues to generate debate (Pomiankowski, 1984; p.100; Draper et al., 1993). Macgill's study suggested that anxiety in relation to this issue existed below the surface of apparently confident discourses amongst local people. In relation to these anxieties, cohesive social groups had formed which mutually reinforced certain rationalisations. These groups treated opposing or threatening positions with suspicion, and therefore acted to further reinforce the process by which concerns about the nearby nuclear facilities were muted.

Macgill's study is an example of a mixed-methods design, which combined interview and survey methodologies: a survey was used to provide 'broad-brush' views (p.60) on the nearby nuclear facilities, and these were used to complement extensive discourse analyses, using a sample of n=462 local people. The combination of qualitative and quantitative data enabled, on occasion, the triangulation of questionnaire results with interpretive conclusions. For example, some of the survey results, when viewed in the context of interview data, suggested that concern about radioactive discharges was at least partially acknowledged, although a link between such discharges and adverse health impacts was simultaneously denied. This illustrates a potential strength of mixed-methods designs, where qualitative and quantitative approaches are used in a complementary manner, such that the results from each approach can be used to either reinforce or add depth to the understanding of each other. Macgill's use of mixed-methods therefore represents a comprehensive, detailed, and robust account of community attitudes towards the nearby nuclear facilities. However, it also reflects a distinct moment in time, when, in the mid- to late 1980s, anxiety about nuclear power was a salient public issue following the 1986 Chernobyl disaster. As described previously, national polls suggest that public attitudes to nuclear power have become more favourable since the 1980s. Contemporary, in-depth research is therefore required to investigate how broader community attitudes towards nuclear power may also have evolved over the last 25 years.

2.8.6 The present thesis[9]

Like Macgill's study, this thesis adopts a mixed-methods design in studying communities situated in very close proximity to an established nuclear power station. However, in contrast to Macgill, Study 1 of this thesis is a Q-Method study, conducted to identify and describe a broad range of shared community views on living with nuclear power. Whilst retaining sensitivity to the local context of the research setting, Q-Method has the advantage, over purely interpretive accounts of risk, of using quantitative statistics to reveal shared community views on the nearby nuclear power station. This enables the present study to avoid some of the criticisms that have been aimed at purely interpretive research designs (e.g. Coolican, 1999; Hyman, 1992; Campbell, 2004; Baxter & Eyles 1999).

Study 2 of this thesis is a large scale household survey. In addition to facilitating the use of quantitative statistics to identify broad trends in the data, this methodology has the advantage of producing more generalisable results than would normally be achieved by a purely qualitative study. In addition, it incorporates the most important findings from the preceding Q-Method study. This enables additional quantitative evidence to be generated in relation to the main qualitative conclusions. For example, through using the points of view on nuclear power identified by the Q-Study as the basis for subgroups in the

[9] The broad conceptual and methodological bases for this thesis were provided by the Social Contexts and Responses to Risk (SCARR) priority network of the Economic and Social Research Council (ESRC) project, 'Living with Socio-Technical Risk: A Mixed-methods Approach' (LWSTR; Pidgeon et al., 2008a). Specifically, when the present thesis was begun, the LWSTR project, which aimed to investigate community impressions of a nearby nuclear power station through a mixed-methods design, specified three empirical phases. The first stage was an interview study (subsequently conducted by Parkhill et al., 2010; see also Pidgeon et al., 2010), which produced the qualitative dataset referred to in selected parts of the present thesis. The second specified empirical phase of the LWSTR project was a Q-Method study, which had not been designed when the present thesis was begun. The third phase of the project was unspecified. These latter two stages were subsequently designed and conducted by the author, with additional guidance and input from Professors N. Pidgeon and K Henwood, and Drs W. Poortinga and K. Parkhill.

subsequent survey, the thesis is able investigate the representation of these within a larger local sample. In addition, as these points of view are not restricted to binary ‘pro-‘ and ‘anti-nuclear’ attitude positions, this thesis is able to investigate the characteristics of a broader range of attitude positions (and their relationships with other important variables) than previous studies have attempted (*c.f.* Eiser et al., 1995; de Groot & Steg, 2010).

Finally, illustrative quotes, identified from secondary analysis of the interview study conducted in parallel by Parkhill et al., 2010 (see also Pidgeon et al., 2008a), are used in selected places in this thesis to exemplify and clarify findings from both the Q-Study and survey phases. Through the use of these, this thesis has an advantage over purely quantitative studies in that it is able to illustrate some of the broad statistical implications of the data through providing examples of how such conclusions are represented in discourse (this methodology is described in detail in Chapter 3).

The mixed-methods approach used in this thesis is therefore chosen in order to allow the relationships between communities and a nearby nuclear power station to be investigated in more detail and in greater depth than one method could achieve in isolation. The design is also novel, in that it is, to the author’s knowledge, the first to combine the results of a Q-Method study with the results of a household survey. There are, however, a number of philosophical issues raised by combining qualitative and quantitative research methods, which are discussed in more detail in Chapter 3.

2.9 Summary and Aims

Recent UK energy policy paves the way for a new generation of nuclear power stations to be constructed across the UK, and these will be sited primarily at existing ‘host’ communities. In the context of a dearth of recent research on the subject, this thesis provides, through a novel combination of methods, the only contemporary in-depth study of local community attitudes towards nuclear power in the UK. Its results will therefore make an important contribution to the understanding of local attitudes towards nuclear power stations at some of the sites which are likely to be required to host them.

The general aim of this thesis is, therefore, to provide a detailed picture of how local communities live with nuclear power, and to consider the implications of this in relation to psychological theory and contemporary UK energy policy. Previous literature suggests that the themes of trust, risk, place and residential proximity to the power station are likely to be central to understanding these relationships, and accordingly, this thesis places particular emphasis on these concepts. This overall aim can also be conceived as a number of sub-aims. The specific sub-aims of this thesis are:

1. To use an appropriate and contextually sensitive research methodology to identify and describe a range of local community opinions on nuclear power which go beyond simplistic ‘pro-‘ and ‘anti-nuclear’ categorisations.
2. To investigate whether these ‘points of view’ are consistent across two communities hosting different nuclear power stations.
3. To investigate the distributions and characteristics of these groups of opinion, and the differences between them, in a larger and more representative community sample.
4. To examine the nature of trust relationships between communities and a nearby nuclear power station, and to investigate whether these are

consistent across (a) familiar and unfamiliar nuclear risk management institutions, and (b) a range of prior attitudes towards nuclear power.

5. To investigate the role of Salient Value Similarity in local people's trust relationships with a nearby nuclear power station.
6. To investigate the associations between risk perceptions, trust, Sense of Place, and residential proximity to a nearby nuclear power station.
7. To investigate the factors associated with support for new nuclear build in the local area.

These aims are investigated in the following sections of this thesis (Box 1):

Box 1: Aims of this thesis and sections in which they are investigated

Aim	Study	Analysis
1. To use an appropriate and contextually sensitive research methodology to identify and describe a range of local community opinions on nuclear power which go beyond simplistic 'pro-' and 'anti-nuclear' categorisations.	**1**	**1, 2, 3**
2. To investigate whether these 'points of view' are consistent across two communities hosting different nuclear power stations.	**1**	**2**
3. To investigate the distributions and characteristics of these groups of opinion, and the differences between them, in a larger and more representative community sample.	**2**	**A, B, C**
4. To examine the nature of trust relationships between communities and a nearby nuclear power station, and to investigate (a) whether these are consistent across familiar and unfamiliar nuclear risk management institutions, and (b) whether they are consistent across a range of prior attitudes towards nuclear power.	**2**	**D, E, F, G**
5. To investigate the role of Salient Value Similarity in local people's trust relationships with a nearby nuclear power station.	**2**	**D, E, F**
6. To investigate the associations between risk perceptions, trust, sense of place, and residential proximity to a nearby nuclear power station.	**2**	**F, H, I**
7. To investigate the factors associated with support for new nuclear build in the local area.	**2**	**J**

Chapter 3 Methods

Chapter 2 of this thesis argues that contextually sensitive methods are required to effectively research the complexities of locally grounded opinions on nuclear power. However, purely qualitative approaches, despite their suitability for accessing the subtleties of locally constructed perceptions of risk are open to criticism as inherently interpretive, and it is also arguable that such accounts are not representative of the broader population or communities under study. Some authors have therefore adopted mixed-methods designs, which typically involve both quantitative and qualitative elements. In such studies (e.g. MacGill, 1987), quantitative techniques are typically used to apply statistical rigour to the project, whilst qualitative results provide contextual sensitivity and detail. It is also sometimes possible to use one set of results to clarify or illustrate the other, or to demonstrate contradictions between the two.

This thesis also adopts a mixed-methods design through combining a Q-Method study with a household survey. Reference is also made to interview transcripts from a study conducted in parallel with this thesis (Parkhill et al, 2010). The Q-Method and survey phases have distinct methodological strengths and weaknesses, and are selected as appropriate techniques through which to address the specific aims and research questions of this project.

The intention to combine qualitative and quantitative methods in a single research project does, however, raise a number of important philosophical considerations. The remainder of this Chapter discusses these issues in detail, and describes how the issue of combining methods will be approached in this thesis.

3.1 Quantitative and qualitative approaches to research

Historically, quantitative (positivist) and qualitative (naturalistic) approaches to research have often been regarded as holding competing epistemological and ontological positions, regarded by exponents of each as the most appropriate way to conduct social science. In this context, *epistemology* refers to *the nature of warrantable knowledge* (i.e. the issue of what knowledge is) and *ontology* refers to *the nature of social reality* (i.e. the issue of what is real). In relation to the former, quantitative approaches have historically relied on the analysis of numerical data to produce knowledge, whilst qualitative approaches rely on a more interpretative epistemology based on understanding, inference, and meaning. In terms of ontology, quantitative approaches are generally assumed to take a *positivist* stance, which assumes that there is a 'true' reality that can be objectively studied. In contrast, qualitative accounts are generally assumed to adopt the ontological position of *constructivism* which is the idea that reality and the meaning of the social world is constructed by individuals, and is therefore shaped by cultural, social, and historical relationships (*e.g.* Henwood & Nicolson, 1995).

In terms of research design, a quantitative approach to research is usually taken as referring to the adoption of the scientific method of hypothesis testing and falsification used in the natural sciences (*see e.g.* Chalmers, 1999). The approach revolves around three main tenets. First, the model for research is that of physical science, whereby an inherently logical design facilitates the study of how relationships between quantitatively measured variables change as a result of manipulations applied to one or more of those variables. Second, it is assumed that relationships between variables are regular and consistent across all relevant circumstances. Explanations are deductive in nature, and statistics are used to express the extent to which a result deviates from that which would be expected by chance. As a result, considerable emphasis is placed on sampling and generalisability, such that the probability that a given phenomenon is likely to be found in the wider population can be assessed. Third, priority is given to directly observable phenomena such as the movement of a physical object. In the case of disciplines such as psychology, where cognitions are not directly observable, indirect, or proxy measures (such as changes on a ratings scale assumed to measure an underlying psychological construct) are used. In such circumstances, emphasis is therefore placed on the validation of scales using appropriate statistical procedures (Hammersley & Atkinson, 2000).

In contrast, qualitative, or naturalistic approaches to research do not attempt to replicate the scientific method. Instead, it is held that the social world, being socially constructed, is more appropriately studied in its natural state, i.e. in the absence of controlled and artificial influences, and with particular emphasis placed on an appreciation of the context in which events occur and individuals interact (Hammersley & Atkinson, 2000). Thus, one of the central tenets of the qualitative approach is that the aspect of the social world under study should remain undisturbed by methodological principles. Stimulus-response type experiments are therefore rejected, as it is argued that the same stimulus can be interpreted differently and have different meanings to different people. Interpretation should therefore be conducted when, for example, a researcher has studied the culture in which a participant operates, in order that the world can be interpreted in the same way as the individual under study. These two approaches to research can be seen, therefore, to hold very different underlying philosophies. However, there is disagreement in the literature in relation to both the degree to which the two approaches differ, and the extent to which they can be reconciled. For example, Jasanoff (1993) regards these two cultures of risk analysis as being situated on each side of an epistemological divide. In contrast, Horlick-Jones & Sime (2004) suggest that the boundaries are not clear-cut.

3.1.1 Realism and epistemological relativism

The assumption of *realism* – that there are literal truths that can potentially be uncovered - is one aspect of quantitative approaches that has been subject to criticism. This is because it is argued that reality cannot ever be fully understood, but only approximated, as individuals construct their own reality (e.g. Guba 1990; Henwood & Pidgeon, 1992). As qualitative approaches attempt to understand the social world in the context of the culture under study, they are often, therefore, regarded as more amenable to the constructivist perspective.

Similar to the constructivist position, *epistemological relativism* is a philosophical stance asserting that there is no absolute truth (in the form of knowledge). Exemplified in the writings of contemporary postmodernists, it is argued that truth can only exist relative to a specific time, culture, or both. Again, qualitative approaches are often regarded as more sensitive to, and compatible with this philosophy. However, others have argued that certain types of knowledge such as the laws of physics are consistent across cultures and cannot change subject to the perspective of the individual (e.g. Dawkins, 2003). In the context of this debate, risk is an interesting issue. Some of the risk-related literature draws a distinction between *risk* and *danger*, suggesting that whilst perceptions of *risk* are always socially construed (Sjoberg, 2000) *danger* is still real (Slovic, 1999, p.689). Leaping from a cliff, for example, is dangerous, but judgements of the level of risk posed by doing so would vary according to the individual. The issue of whether an objective or 'real' level of risk is posed by a nearby presence of a nuclear power station is too complex to resolve here, and is not, therefore, the subject of this thesis. Rather, it is the *construction of risk by individuals* which is the focus of the study.

3.1.2 Reflexivity

A characteristic common to both qualitative and quantitative methodologies is the desire to reduce the effects of researcher bias on the data as much as possible. Quantitative methods approach this through robust and logically sound experimental design, standardised techniques and other measures designed to decrease subjectivity such as blinding. Qualitative approaches attempt the same through immersing themselves in the cultures that are under study. There is thus a shared ideal that it remains possible in principle, if not in practice, that the researcher can retain complete neutrality and operate independently of theoretical and cultural presuppositions (Hammersley & Atkinson, 2000). Reflexivity implies that any research will inevitably be coloured to some degree by characteristics of the researcher. Thus, the production of knowledge must inevitably occur in specific circumstances, and will therefore be shaped, however subtly, by those circumstances. For example, in undertaking the present thesis, the researcher was, as in many similar research projects, an 'outsider' to the local communities that were studied. This, along with other issues such as perceptions of gender, age, race, social class, assumptions about the researcher's attitude towards nuclear power, and external impressions of Cardiff University (e.g. the motives of the institution) are also likely to have had some impact on the data. However, it is also unrealistic to assume that it is possible to be fully aware of these influences and how they might affect the research project (Bush et al., 2001). Taken to extremes, the reflexivity issue suggests that research cannot be fully objective and therefore cannot be valid. However, whilst an appreciation of reflexivity undermines naïve interpretations of realism, it does not justify the complete rejection of either positivism or naturalism. Hammersley and Atkinson (2000) therefore argue that whilst it is important to bear in mind that it is not possible to escape the influences (on research) of the social world in which we live, it can also be argued that research is itself part of that world. Furthermore, it remains reasonable to assume that events can, in theory at least, be described as they are, as opposed to how one would like them to be. There is, therefore, "no escape from common sense knowledge and methods of investigation" (Hammersley & Atkinson, 2000, p.21).

3.2 A Pragmatic Approach

Despite their differences, the interview, Q, and survey methodologies used in this thesis share the goal of attempting to shed light on social phenomena that exist independently of the researcher (Hammersley & Atkinson, 2000). Perhaps, then, they are not so incompatible. Indeed, some authors suggest that the supposed differences between qualitative and quantitative methods are artificial (Brewer & Hunter, 1989), and that the approaches can be considered under a single paradigm (Coxon, 2005; Moran-Ellis, 2006). Arguably, the crucial issue is, therefore, not that of which approach is 'best' but rather, which is the most appropriate to achieve the objectives of the research project and to answer a project's specific research questions (Bryman, 1988). Under this conception, whilst the adoption of a particular epistemological or ontological position may warrant the use of a certain methodology, the use of a particular methodology does not necessarily require adherence to a certain philosophical position. This can be described as taking a 'pragmatic approach' to mixed-methods research.

One such approach is via a *critical realist* ontological position (*e.g.* Patomaki & Wight, 2000). Widely adopted in human geography (Wai-chung Yeung, 1997), this approach assumes that while there is indeed a reality which can be studied, in which social and material realities are fused, the social world can only be approximated through research due to the highly complex nature of society. However, critical realism not only rejects the positivist account of science, but also regards experimentation as impossible (Wai-chung Yeung, 1997). A further step in the direction of pragmatism may therefore be required. One such approach is through adopting the position of *methodologically aware eclecticism* (Hammersley, 1996) which is fully compatible with mixed-methods designs. This position suggests that researchers should seek to answer research questions using the most appropriate method of enquiry, whilst remaining aware of the fallibility and weaknesses of their own methods (O'Byrne, 2007). This applied approach therefore places research in a technical as opposed to an epistemological frame in which little attention is afforded to paradigm differences (Moran-Ellis et al., 2006), and research is designed according to needs of practice, without necessarily adhering to 'the conceptual straitjacket of the disciplines' (Horlick-

Jones & Sime, 2004, p.453). This is the approach taken to combining methods in this thesis.

3.3 Mixed Methods

Mixed methods designs are conducted with increasing frequency in a number of disciplines (e.g. Boaler, 1997; Barbour, 1999; Foss & Ellefson, 2002; Nash, 2002; Poortinga et al., 2008; Punch, 2005; Moran-Ellis et al., 2006). The reasons for this are multiple: Box 2 lists some of the potential advantages of utilising a mixed methods approach.

Box 2: Advantages of Mixed Methods Designs

- Increased accuracy of findings
- Increased confidence in findings
- Generation of knowledge through synthesis of findings
- Gaining of a broader understanding through the consideration of multiple voices, constructions or ontologies
- Logical implementation of a theoretical framework

(from Moran-Ellis et al., 2006)

Notably, the advantages of utilising mixed-methods research designs can therefore be viewed as constituting more than a simple question of one approach simply covering for the weaknesses of another. Bryman (2006), in a review of mixed-methods studies, lists 16 potential advantages cited by various authors across 232 studies (Box 3, p73). There is debate surrounding epistemological claims that triangulation (the use of convergent findings to enhance the results and conclusions of the study) increases the *validity* of the findings (Moran-Ellis, 2008). However, it can be argued that through combining results from different research paradigms, mixed methods approaches have the potential to generate a *broader* understanding of the multi-faceted social world through the consideration of multiple perspectives on the issue (Sale et al., 2002).

3.4 Use of mixed methods in this thesis

This thesis therefore takes a pragmatic approach to combining methodologies, and attempts to remain both sensitive to and aware of the limitations of qualitative and quantitative approaches. In attempting to utilise the strengths of each method to produce a broad understanding of how local communities live with nuclear power, appropriate methods are used to address specific aspects of the thesis.

Study 1 aims to identify, describe, and explore a range of local attitudes to nuclear power, in a contextually sensitive manner. It also aims to go beyond simple 'pro-' and 'anti-nuclear' dualisms. As some literature argues that perceptions of risk are framed in, and cannot be divorced from the context of everyday lived experiences (Tulloch and Lupton, 2003; Henwood et al., 2008) the design of this thesis incorporates Q as an approach that is sensitive to such contextual nuances. Q is a long-established technique for identifying and differentiating between shared viewpoints amongst a given group of individuals (Brown, 1980; McKeown & Thomas, 1988). It does not represent views in a statistically representative sense, but is particularly well suited to the study of the complexities and distinct configurations in understandings common to sub-sets of participants within well-defined populations or expert communities. In addition to the previously described study by Hill (1992; see Chapter 2), Q has been utilised in a range of recent risk studies (e.g. Simmons & Walker, 1999; Niemeyer et al., 2005; Tuler et al., 2005; Johnson & Chess, 2006), and is selected as an appropriate research tool in the context of this thesis.

The second (survey) stage of this thesis involves a number of aims and research questions. These include an investigation of the extent to which the main results from the Q-Study are represented in a larger local community sample; investigating the dimensionality of trust relationships between communities and the nearby nuclear power station; examining the relationships between perceptions of risk, place, and residential proximity to the power station; and identifying the factors associated with support or opposition towards new nuclear build in the local area. Such aims involve investigating broad trends across sizeable geographical areas and large numbers of respondents, and are best answered through a quantitative, survey-based approach. Next to the results of the Q-Study, the results from the survey phase of this thesis are therefore relatively robust and broadly representative of the local populace, but they are also restricted through a range of quantitative assumptions. In particular, risk is conceived, in this latter phase, on a quantitatively-measured continuum, and the term is left undefined (following Slovic, 1999). Quantitative approaches to the study of risk are sometimes criticised for reifying the concept and assuming that the term has universal meaning to research participants (*e.g.* Henwood et al., 2010). Therefore, although the assumption is made in this thesis that it is valid to aggregate such responses, it is also acknowledged that individuals' assessments of risk are socially constructed, rather than 'actual' or objective, and are therefore likely to reflect a wide range of possible undesirable outcomes (*c.f.* Henwood et al., 2010).

In interpreting the results from both these phases, additional use is made of interview data generated in a previous stage of the project (Pidgeon et al., 2008a; Parkhill et al., 2010). These illustrative quotations were identified by the author from themes coded in an existing qualitative database compiled by Pidgeon et al., (2008a; also Parkhill et al., 2010). They are used in selected analyses in this thesis where it was considered that the inclusion of such information would facilitate the interpretation and understanding of the quantitative conclusions. First, in Study 1 (the Q-Study), a series of quotations, identified from the interview transcripts of individuals associated with each of the emergent points of view, are presented to help illustrate each of the Q-factor interpretations. Second, consistent with the use of citations to illustrate conclusions in previous qualitative studies of place and place-related concepts (e.g. Bush et al., 2001; Wakefield et al., 2001; Bickerstaff & Walker, 2001; Wakefield & Elliot, 2000; Twigger-Ross & Uzzell, 1996; Dixon & Durrheim, 2004; Irwin et al., 1999; Schluter et al., 2004; Bickerstaff & Simmons, 2009; Nash et al., 2009; Devine-Wright & Howes, 2010; Burningham & Thrush, 2004; Mah, 2009; Luginaah et al., 2002; Baxter & Lee, 2004; Baxter & Eyles 1999), illustrative quotations are also used in Study 2 (Analysis J) to provide examples of the ways in which the main quantitative conclusions (relating to individuals' perceptions of the nearby nuclear power station in the context of perceptions of place) can be manifest in participant discourse.

Interview data are therefore used to aid the interpretation of quantitative results: an approach sometimes used, for example, alongside medical randomised controlled trials to provide a 'human perspective' on treatment experiences. In technical terms, interview data is therefore used to *complement* some of the quantitative results that are generated (Hammersley, 1996). However, combining results in this manner has additional positive implications for the project beyond complementarity (Box 3).

Box 3: Potential advantages of mixed method designs (from Bryman, 2006)

	Advantage	Explanation
a.	Increased validity	Mutual corroboration of results enhances validity of findings
b.	Offset	Combining approaches allows the strengths of one to offset the weaknesses of the other
c.	Completeness	A more comprehensive account of the area of enquiry can be achieved through using both qualitative and quantitative methods
d.	Process	Quantitative research describes structure in the social world; qualitative research describes process
e.	Different research questions	Quantitative and qualitative research each answer different research questions
f.	Explanation	The results from each type of research approach are used to help explain the results of the other
g.	Unexpected results	Surprising results from one approach may be explained through reference to the other
h.	Instrument development	Use of qualitative research to help develop questionnaire and scale items
i.	Sampling	One approach facilitates sampling for the other
j.	Credibility	Increased face validity of findings through mixed method designs
k.	Context	Qualitative results provide context for externally valid survey results
l.	Illustration	Qualitative results can be used to illustrate quantitative findings
m.	Utility	An implication that combined results are more useful to practitioners and others
n.	Confirm and discover	Quantitative research can be used to confirm qualitatively generated hypotheses within a single project
o.	Diversity of views	Combining researchers and participants' views; also combining relationships between variables and meanings amongst participants
p.	Enhancement	Using one approach to augment the results of the other

Bryman (2006) describes the potential advantages of mixed-methods research designs (Box 3), and a number of these are identifiable in this thesis. To an extent, the two methods (Q-Method and survey) together with the use of illustrative quotes help to *offset* the strengths and weaknesses of each through using different methodologies to answer different research questions. The incorporation of the results of the Q-Study into the subsequent survey helps to *increase the validity* of the Q-Study results through *confirming* their relevance to a larger sample of local people. Together, the methods provide a more comprehensive account of how the communities under study live with nuclear power than one method could on its own (*completeness*). Further, the interview excerpts are used to *illustrate*, *explain*, and *enhance* the quantitative results. Finally, from a policy perspective in particular, the mixed-methods design of the study potentially increases its face validity (*credibility*), and this, in turn, increases the potential *utility* value of the study as a whole.

Chapter 4 Study 1: Q-Method Study

This Chapter presents the first empirical phase of this research project. It addresses Aims 1 and 2 of this thesis, which are (a) to identify and describe the main groups of shared community opinions on the nearby nuclear power station, and (b) to investigate whether these are consistent between communities at two nuclear sites. The main objective of this chapter is to use a contextually sensitive research methodology to identify the main points of view on nuclear power amongst nearby communities, and in doing so, go beyond simplistic 'pro-' and 'anti-nuclear' categorisations. The approach selected to achieve this aim is Q-Methodology (Q).

4.1 Q-Methodology

Q is a relatively long-standing technique for the systematic examination of human subjectivity, with wide applicability to the social sciences or to any situation where the study of individual opinions and points of view is of interest (McKeown & Thomas, 1988). Subjectivity, in this context, refers to 'a person's point of view on any matter of personal and/or social importance' (McKeown & Thomas, 1988, p.7). Such points of view are assumed to be 'self-referent', meaning that they are expressed in relation to the internal frame of reference held by the participant (i.e. the self). The technique is centred on the premise that self-reference is preserved through objective (i.e. statistical) analysis of the data, rather than being compromised by the imposition of an external (subjective) frame of reference by the researcher. It is argued, therefore, that Q-Method lends a structured and relatively objective framework to the study of subjectivity.

Created as an alternative to 'inverted' factor analysis, Q seeks to make the form of subjective opinions manifest, in order that they can be observed and studied (Brown, 1980)[10]. Q method is therefore a technique through which subjective opinions can be modelled and expressed by the participant. Opinions are regarded as *operant*, as they can only reflect the point of view of the individual at that moment in time. Modelling in Q takes the form of a ranking task, in which participants are required to rank order a set of stimuli, typically a selection of statements referring to different aspects of the issue under study[11]. Rank ordering is performed according to a 'condition of instruction' (e.g. an instruction to sort the statements from those that are 'least' to 'most' like one's point of view). The stimuli themselves are intended to encompass the sum of current discourse, and are therefore limited only by the domain of subjectivity under study (McKeown & Thomas, 1988).

Completed Q-sorts are subjected to statistical analysis[12], with completed *Q-sorts* as variables (i.e. participants are treated as variables, rather than items). The person-by-person correlation matrix is then factor analysed, such that

[10] The term *R* is a generalised reference to the correlation coefficient, Pearson's *R*. *Q* is used to distinguish between conventional trait correlations (*R*) and person correlations, such as those examined through Q-methodology (Brown, 1980).

[11] Visual stimuli such as images can also be used.

[12] Q-Method relies on factor analysis to group together participants who produce similar card sorts. In general terms, FA is a process of data reduction which is used to identify subsets of correlated variables and group these clusters together as factors (Field, 2000). In *R* analysis, the objective is to produce groups of variables (factors) which collectively reflect aspects of the same underlying construct. In Q methodology, however, factors do not represent items, but groups of respondents who have produced similar Q sorts. The underlying construct represented by the Q-factor can therefore be regarded as a point of view, or perspective, to which each individual sort will correlate to a greater or lesser degree, and the loading matrix is a table of these correlations. Strictly speaking, Q, therefore, is not an 'inverted' form of conventional FA. This is because in conventional FA, the columns in the factor matrix represent individual traits with a single unit of measurement. Inversion of conventional FA, however, so that the columns in factor matrix become people, means that the columns no longer consist of scores with a single unit of measurement, which makes the scores incompatible when it comes to statistical analysis (McKeown and Thomas, 1988). In a Q method study, however, the rank assigned to a statement indicates its 'importance to me', and that is the common unit of measurement. This means that statistical analyses can be conducted, as the value of statement 'A' can be compared to that of 'B' in terms of 'self significance', even if the relevant statements relate to different concepts (McKeown and Thomas, 1988).

each emergent factor represents a point of view, and every individual participant loads to a greater or lesser degree on each factor. The magnitude of an individual's loading on a factor therefore indicates the extent to which that participant's Q-sort corresponds to that point of view (factor). Participants whose sorts show a statistically significant loading on one factor alone are typically regarded as having a perspective similar to the overarching point of view represented by that factor. Interpretations of factor (point of view) meanings are inferred by the researcher, and are based on factor arrays, which are weighted composites of all the individual Q-sorts associated with each individual factor[13].

Q therefore provides a means through which essentially qualitative subject matter might avail itself to quantitative analysis, but without completely divorcing itself from the voices of individual participants. Thus, it does not attempt to examine how views are spread across a population, and it makes no claims of generaliseability or representativeness. Instead, Q informs on the breadth of shared opinions, accounts, discourses, stories, or subjectivities (Eden, 2005). Surprises in Q therefore come from the revelation of an unexpected set of factors, and from associations between the sorts of un-associated individuals in ways the researcher had not previously realised

[13] Conceptually, the literature is unclear on what a Q-group is. They are referred to by various authors as 'narratives' (e.g. Mattson et al., 2006), 'stories', 'accounts' or 'voices' (Stainton Rogers & Stainton Rogers, 1990), 'perspectives' (e.g. Johnson & Chess, 2006), 'viewpoints' or 'points of view' (e.g. van Exel et al, 2008; Brown 1980; McKeown & Thomas, 1988), and 'attitudes' (Brown 1980). However, the use of some of these terms risks confusion with other conceptual literatures in which they have specific meanings. According to Dietz et al., (2005), an 'attitude' is a positive or negative evaluation of something specific, whilst a 'value' is a broader construct (e.g. one might 'value' nature). In contrast, a 'trait' is a personality characteristic, and a 'norm' is an 'ought to' statement. 'Beliefs' are facts as an individual perceives them, whilst 'worldviews' are generalised beliefs. In this thesis, following Brown (1980), the terms 'point of view', 'perspective' and 'attitude group' are generally adopted to refer to Q-factors. These are chosen (a) to avoid overlap with other terms which may have specific meanings, and (b) because Q-factors in the present study are comprised of a mix of attitudes, beliefs, and norms with regard to nuclear power and the nearby power station. In this thesis, a Q-factor is arguably too specific to be considered a worldview, but nevertheless constitutes a broad outlook on the issue of living with nuclear power. In this thesis, Q-groups are therefore regarded as representing shared points of view on the subject.

(Robbins & Krueger, 2000). Therefore, in keeping with the sampling requirements for qualitative interviewing, Q emphasises the inclusion of as many individuals as possible who might be likely to hold different views on the topic of the study. Q-method therefore attempts to 'provide a bridge' between qualitative and quantitative methods (Robbins & Krueger, 2000; p.636), and, although appearing highly quantitative, retains strong elements of humanistic enquiry (Eden et al, 2005).

This raises the issue of whether Q should be regarded as a qualitative or quantitative technique. Arguably, this depends, at least in part, on how it is utilised. On the one hand, Q statements are usually drawn from qualitative sources, and a significant amount of interpretation is required in the attribution of meaning to factors and sorts. On the other, the application of quantitative statistics (factor analysis) is central to Q. Thus, de Graaf (2001) regards Q as primarily qualitative, whilst Stainton Rogers & Stainton Rogers (1990) take a more quantitative stance. Hill's (1992) approach to Q resembles quantitative survey methodology, whilst Fairweather and Swaffield (2001) argue that although Q can be used in a predominantly quantitative manner, its strengths lie in its qualitative aspects. It seems, however, that the insistence of a qualitative-quantitative dualism may be at the heart of the problem, for it has also been described as a hybrid of the two, or 'qualiquantology' (Stenner & Stainton Rogers, 2004; Watts & Stenner, 2005). Those authors argue that through occupying a position somewhere between the two approaches, Q-method unfortunately appeases the exponents of neither and provokes criticism from both sides.

Consistent with the approach of Stainton Rogers & Stainton Rogers (1990), this thesis uses Q in what could be regarded as a primarily quantitative manner, in emphasising the investigation of shared, rather than individual community opinions on a nearby nuclear power station. Nevertheless, it is also recognised that Q contains strong qualitative elements. It is not, however, the aim of this thesis to contribute further to the debate on whether Q should be regarded as a qualitative or quantitative technique.

4.2. Rationale for choosing sites

Previous research on living with nuclear power has tended to focus on 'nuclear communities' such as Sellafield (MacGill, 1988; Wynne et al (1993 [2007]). In such circumstances, where the facility represents the only nearby economic multiplier, the isolation and marginalisation of nearby communities has led to the development of a specific type of 'dependent' relationship between local people and the power station. In contrast, this thesis focuses on what could be considered to be somewhat different situations, where nearby communities do not appear to be particularly marginalised or without economic opportunity. Until recently, little attention has been afforded to such sites (Simmons, 2004).

As the design of the present Q-Study drew on interview data collected previously at communities situated close to the power station at Bradwell, Essex, a decision was made to conduct the first stage of data collection at those communities. Subsequently, Oldbury was selected as a second suitable location. This decision was based partly on a desire to sample active nuclear sites: the power station at Bradwell had closed 5 years previously, and was undergoing decommissioning at the time of data collection, while the reactor at Oldbury was still operational. Being situated within two hours drive of Cardiff University, Oldbury was also selected, in part, on the basis of pragmatic considerations (time and available funding).

4.3 Study Locations

The Q-Study was therefore conducted at two communities situated close to the nuclear power stations at Oldbury, South Gloucestershire, and at Bradwell, Essex. The power station at Oldbury is situated on the southern bank of the Severn Estuary, and the nearest settlements are at Oldbury-on-Severn, which is a small, rural village (population approx 708)[14] approximately 1 mile from the reactor. The nearest towns are Thornbury (12,500), approximately 4 miles from the power station, and Chepstow (11,000), which is on the opposite bank of the Severn. The site is relatively close to the M4 motorway, the Severn Bridge crossings and the major conurbation of Bristol (400,000). In addition, there is significant industrial activity, primarily petrochemicals and shipping, around 10 miles further down the estuary. The power station at Oldbury began generating in 1968 and was operational at the time of data collection, with decommissioning due to start at the end of 2008 (although it had operated only intermittently since 2007). The operational life of the reactor was subsequently extended, and at the time of writing was scheduled to close in 2011. At the time of data collection, there had been no major local incidents or past instances of major organised opposition, although a 'Stop Hinkley, Close Oldbury' campaign had existed since 2000. This emerged as an expansion of a long-established campaign opposing the Hinkley Point nuclear power station some 40 miles further down the Severn Estuary, rather than originating in the community local to Oldbury. The site was listed as a possible location for a new nuclear power station (DECC,

[14] All population figures taken from Census (2001)

2009), and a local protest group, Shepperdine Against Nuclear Energy (SANE) has since emerged.

Bradwell-on-Sea is a small village in Essex, with a population of approximately 550 adults. The main towns in the district are Maldon (13,000), Heybridge (approx 6,500) and Burnham-on-Crouch (7,500), all about 9 miles from the power station. There is also a small town about 2.5 miles away across the Blackwater Estuary (but a 30 mile drive by car) at West Mersea (6500), from which the power station is highly visible, and the major city of Colchester (156,000) is a further 6 miles to the North. By land, the most proximate settlements are small rural villages, many of which originally drew their livelihoods from the coastal or agricultural economies. Although just under 50 miles from the centre of London, the area, being on a peninsula, is quite isolated, with poor transport links. Opened in 1962, the Bradwell station is a very early example of the Magnox type. The initial siting proposal was contested at a short public inquiry in 1956 (Welsh, 2000). Subsequent nuclear industry (NIREX) efforts to investigate the feasibility of a repository for low and intermediate level radioactive waste adjacent to the Bradwell site prompted intense local opposition in the mid-1980s, but these were not directed at the local power station itself. The reactors at Bradwell were shut down in March 2002, with lengthy decommissioning now ongoing. Like Oldbury, the site has recently been nominated as a likely site for a new nuclear power station.

4.4 Aims

This Q-study is conducted to address Aims 1 and 2 of this thesis (Box 1) through three separate analyses:

1. The first aim of the study is to identify and describe the main points of view on living with nuclear power amongst local communities. This aim is addressed in Analysis 1, which provides a broad overview of community perspectives on nuclear power.
2. The second aim of the study is to investigate whether the points of view on nuclear power revealed in Analysis 1 are consistent across the Bradwell and Oldbury sites. To do this, an alternative statistical technique (second-order factor analysis), is used to examine (a) whether the points of view identified in Analysis 1 are evident at both study locations, and (b) whether there are additional points of view that are unique to each study location.
3. Analysis 3 is then conducted to investigate one of the points of view revealed in the previous analyses in greater detail.

4.5 Method

4.5.1. Design

Q-study design hinges on the ability of participants to accurately model their point of view through the medium of the statements with which they are provided (the Q-Sample). The Q-sample must therefore be both representative of the breadth of real world opinion, and balanced in the sense that no single point of view is either under- or over-represented. In the present study, particular attention was therefore paid to two basic tasks: the generation of a comprehensive, exhaustive list of potential Q-statements (in Q-terminology, the ‘concourse’), and the procedure by which this list was condensed into a representative, balanced subset (known as the ‘Q-sample’) for use in the actual study.

To ensure that all relevant positions were covered by the Q-Sample, statements were exhaustively generated from transcripts of 35 biographical narrative interviews, conducted previously with people living near to Bradwell nuclear power station. Subjective statements, in which participants expressed views, attitudes, opinions, and values with respect to their experiences of the power station and of living in close proximity to it, were identified and listed together with their source transcript. As in some other Q-method studies (*e.g.* Eden et al., 2005), elements of grounded theory were adopted to ensure that all relevant perspectives were covered (Glaser & Strauss, 1967). On completion of this task, a point of theoretical saturation was reached and a concourse of approximately 400 potential Q-statements had been generated.

The concourse was then organised around emergent categories and themes, enabling a draft Q-sample (the set of statements) to be formulated according to those headings. This structured approach facilitated the process of ensuring that all perspectives were represented (McKeown & Thomas, 1988). Where multiple statements conveyed similar underlying perspectives, the clearest and most concise option was selected for inclusion in the study. When a common theme was represented in idiosyncratic terms over multiple statements, a generically worded statement that captured the underlying point of view was devised by the researcher[15]. Statements from the Q-sample were then contrasted with the source interviews, in order to confirm that the major themes from all interviews could be reconstructed through the statements. This ensured that all of the participants in the source interviews would, hypothetically, be able to convey their stance through the medium of the Q-

[15] For example, multiple statements reflected the theme of concern over local contamination, with regard to factors such as the safety of swimming in the sea, the cleanliness of the air, and the edibility of local produce. A general statement was devised to reflect all of these concerns: 'I sometimes worry about what gets out of the power station and into the local environment'.

sort[16]. After checking for statement duplication, eight further statements were then added. These related directly to prominent themes in the literature that were not directly addressed by any of the initial statements[17]. Finally, the Q-sample was reviewed in terms of its balance with regard to positive and negatively worded statements[18]. At the conclusion of this process, a balanced and representative Q-sample of 61 statements, each reflecting a unique perspective on living near to a nuclear power station had been generated (see Appendix 1).

4.5.2 Procedure

The Q-study was administered according to the guidelines published by McKeown & Thomas (1988). Sorting was conducted according to the condition of instruction (COI) 'Sort the cards according to the extent to which each statement reflects your point of view'. A broad COI was intentionally adopted, as the study was concerned with how the participants conceived living close to a nuclear power station, rather than with their attitudes to a specific issue such as waste storage, new nuclear build, or the risk of accidents. Cards were manually shuffled to produce an approximately random order before each sort took place, and Q-sorts were conducted on a

[16] This exercise highlighted the absence of definitive statements representing an 'activist' position. Specific transcripts from activists in the initial interviews were therefore re-examined, and additional statements were then generated from both specific articulations and overall impressions of those interviews.

[17] These were: ambivalence; 'silencing' in close communities; public need for reassurance about nuclear safety; conscious attempts to block the power station from one's mind; the 'reluctant acceptance' of nuclear power in order to combat climate change or to achieve a secure energy supply; the safety of the decommissioning process; and environmental justice.

[18] It was noted at this point that all statements relating to trust in the nuclear industry expressed distrust. Two statements were therefore reversed in polarity in order to achieve a balance of positive and negatively valenced statements on this issue. First, 'The nuclear industry operates behind a veil of secrecy' was reversed to 'The nuclear industry is open and honest'. Second, 'There are all sorts of discharges and incidents that the industry won't admit to' was reversed to 'We can trust the nuclear industry to come forward and tell the truth about any discharges and incidents'.

grid representing a forced normal distribution (Figure 1). Instructions to participants were as follows:

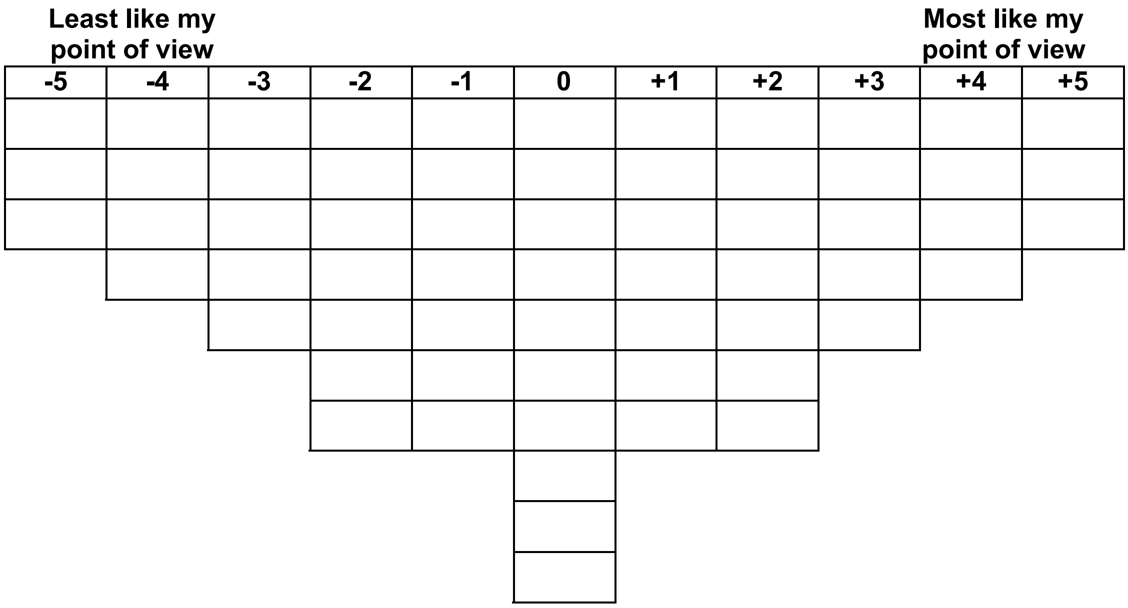
1. Participants were given the cards and instructed to sort them into 3 piles. They were asked to place those that were most like their point of view on the right, those which they were uncertain about in the middle, and those which were least like their point of view in a pile on the left.
2. A brief explanation of the board was provided (Figure 1), indicating that the cards would be placed on the grid, with the right hand side representing items that were most like the participant's point of view, and the left hand side representing items that were least similar to it.
3. Participants were then instructed to study the items on the right, select the 3 which were most like their point of view, and place these vertically under the +5 marker.
4. They were then asked to turn to the left hand pile and repeat the process, this time selecting the 3 which were least like their point of view, and placing them under the -5 marker.
5. Participants were then asked to return to the right hand side and select the 4 items that were most like their point of view and place them under the +4 marker. They were also reminded that they were free to swap items between columns at any time if they changed their mind.
6. They were then asked to repeat the process on the left hand side, then on the right hand side under the +3 column, and so on,

working towards the middle column, where unselected items were placed by default after the -1 column was completed.

7. At the end of the task, participants were asked to review the sort and make any adjustments as necessary.

On completion of the sort, the experimenter recorded the position of each item on a separate scoring sheet that reproduced the Q-sort distribution.

Figure 1: Sorting board used for Study 1



4.5.3 Pilot Study

Piloting was conducted with 5 participants, selected to represent a mix of gender, age, proximity of residence to the power station, and affiliation to the power station[19]. At the conclusion of each sort, which took approximately 30 minutes to complete, participants were asked whether there were any

[19] 'Affiliation' is defined in this thesis as an indication of whether the individual had experienced past or present employment either at a nuclear power station or for the broader nuclear industry.

statements not included in the Q-sample which would have enabled them to more accurately express their point of view.

A number of minor changes were made on the basis of the pilot. First, an additional statement, 'When it comes to nuclear power, you can't trust the government', was added to the Q-sample, on the basis of one participant's comment. An additional box was then added to the central column of the sorting board to accommodate the extra statement. Second, the 'Neutral' label on the central column was removed, as some participants found this misleading. The column was subsequently left blank (in line with Simmons & Walker, 1999). A minor procedural change was also introduced to avoid participants placing cards on the sorting board before sorting them into piles (in accordance with the procedure outlined above).

As the main aim of the pilot study was to identify procedural imperfections and gather constructive feedback from participants, a qualitative approach was employed when interpreting the pilot Q-sorts. General patterns of response were identified from each individual sort, and each was then contrasted with its corresponding interview transcript to ensure that the two were not widely dissimilar. This procedure suggested that all Q-sorts were broadly in line with the opinions expressed in the accompanying interview and no causes for concern were therefore identified.

4.5.4 Participants

Following the pilot study, data for the main study phase were collected between April and October 2007. The standard sampling procedure in Q-method is to actively gather the perspectives of individuals who would be considered to have a distinctive point of view on the topic of the research.

Accordingly, the sample included 16 individuals with specific affiliations to nuclear power, defined by past or present employment at a nuclear power station or within the wider nuclear industry[20], and also by close family ties (i.e. spouses, parents, and adult children with similar employment links). Also included were farmers working on land adjacent to the power station; their families; farm labourers; local councillors; a member of the Site Stakeholder Group at Oldbury; and a number of individuals who described themselves as having had past or present involvement with organised anti-nuclear groups (n=4, Bradwell[21]; it was not possible to identify any such participants in the Oldbury area)[22]. The study was also intended to uncover clusters of opinion amongst unaffiliated local community members (i.e. those with no specific links to the power station other than close proximity). Thus, a further group of local people was included at both sites, with a mix of gender, age group and length of residence[23]. Participants were initially identified using professional recruitment agencies which used local press advertising, canvassing (door to door and at local events) and social networking to construct a sample of local people residing in towns and villages close to both stations. The final sample was comprised of 84 participants, 42 from each location (Table 1)[24].

[20] Employment could be either direct, as with power station employees, or indirect, such as building contractors involved with on-site work.
[21] A number of additional participants were recruited at Bradwell who, although not identifying themselves as involved with anti-nuclear organisations, were nevertheless part of the social networks of such groups.
[22] Some participants, particularly those with strong views, wished to endorse or reject a larger number of statements than permitted by the forced normal distribution. As a result, two participants did not complete the Q-sort, and withdrew from the study on the grounds that they believed the technique did not allow them to represent their views adequately.
[23] The majority of participants in the Bradwell sample had originally been recruited for the interview phase of the project in 2004-5, and were re-contacted for the present study. From the original database of 37 potential participants at Bradwell, 24 agreed to take part in the Q study, 9 were not contactable, and 4 refused to participate. As in the recent Q-method study by Johnson & Chess (2006), additional participants (n=18) were identified via snowball sampling at this location. At Oldbury, however, all of the recruitment was through a local professional agency.
[24] Q is something of a paradox when it comes to considerations of appropriate sample sizes. First, it is not clear what constitutes the 'sample size' in a Q study. One argument is that

4.5.5 Use of qualitative data

As described previously, this thesis uses illustrative quotes to exemplify and clarify some of the research findings. These were identified from secondary analysis of interview transcripts from (a) a set of pre-existing interviews conducted at Bradwell in 2004-5 (not published), and (b) an interview study conducted in 2007 at Oldbury in parallel with the Q-Study (Pidgeon et al., 2008; Parkhill et al., 2010). In addition, as many of the original Bradwell interviewees as possible were re-contacted by the author in 2007 and asked to update their views on nuclear power and the nearby facility. The interviews

---

because Q analysis is sometimes regarded as inverted Factor Analysis (FA), it is the number of statements that forms the sample size, whilst the number of study participants is equivalent to the number of items in a conventional analysis. There are two problems with conceptualising the issue in this way however. First, Q theorists themselves argue that Q-analysis is not inverted FA (McKeown & Thomas, 1988). Second, some contemporary authors (Watts & Stenner, 2005) have argued that the 'inversion' argument is based on flawed logic, and that the situation is more complex than simply reversing the requirements of a typical FA. Consistent with this view, the present thesis takes the view that it is the number of participants that form the sample size.

Q-Method also raises issues in relation to the application of FA (or Principle Components Analysis; PCA) to the data. Factoring typically requires a large number of participant responses to a relative small number of items. Kline (1994) recommends a minimum sample size of 300. Costello & Osborne (2005) suggest a minimum respondent to item ratio of 10:1, although they found that ratios of between 2 and 5:1 are most commonly reported in the literature and report that strict rules have generally disappeared. They recommend that the sample size required for FA/PCA is largely a function of data quality, although as a general rule, it is emphasised that FA/PCA are large-sample procedures in which more is always better. These guidelines place Q-Method in something of a predicament, as in Q-studies, *small* sample sizes are often explicitly advocated, and the minimum sample size required for a Q study is a single case (McKeown & Thomas, 1988). Indeed, Brown (1980) describes a Q-study with n=250 participants, with the specific goal of demonstrating that large samples are unnecessary. He argues that factors appear early on in the data gathering process and additional subjects simply fill up factor space without contributing anything meaningful to the results. Others have argued that large sample sizes are actually detrimental to Q-studies, as additional sorts lead Q factors to lose detail, and the over-representation of some points of view may lead to others being obscured.

There is, therefore, disagreement in the literature in relation to this issue. Some authors argue that participant groups of between 40 and 60 are most effective (Brown 1980; Stainton Rogers, 1995). However, some established studies break this convention (notably, the study by Hill [1992], in which a random sample of n=147 is used). This thesis also adopts a relatively large sample (n=84). Samples of this size and statement-to-participant ratios similar to those used here are not unusual amongst recently published Q-studies (*see e.g.* Stainton Rogers & Stainton Rogers, 1990; Steelman & Maguire, 1999; Niemeyer et al., 2005; Bryant et al., 2006; Johnson & Chess, 2006), and some Q-theorists regard large samples as justified when the research is concerned with the identification of shared, as opposed to individual opinions (Stainton Rogers & Stainton Rogers, 1990). From a statistical point of view, this approach has the advantage of improving the quality of the analysis by improving factor stability through greater data volume.

were designed to elicit stories about participants' experiences of living near to a nuclear power station and were intended to remain open to participants' ways of representing their experiences. They were designed to be flexible and adaptive to new fields of inquiry, and the interview schedule was therefore regarded as a guide rather than a proscriptive set of questions. In total, 83 participants (Bradwell *n*=43, Oldbury *n*=39; total n=82) took part in 61 interviews (Bradwell *n*=30, Oldbury *n*=31; total *n*=61). In the majority of cases, the Q-sort was conducted before the interview. All of the interviews took place in participants' homes, and were recorded using audio equipment and subsequently professionally transcribed. All original names and identities were exchanged for pseudonyms.

Table 1: Sample characteristics

Characteristic	**Category**	**Oldbury n (%)**	**Bradwell n (%)**	**Total (%)**
Gender	Male	23 (55)	19 (45)	42 (50)
	Female	19 (45)	23 (55)	42 (50)
Age group	18-29	6 (14)	2 (5)	8 (10)
	30-39	8 (19)	8 (19)	16 (19)
	40-49	8 (19)	8 (19)	16 (19)
	50-59	8 (19)	10 (24)	18 (21)
	60+	12 (29)	14 (33)	26 (31)
Affiliation	Power Station	5 (12)	11 (26)	16 (19)
	NGO	0 (0)	4 (10)	4 (5)
Total		42 (50)	42 (50)	84

4.6 Analysis 1: Main Analysis[25]

This study provides an overall analysis of the full sample of 84 Q-sorts from both study locations. It therefore provides an overview of shared community perspectives on living with nuclear power at both sites.

4.6.1 Hypothesis

It was hypothesised that:

1. A range of 'points of view' on nuclear power would be detected, going beyond simple 'pro-' and 'anti-nuclear' attitudes.

4.6.2 Data Analysis

Consistent with most recent Q-studies, the data were subjected to principal components analysis (PCA) with Varimax rotation. Initially, all factors with eigenvalues greater than 1 were considered for retention in the factor solution (McKeown & Thomas, 1988; Stainton Rogers & Stainton Rogers, 1990). Cattell's Scree test (Kline, 1994), was adopted as a second retention criterion, and the combined results suggested that 3 factors should be retained. Finally, an interpretability criterion (Stainton Rogers and Stainton Rogers, 1990) together with a requirement that at least two Q-sorts load significantly and uniquely on each factor (Watts and Stenner, 2005) was applied to the remaining factors, leading to the retention of a fourth, clearly interpretable factor, containing 3 sorts[26]. The 4 factors accounted for 22, 20, 7 and 4% of

[25] A version of this analysis appears in *Risk Analysis* (Venables et al., 2009).

[26] There are various possible criteria for factor retention. The most basic is that all factors (or components) with an eigenvalue of greater than 1 should be selected for rotation. However, Costello & Osborne (2005) argue that this is one of the least accurate methods, and there is a general consensus that the Scree test is the best approach (Kline, 1994; Costello & Osborne, 2005). This involves plotting the size of the eigenvalues on a graph and looking for the 'break' in the data where the curve flattens (Costello & Osborne, 2005). Nevertheless, pursuing a purely mathematically driven solution to factor retention may not produce the best

the variance respectively, and cumulatively explained 53% of the total variance (Table 2).

Sorts which loaded significantly on one factor only were flagged to that factor. The significance cut-off for factor loadings was initially set at the $p \leq .01$ level, which corresponded to a factor loading of .33. This was raised incrementally in order to determine the 'optimal' cut-off which enabled the highest number of sorts to be retained (Brown, 1980; Watts & Stenner, 2005) [27,28]. Following this procedure, the final factor loading threshold was raised to .45, which enabled the retention of an additional 13 sorts.

Only 7 participants did not load significantly on any one factor. However, a further 12 participants loaded significantly on more than one factor. Most of these (9) were instances of a significant negative loading on factor 1 combined with a significant positive loading factor 2 (or vice-versa), suggesting that these two points of view are, to an extent, bipolar (see factor descriptions, below). The correlations between factor scores were of medium

---

factors for understanding and interpreting the underlying construct (Howett & Cramer, 2003). As a result, an 'interpretability' criterion is sometimes applied, where a factor may be retained if it 'makes sense' or fits with the expectations of prior theory. Some authors recommend conducting multiple analyses and retaining a different number of factors each time, in order that the solution which produces the 'cleanest' factor loadings is retained (Costello & Osborne, 2005). According to Tabachnick and Fidell (1996), 'a good PCA or FA makes sense; a bad one does not' (p.636). The Q-analyses undertaken in this thesis take all four of these considerations into account.

[27] A single sort (no.45), loaded significantly (p=.49) on Factor 3 but was also very close to reaching significance (p=.43) on Factor 1. As both sorts therefore loaded to an almost identical degree on more than one factor, the sort was classified as confounded and was therefore discarded, despite technically satisfying the significance criterion.

[28] The default criterion in Q-Method is that of the 'pre-flagging' algorithm provided in the commonly-used Q-Method analysis software 'PQMethod'. This software indicates which sorts load significantly (p<.05) on one sort only. This constitutes a perfectly adequate method of allocation, and is used in some published studies (*e.g.* Bryant et al., 2006). Brown (1980) (*also* Watts & Stenner, 2005), suggests a slightly more complex solution, however. Brown recommends calculating the factor loading that corresponds to the p<.01 significance level, using the formula $2.58(1/\sqrt{n})$, where n equals the number of statements in the Q-study. Having determined the number of sorts flagged to each factor using this formula, the cut-off can then be incrementally increased in order to find the point at which as many participants as possible can be flagged to a factor, in order to maximise the use of the data (i.e. to minimise the number of sorts that are confounded through loading significantly on more than one factor). As long as the cut-off value is increased (not decreased) to reach this goal, the approach has the effect of making the study more stringent, from a statistical point of view (Brown, 1980; Watts & Stenner, 2005). This is the approach adopted throughout this thesis.

strength (.51, between Factors 1 and 2; and .37; between Factors 1 and 4; Table 3). In addition, just one of the 62 statements was consensual (i.e. did not discriminate between any pair of factors).

4.6.3 Results

Factor meanings were interpreted from the 4 prototypic sorts. Interpretation was facilitated through additional reference to the existing interview transcripts and also to the individual sorts of those who loaded highly on each factor.

4.6.3a Factor 1: Beneficial and Safe

This factor was characterised by two main constructs: the benefits that nuclear power brought both locally and nationally, and safety associated with moderate levels of trust in the competence of the power station operators and moderate confidence in the regulators.

4.6.3b Factor 2: Threat and Distrust

This factor was based strongly on themes of threat, distrust and, to a lesser degree, social mobilisation. It produced an unequivocal sort pattern and represented a clear anti-nuclear stance.

4.6.3c Factor 3: Reluctant Acceptance

This factor was defined by far fewer sorts than the previous two perspectives. It retained elements of the other points of view but very clearly placed emphasis on aspects of current policy discourse on nuclear power and in so doing defined a unique stance. Unlike factor 1, the perspective was dominated by a cluster of similar statements indicating the *reluctant* acceptance of nuclear power.

4.6.3d Factor 4: There's No Point Worrying

As with factor 3 this emerged as a minority position among the sample, with only 4 sorts flagged, but was defined by consistently high factor scores of a small number of similar statements. Respondents with this point of view regarded the power station as 'just part of the landscape', not something that they worried about particularly, and something that they barely noticed was even there.

Interestingly, individuals with employment links to the power station were mostly associated with the B&S viewpoint, whilst all participants associated with the RA and There's No Point Worrying (TNPW) points of view were unaffiliated (i.e. they were part of the general population sample with no specific associations with the power station other than their proximity to it).

Table 2 shows the numbers of participants associated with each factor, overall and also split by the two study locations.

Table 2: Factor characteristics: Participants grouped in each factor; % of variance explained; number of distinguishing statements; and numbers of participants within each factor from each geographical location

Factor	**Total n (participts.)**	**Oldbury n**	**Bradwell n**	**Variance exp. (%)**	**No. dist. statements**
Beneficial and Safe	30	17	13	22	28
Threat and Distrust	26	8	18	20	30
Reluctant Acceptance	6	5	1	7	20
There's No Point Worrying	3	2	1	4	15

Table 3: Correlations between factor scores

Factor	1	2	3	4
Beneficial and Safe	1.00	-.51	.29	.37
Threat and Distrust		1.00	.17	-.04
Reluctant Acceptance			1.00	.19
There's No Point Worrying				1.00

Box 4 shows a number of illustrative quotations identified from the interview transcripts of individuals associated with each factor. These were selected to exemplify the four points of view and facilitate their interpretation.

Box 4: Illustrative quotes[29]

Point of View	Excerpt	Quotation
Beneficial and Safe	**A**	*Mr Ormston*: "We've got to trust the engineers. British engineers are the finest in the world"
Threat and Distrust	**B**	*Mrs Henson:* "There was a school trip a couple of years ago to the visitor centre. I forbade my son to go - it's just propaganda"
Reluctant Acceptance	**C**	*Mr Skillen:* "there's a lot of good things about it [nuclear power], in a way it's safe, in a way it's clean but the long term future is to me pretty worrying"
	D	*Mrs King:* "Yeah, it's going to have to be…I don't know about this [Severn] barrage thing… And you need so many [windfarms] to produce such a little amount..."
	E	*Mrs Dart*: "Well until they come up with a viable alternative it seems to be nuclear power [that will be necessary]"
	F	*Mrs Gerritson:"* I can't see renewables as being the hundred percent way forward. Which leaves us with what?"
There's No Point Worrying	**G**	*Miss Gerritson:* "You choose not to pick it out and identify it as something hazardous. The only time you are aware of it is if the sirens go off, and then you just think 'Oh…the power station alarm's going off…"

Table 4 shows the highest and lowest ranked statements associated with each of the four points of view. Table 5 shows the relative rankings of statements expressing (mis)trust in relation to the nearby nuclear power

[29] Psydonyms are used to protect participant identities.

station, the broader nuclear industry, and the UK government's regulation of nuclear power.

Table 4: Highest and lowest ranked statements for each factor

	Position	Beneficial and safe	Threat and distrust	Reluctant acceptance	There's No Point Worrying
Most like my point of view	**+5**	I'd rather live close to a nuclear power station than a coal fired one, or a factory billowing out toxic fumes	We need to move towards using renewable energy sources as soon as possible	Nuclear power has drawbacks but at the end of the day it will be necessary if we want to have a secure energy supply – we can't rely on imported gas and oil	There's no point worrying about the risks, otherwise you'll spend your whole life worrying
	+5	I'm confident that this nuclear power station is safe	There are far less risky ways of generating electricity than nuclear	I don't like the idea of nuclear power but I reluctantly have to admit that we may need it if we are to have any chance of combating climate change	I've never given the power station a thought – it's just part of the landscape
	+5	Nuclear power has drawbacks but at the end of the day it will be necessary if we want to have a secure energy supply – we can't rely on imported gas and oil	If they tried to put a permanent radioactive waste store on the power station site, I for one would do whatever I could to stop them	There's no point worrying about the risks, otherwise you'll spend your whole life worrying	There's nothing to stop terrorists crashing a plane into the power station and causing a major disaster
	+4	Nuclear power is one of the best forms of electricity generation. The country needs it and will have to build more nuclear power stations	I don't like the idea of radioactive waste being stored on the power station site after decommissioning	I don't really want nuclear power here, but these things have got to go somewhere	Any little incident is blown out of proportion by the media and treated as a major nuclear catastrophe
	+4	Nuclear power is one of the cleanest ways of producing energy	When you get a study that shows there's more cancer here than there should be, they just say it's a 'statistical blip'. You get the feeling they are trying to hide something	There's so much contradictory information on the risks, in the end you just don't know who to believe	As long as you block the nuclear power station from your mind, this is a great place to live
	+4	The power station has been a great asset to the community over the years	The nuclear industry doesn't really consult – they go through the motions but the important decisions have already been made	There's nothing to stop terrorists crashing a plane into the power station and causing a major disaster	According to the news, everything is going to give you cancer, so I don't let it worry me
	+4	People are only worried about nuclear power because they don't understand it	The nuclear industry tries to brainwash people into thinking that nuclear power is safe and acceptable	If there was a major incident at the power station, it would affect me wherever I lived	The government is more concerned with money and big business than our best interests
Least like my point of view	**-4**	I am reminded of the potential risks of the power station only when I see it, or when someone nearby has got cancer	Nuclear power is one of the cleanest ways of producing energy	If there was a problem, there is a very good, fail-safe system. The power station would just cut out, like pulling a plug out of the wall. It would just shut down, and that would be that	If they tried to put a permanent radioactive waste store on the power station site, I for one would do whatever I could to stop them
	-4	I worry something will go wrong because of people cutting corners or making mistakes	I find the power station quite comforting rather than a threat	I find the power station quite comforting rather than a threat	In a community like this you have to be careful about expressing your opinions about nuclear power at public meetings
	-4	A lot of people are unhappy about the power station but they don't do anything about it. Only a few of us are willing to stand up and be counted	The nuclear industry is open and honest	The power station has provided good jobs for the area - without it, this place would have ceased to exist	There are lots of cancer risks associated with the power station
	-4	There's just something about nuclear power that makes me feel uneasy	We can trust the industry to come forward and tell the truth about any discharges and incidents	The Chernobyl accident focused my mind on the fact that I was living with that potential danger	I am reminded of the potential risks of the power station only when I see it, or when someone nearby has got cancer
	-5	The power station is a terrible eyesore	I'm confident that this nuclear power station is safe	I would welcome a new nuclear power station being built here	Because of the power station, this will be a polluted, hazardous place forever
	-5	There are lots of cancer risks associated with the power station	Nuclear power is one of the best forms of electricity generation. The country needs it and will have to build more nuclear power stations	The presence of the power station is just another example of this area being picked on	We can trust the industry to come forward and tell the truth about any discharges and incidents
	-5	Because of the power station, this will be a polluted, hazardous place forever	I would welcome a new nuclear power station being built here	A lot of people are unhappy about the power station but they don't do anything about it. Only a few of us are willing to stand up and be counted	The Chernobyl accident focused my mind on the fact that I was living with that potential danger

Table 5: Rankings for 'Trust' statements

Statement	Beneficial and safe	Threat and distrust	Reluctant acceptance	There's No Point Worrying
The nuclear industry is open and honest	+1	-4	-3	-3
The government is more concerned with money and big business than our best interests	+1	+3	+2	+4
When I hear spokespeople for bodies like the Environment Agency telling us we have nothing to worry about, I do not find that reassuring	-1	+3	0	+3
If there was a problem, there is a very good, fail-safe system. The power station would just cut out, like pulling a plug out of the wall. It would just shut down, and that would be that	+2	-3	-4	-3
The nuclear industry doesn't really consult – they go through the motions but the important decisions have already been made	0	+4	+1	-1
We can trust the nuclear industry to come forward and tell the truth about any discharges and incidents	+1	-4	-3	-5
We can trust the power station staff to make sure it is safe – they are ordinary people just like us	+3	-1	+1	+2
The nuclear industry tries to brainwash people into thinking that nuclear power is safe and acceptable	-4	+4	-3	0
When you get a study that shows there's more cancer here than there should be, they just say it's a 'statistical blip'. You get the feeling they are trying to hide something	-3	+4	-3	0
The regulatory authorities in this country are probably the best in the world. There's never any question about nuclear safety at all, in any of the plants	+2	-3	0	-2
I worry something will go wrong at the power station because of people cutting corners or making mistakes	-4	+2	-1	-3
When it comes to nuclear power, you can't trust the government	0	+3	-1	+3

4.6.4 Supplementary attitude measures

Immediately following the Q-sort procedure, participants were asked to complete two supplementary questions relating to (a) attitudes to nuclear power in general, and (b) support for the building of a new nuclear power station locally. These questions incorporated a 5-point scale ranging from 'very negative' to 'very positive', and 'strongly oppose' to 'strongly support', respectively. Responses to these questions, by point of view, are shown in Tables 6 & 7.

Table 6: Overall attitude towards nuclear power by point of view

Q group	Very Negative	Fairly Negative	Neither positive nor Negative	Fairly Positive	Very Positive	Mean
Beneficial and Safe	-	-	1	15	14	4.4
Threat and Distrust	14	8	1	3	-	1.7
Reluctant Acceptance	-	-	3	2	1	3.7
There's No Point Worrying	1	-	1	-	1	2.7

Question: Overall, how do you feel about nuclear power?

Table 7: Attitude towards new nuclear build at the existing local site by point of view

Q group	Strongly oppose	Tend to oppose	Neither support nor oppose	Tend to support	Strongly support	Mean
Beneficial and Safe	1	2	3	15	9	4.0
Threat and Distrust	24	1	1	-	-	1.1
Reluctant Acceptance	1	1	3	-	1	2.8
There's No Point Worrying	-	-	2	1	-	3.3

Question: To what extent would you support or oppose the building of a new nuclear power station on the existing Oldbury/Bradwell site (as appropriate to study location)

Responses to supplementary questions were as expected. Respondents associated with the B&S point of view held, on average, relatively positive attitudes to nuclear power, and they were also most likely to support local new build. Conversely, those associated with the T&D perspective were associated with the least positive attitudes to nuclear power, and were generally opposed to the idea of new nuclear build in the local area. Mean scores for respondents associated with the RA and TNPW points of view fell between those for the B&S and T&D groups. For the B&S and T&D perspectives at least, where the group sizes were relatively large, the mean scores on these supplementary questions (which were relatively high and low, respectively) therefore help to validate the factor interpretations.

4.6.5 Discussion

This overall analysis reveals four shared community perspectives on nuclear power and the nearby facility. The points of view revealed by the study reflect a range of considerations relating to perceptions of the qualitative characteristics of the nearby power station, biases and rationalisations, value positions, trust, and place. These are now discussed in detail.

4.6.5a 'Beneficial and Safe'

The first factor revealed a point of view in which the nearby nuclear power station was perceived as 'Beneficial and Safe' (B&S). In this perspective, nuclear power was regarded as both safe and clean, and appeared to reflect a perception of risk shaped partly by economic and political factors. Respondents were clear that nuclear power brought benefits at both local and national levels (e.g. through improving the UK's energy security), and that they would rather live near to a nuclear power station than a coal fired one. The presence of this point of view is consistent with surveys describing strong support for nuclear power amongst segments of 'nuclear communities' (Melber et al., 1977; Eiser et al., 1995; Bisconti Research, 2005; 2007a; 2007b). However, although clearly a perspective that views nuclear power as highly beneficial, one of the highest ranked statements (ranked +5; Table 4) expresses a degree of ambivalence, acknowledging that while nuclear power is not perfect and has drawbacks it is considered to be the best option available. In relation to its representation amongst local stakeholders, the factor included all but one of the respondents with a direct employment link to the industry. However, it also included many who did not hold such links. Spies et al. (1998) suggest that local councillors may be more favourable towards nuclear facilities due to a preoccupation with its potential local benefits. However, the present data did not confirm this association.

In addition to the perceived benefits of nuclear power, individuals associated with this point of view expressed confidence that the power station was safe, and this appears to be linked to a strong sense of social trust, particularly in the power station workers. Previous research has shown that increased trust in the institutions responsible for nuclear governance is associated with decreased levels of perceived risk, and that high trust and low risk perceptions together are associated with positive attitudes towards nuclear power (e.g. Whitfield et al., 2009). Risk and trust have been theorised as relating to perceptions of the competence and care of an organisation (Johnson, 1999; Metlay, 1999), as a combination of expressions of trust and scepticism (Poortinga & Pidgeon, 2003), or as an indication of perceived salient value similarity (Earle & Cvetkovitch, 1995; Siegrist & Cvetkovich, 2000; Siegrist et al., 2000; 2001). The rankings of trust-related statements in this perspective suggest that individuals associated with this point of view place trust mostly in the reliability and competence of the power station personnel, with whom they appear to consider that they share salient values. However, only moderate levels of trust are expressed in relation to the nuclear industry, government or Environment Agency. Thus, concern about operators ‘cutting corners’ was rejected (-4), while the statement ‘We can trust the power station staff to make sure it is safe – they are ordinary people just like us’ was positively endorsed (+3). This may relate to perceptions that local staff will not compromise safety because any dangers will also threaten them. Some evidence suggests that social trust can be generated where people perceive a sense of common social group membership and identity (Earle & Cvetkovitch, 1995; Burningham & Thrush, 2004; Hogg, 2007; Parkhill et al., 2010), possibly as heuristics adopted to reduce cognitive demands (Langford, 2002). Social trust may therefore arise from sharing the same spatial location (place identity), and also through interpersonal social networks and day-to-day interactions between community members and locally-based plant staff (referred to as ‘thick’ trust; Williams, 1988). Consistent with this, the highest loading individual associated with this factor expressed, in interview, a strong sense of social trust and also of pride in the skills of the power station engineers (Excerpt A, Box 4). The implied reliance on the engineers in this quotation is also interesting. Langford (2002) argues that one has no choice but to trust such individuals, as the only other option is to accept a lack of control, and face the true extent of one’s helplessness and reliance on such individuals. Therefore although the reality is that most community members have to place some degree of reliance on the technology and its operators, this point of view provides an interesting contrast to the ‘dependency syndrome’ described by Wynne et al., (1993 [2007]) in communities close to the Sellafield nuclear complex in Cumbria. In that study, the dominance of the nuclear industry in providing jobs, economic multiplier effects on the local economy, and sponsorship led to the apparent 'burying' of local people's anxieties and concerns (*c.f.* Blowers & Leroy, 1994; Williams et al., 1999). The current findings indicate, however, that conditions of isolation, social deprivation and a lack of personal agency might not be the only situations in which some local people express positive attitudes towards a nearby nuclear power station.

Finally, respondents associated with this point of view generally rejected the idea that the station was an eyesore or had contaminated the local area (*c.f.* Flynn et al., 2001; Edelstein, 2003). Strong denial that valued places have been negatively affected by industrial development have been noted amongst local residents in previous literature (e.g. Bonauito et al., 1996; Kaltenbourn, 1998; Bickerstaff, 2004; Bush et al., 2001; Bickerstaff & Walker, 2001; Walker et al., 1998; Wakefield et al., 2001) and may relate to attempts to avoid the imposition of stigmatised identities on one's community by outsiders. Referred to as a 'neighbourhood halo effect' (Bickerstaff & Walker, 2001; 2004), this may reflect a cognitive strategy adopted by individuals associated with this point of view to offset perceptions of spoiled identity linked to the nearby presence of the power station. Such perceptions are investigated in more detail in Study 2 of this thesis.

4.6.5b 'Threat and Distrust'

A second point of view, this time characterised by feelings of Threat and Distrust (T&D) was also detected. Consistent with the first factor, it strongly reflects considerations of costs and benefits. However, in this instance it was the former that outweighed the latter, particularly with regard to issues of safety. All of the statements relating to nuclear threat received high rankings, and the perspective emphasised, above all, a perceived need to stop using nuclear power and to move towards using renewable sources of energy as soon as possible. Nuclear power was regarded as risky, and neither clean, nor a ‘necessary evil’ that might be required to help combat climate change or improve the UK’s energy security. Consistent with Hill’s study (1992), there was a marked sense of distrust, particularly in relation to the nuclear industry. In addition, fears about terrorism, day-to-day emissions, and the storage of radioactive waste on the site following decommissioning were apparently major concerns for people associated with this point of view.

Previous research has tended to regard clearly defined positions of opposition and support towards nuclear power as simple bipolar opposites. However, the emergence of the B&S and T&D points of view as separate points of view in this analysis suggests that in this context at least, this may not necessarily be the case (although a partial overlap is clearly evident[30]). On many issues these two perspectives do indeed express clear opposites, as with that of plant safety, which was endorsed within Factor 1 and rejected in Factor 2. However, the positioning of other statements suggest that individuals associated with the B&S and T&D points of view do not necessarily hold opposing views on all relevant issues. For example, the need to move towards using renewable sources of energy as soon as possible was highly ranked within the T&D factor (+5) and to only a slightly lesser degree in the B&S perspective (+3). Similarly, whilst the notion of spoiled place is strongly rejected in the B&S perspective, these items are ranked relatively neutrally in the T&D point of view. For example, the statement “Because of the power station, this will be a polluted, hazardous place forever” was strongly rejected in the

[30] Partial overlap is also indicated through the moderate negative correlation (-.51) of the pure case factor scores for Factors 1 and 2.

B&S factor (ranked -5), but was ranked at +2 in the T&D perspective. Likewise, "The power station is a terrible eyesore" was ranked at -5 and +1, respectively[31].

A further important difference is evident with regard to the power station's perceived contribution to the local community. Whilst the community benefits of the nearby power station were emphasised in the B&S perspective, individuals associated with the T&D factor were relatively uncommitted on this issue. This again suggests that local people with 'pro' and 'anti' views on nuclear power emphasise different (rather than simply opposite) values and salient dimensions of the issue (Otway et al., 1978; Woo & Castore, 1980; Eiser & van der Pligt, 1979; van der Pligt et al., 1982; van der Pligt et al., 1986).

Individuals associated with the T&D perspective were also most likely to express a readiness to engage in actively protesting against the nearby siting of any new nuclear facility. Indeed, the four individuals in the sample who were, or had been involved in activism all loaded highly on this factor (range: .76 - .80), and included the single highest loading individual. However, many individuals loading on this factor had no prior connection to such activity, and the 'activist' perspective did not emerge as a separate factor representing an exceptional level of concern. One possibility here is that the strength of the activist perspective may have been partly masked by the ranking requirements of the Q sort, which, contrary to the wishes of some of these individuals, restricted them from allocating more than three 'anti-nuclear' statements to the highest or lowest rank. It is notable that the potential for social mobilisation focused particularly strongly on the issue of local disposal of radioactive waste (ranked +5; Table 4). In the Bradwell area at least, this may

[31] This does not necessarily mean, however, that respondents associated with the T&D point of view did not regard the local area to have been spoiled or contaminated by the power station. Rather, it illustrates that the issues of threat and distrust are considered to be the most salient concerns for people with this point of view.

reflect the salient local issue of waste disposal, which provoked widespread local objection and protest in the late 1980s.

The issue of distrust of the nuclear industry is particularly prominent in the T&D point of view. Previous research has shown that distrust in risk managers is often correlated with the rejection of nuclear power and radioactive waste (Rosa & Clark Jr, 1999). Participants associated with the T&D factor expressed distrust towards government and the Environment Agency, but in particular of the nuclear industry (as exemplified by the highest loading individual associated with this factor: Box 4, Excerpt B). Thus, expressions of distrust in this point of view not only received higher rankings than expressions of trust in Factor 1 (B&S), but also concerned different actors and aspects of trust. In Factor 1, trust was associated with the perceived familiarity, reliability, and competence of the local power station staff, whilst distrust (in Factor 2; T&D) tended to be associated with the openness, honesty and integrity of the nuclear industry. This pattern of results points to an *asymmetry* in between judgements of trust and distrust in this context (Table 5), which reflects evidence suggesting that trust and distrust in risk management might operate in different ways. Slovic (1993), for example, demonstrates that trust is harder to gain than it is to lose, and other studies have noted the differential impacts of negative and positive risk information and their interaction with prior beliefs (White et al., 2003; Poortinga & Pidgeon, 2004; White & Eiser, 2006). In theoretical terms then, rather than viewing trust and distrust as opposite ends of a single continuum, these findings support the view that trust and distrust should be regarded as separate constructs with different functions (Earle and Cvetkovitch, 1995; Lewicki et al., 1998; Poortinga & Pidgeon, 2003; Earle, 2004). In addition, the relative salience of different aspects of trust in relation to different institutions (familiarity, reliability, and competence in relation to the local power station staff;

openness, honesty and integrity in relation to the nuclear industry) draws attention to the theoretical literature on the *dimensionality* of trust, and suggests that the perceived importance of different dimensions, or groups of trust dimensions may vary either across individuals or in relation to different institutions. These issues are investigated further in Study 2 of this thesis.

4.6.5c 'Reluctant Acceptance'

In addition to these two main factors, two other main points of view were identified. Unlike the first two perspectives, these were generally associated with participants with no specific connections to the nearby power station or to the nuclear industry in general. The first, which was associated with 6 individuals, appeared to relate to an emerging discourse of conditional acceptance of nuclear power, as a result of a perception that nuclear power may help combat climate change and contribute to energy security. Identified in focus groups by Bickerstaff et al. (2008a) as 'reluctant acceptance' of nuclear power, this discourse is exemplified in particular by two of the statements with highest rank in Factor 3. The nature of the perspective suggests that respondents associated with this point of view are likely to have been aware of recent media debates over the future of nuclear power. However, despite apparently endorsing current policy discourses, respondents flagged to this factor also harboured significant concerns about the proximity of the power station. This apparently contradictory thinking, reinforced by feelings of uncertainty ('There's so much contradictory information on the risks, in the end you just don't know who to believe'; ranked +4; Table 4), together with an apparent distrust of the nuclear industry, and to some extent the government too, suggests that some people who outwardly support policy arguments in favour of nuclear power remain ambivalent on the issue. This sense of ambivalence is partially captured in Excerpt C, a comment from an individual associated significantly with this factor (Box 4). This seems to endorse the conclusions of Pidgeon et al. (2008), that the 'reluctant acceptance' position is potentially unstable, with nuclear power only endorsed as 'the best of a bad lot'.

In addition, the provision of jobs for local people was not a prominent theme in this perspective. This suggests that although local economic multipliers may be salient to some segments of the community in generating support for the nearby power station (e.g. Eiser et al, 1995; Wynne et al., (1993 [2007]; Flynn et al 1992), the broader concerns of climate change and energy security appear to be relatively more influential as conditions underlying support for nuclear power, at least for people with this point of view[32]. Individuals associated with this perspective also appeared to consider that personal objections alone are insufficient to warrant the rejection of nuclear power, perhaps through a sense of national interest or civic duty - the idea that in the interests of the common good, an individual might accept or tolerate a certain degree of risk. As a particularly relevant and interesting point of view, this perspective is subjected to a focused Q-analysis later in this Chapter (Study 1, Analysis 3).

4.6.5d 'There's No Point Worrying'

The fourth of the factors was clear and straightforward to interpret. In contrast to factors 1 and 2, it reflected a view that the nuclear power station was a normal and unremarkable part of the landscape and place (*c.f.* Simmons & Walker, 1999; Parkhill et al., 2010), although only a very small number of individuals (3) loaded cleanly onto this factor. In this perspective, nuclear power was regarded as a

[32] This may partly reflect the fact that the power station at Bradwell is currently in the process of decommissioning, and the number of people employed there has fallen considerably compared to when the facility was operational.

relatively clean source of energy, and although there was concern about emissions to the local estuaries on which the stations were sited, minor incidents at the power station were dismissed as inconsequential and subject to media exaggeration (or 'amplification'; Kasperson et al., 1988). People associated with this perspective did not therefore appear to be particularly motivated to consider the potential risks of the power station. Accordingly, the factor was labelled 'There's No Point Worrying', and its meaning is partially captured in Excerpt G, a quotation from the highest loading individual on this factor (Box 4). In this point of view, statements which expressed criticism of those who objected to, or protested against the power station were ranked positively, while statements relating to personal activism were rejected. There was, therefore, no sympathy for local critics of the power station, who were seen as having the choice to live elsewhere, while 'Greens' were seen as blocking progress. Despite their apparent indifference to risk, however, the factor was also associated with a strong sense of cynicism towards a range of institutional actors including the government, the nuclear industry, the regulatory authorities and also environmentalists. Such expressions may reflect a general distrust of institutions and a sense of powerlessness or fatalistic acceptance (Wynne, 1993 [2007]; Douglas & Wildavsky, 1992) – not only a belief that they as individuals do not bear the responsibility or have the power to make a difference, but also that one cannot trust those with formal responsibility to act (Bickerstaff, 2004; Bickerstaff et al., 2008b). Nevertheless this point of view does express, in common with the other three perspectives, relatively more trust and confidence in the workers at the local power station.

This analysis of the full sample of n=84 reveals four clear and interpretable points of view on nuclear power. The hypothesis that a range of points of view on nuclear power would be uncovered, going beyond simple ‘pro-‘ and ‘anti-nuclear’ stances, was therefore confirmed. However, as the study represents an aggregation of the data from both study locations, further analysis is now conducted in order to investigate whether any additional points of view can be detected when the two study sites are analysed separately, and also to test whether the four points of view identified here are present at both study locations.

4.7 Study 1, Analysis 2: Second Order Factor Analysis

4.7.1 Aims and hypotheses

Study 1 Analysis 1 reveals four clearly interpretable points of view on nuclear power, and each of these is represented by participants from both study locations. This suggests that the four points of view are broadly consistent across study locations – otherwise some of the perspectives would be associated with participants from one location only. However, the act of combining datasets may also have resulted in the loss of contextual detail relating to specific concerns or salient aspects of living with nuclear power at a specific study location. The present analysis is therefore conducted to investigate these issues. It addresses Aim 2 of this thesis by examining first, whether the four points of view identified in Analysis 1 are present at both locations; and second, whether additional points of view reflecting specific local concerns exist uniquely at the two individual sites (Oldbury and Bradwell).

The following hypotheses are therefore tested:

1. All four points of view described in Analysis 1 are present at both study locations.
2. In addition to the four points of view identified in Analysis 1, there are a number of additional points of view on nuclear power which are unique to each study location.

4.7.2 Second order factor analysis

In Q-Methodology, second-order factor analysis is used to investigate whether the points of view generated after conducting the same Q-Study at separate locations are unique to each site, or consistent across studies. Second order factor analysis involves computing a correlation matrix between factors, and then factor analysing the matrix to produce new factors (Howitt & Cramer, 2003). Second order factors are therefore 'factors of factors' (p.325) and are extremely general in nature. The actual meaning of the second order factors themselves is therefore not important (Brown, 1980). Rather, it is the meanings of the first order factors, and their loadings on the second order factors that are of interest. In other words, rather than examining the extent to which individual participants are associated with first order factors (as in a conventional 'first order' Q-analysis), this procedure examines whether individual first order factors from Oldbury and Bradwell (when the two locations are analysed separately) are significantly associated with common second order factors.

This is best explained via an example. The procedure follows Brown (1980), who presents a Q-Study which produced a total of 5 different points of view after conducting the same Q-study at 3 different locations. Brown then treats the factor arrays representing the 5 points of view as *individual* (rather than composite) Q sorts and subjects these to a further factor analysis. In this context, it is therefore factors that are being factor analysed, rather than individual sorts. In Brown's study, factor analysis of the 5 points of view produced two second order factors. The meaning of these is not important – it is the loadings of the first order factors on the two second order factors that is of interest. Brown reports that 'Factor 1' from study locations 1 and 2 was associated with a common second order factor. This means that Factor 1 at study locations 1 and 2 is present at both locations, and can also be regarded as having essentially the same meaning. Factor 2 from locations 1, 2 and 3 were associated with second order factor 2. Again, this shows that these three factors are essentially the same, and that the point of view they represent was present at all 3 locations. The same approach is used by Simmons and Walker's more recent study of public perceptions of risk associated with major accident hazards at industrial sites (1999). That study found 6 factors across 7 locations. Factor 1, a point of view representing risk intolerance on the basis of vulnerability, powerlessness, and distrust, was present at all seven sites, whilst factor 3, a perspective in which risks were tolerated on the basis of trust in the companies involved, was only present at four of the locations studied.

4.7.3 Data Analysis

First, the data from Oldbury and Bradwell were separately subjected to a conventional 'first order' analysis, the same procedure as Analysis 1. This revealed four factors at each location. Following the procedure described in Analysis 1, the cut-offs for flagging sorts to factors were set at .40 (Oldbury) and .49 (Bradwell). Initial examination of these eight factors (four from each location) suggested that they corresponded broadly with the same four factors revealed in the main analysis (i.e. factors broadly similar to the previously described B&S, T&D, RA and TNPW points of view appeared to be present at both locations). To test this statistically, the eight factors were subjected to a second-order factor analysis. This involved treating the eight prototype factor arrays as individual Q-sorts, and performing a second factor analysis on these first order factors. The eight first order factors were therefore entered into PQMethod and reanalysed using PCA. Using the same retention criteria as described previously, 6 second order factors were retained. Sorts (i.e. the first order factors) were then flagged to the new (second order) factors using PQMethod pre-flagging criteria (i.e sorts were flagged to factors when they loaded at the $p<.05$ level or better on one second order factor only).

4.7.4 Results

The results of the analysis were as follows:

4.7.4a Second order factor loadings

The loadings of the eight points of view (first order factors) from each study location on the second-order factors are shown in Table 8.

Table 8: Loadings of first order factors from each location on second order factors

	Second Order Factors					
First Order Factor	**F1**	**F2**	**F3**	**F4**	**F5**	**F6**
Bradwell						
Beneficial and Safe	.22	-.30	.13	.12	**.86**	.10
Threat and Distrust	-.11	**.92**	-.01	.09	-.27	-.02
Reluctant Acceptance	-.06	.02	**.94**	.00	.22	.22
There's No Point Worrying	.12	.09	.00	**.95**	.16	.17
Oldbury						
Beneficial and Safe	.18	-.29	.22	.14	**.84**	.17
Threat and Distrust	.02	**.94**	.05	.02	-.20	.12
Reluctant Acceptance	.20	.11	.34	.26	.23	**.83**
There's No Point Worrying	**.93**	-.06	-.05	.13	.26	.14

Table 8 shows that the two T&D factors (at Bradwell and at Oldbury) loaded at .92 & .94 respectively on the same second order factor [F2]. In addition, it shows that the two B&S points of view (from Bradwell and Oldbury) load at .86 & .84 respectively on a common second order factor [F5]. It can therefore be concluded that the B&S and T&D points of view are present at both study locations, and are essentially the same. As an interpretation of the B&S and T&D factors has been previously presented (in Analysis 1), they are not described or discussed further here. However, the remaining points of view were statistically distinct (i.e. they do not both load on a common second order factor). This suggests that both the RA and TNPW points of view are statistically distinct between study locations. These, therefore, are now investigated in more detail.

4.7.4b Factor Interpretations

The following sections describe the RA and TNPW points of view revealed separately at Bradwell and Oldbury in detail.

4.7.4b(i) Oldbury: Reluctant Acceptance (n=5; 10% variance explained)

Consistent with the RA factor described in Analysis 1, this point of view is characterised by the *reluctant* acceptance of nuclear power (Tables 9 & 10). However, compared to the RA point of view presented in Analysis 1, the acceptance of nuclear power appears to be based slightly more on concerns about energy security than on the potential for nuclear power to help mitigate climate change (ranked + 5 and +3 respectively in the present analysis; both ranked +5 in Analysis 1 [Table 4]). Consistent with Analysis 1, statements describing the potential risks of nuclear power were generally ranked close to neutral in this point of view, suggesting that these were not generally salient aspects of the perspective. However, concern was expressed in relation to the possibility of a terrorist attack at the Oldbury power station (Table 10).

4.7.4b(ii) Bradwell: Reluctant Acceptance (n=3; 6% variance explained)

As expected, this point view also conveys the reluctant acceptance of nuclear power in relation to concerns about climate change and energy security (Table 9). However, in contrast to the equivalent factors described in Analysis 1 and at Oldbury, there appears to be relatively more confidence in the positive aspects of nuclear power at Bradwell. Thus, although nuclear power was considered to have drawbacks, it was also regarded as 'one of the best forms of electricity generation' (ranked +5). Interestingly, concern about radioactive waste storage emerged as a salient local concern (ranked +4).

Table 9: Ranks of statements 'defining' the RA perspective at each study location

Statement	Rank (Oldbury)	Rank (Bradwell)
I don't like the idea of nuclear power but I reluctantly have to admit that we may need it if we are to have any chance of combating climate change	**+3**	**+4**
Nuclear power has drawbacks but at the end of the day it will be necessary if we want to have a secure energy supply – we can't rely on imported gas and oil	**+5**	**+5**
I don't really want nuclear power here, but these things have got to go somewhere	**+3**	**+4**

4.7.4b(iii) Oldbury: There's No Point Worrying (n=2; 6% variance explained)

Consistent with Analysis 1, this point of view is characterised by the high ranking of a group of statements expressing a refusal to worry about the risks of nuclear power and the idea that the power station is an unremarkable aspect of the local place. Consistent with the RA point of view at Oldbury, concerns are strongly expressed in relation to the possibility of a terrorist attack at the Oldbury power station (ranked +5; Table 12). Other statements referring to the potential dangers of nuclear power are generally rejected, and the point of view suggests that it is generally considered that there is no point worrying about these. Overall, this point of view is very similar to the TNPW perspective made in Analysis 1.

Table 10: Reluctant Acceptance: Highest and lowest ranked statements at each study location

-5	-4	+4	+5
Oldbury			
A lot of people are unhappy about the power station but they don't do anything about it. Only a few of us are willing to stand up and be counted	We can trust the industry to come forward and tell the truth about any discharges and incidents	I'd rather live close to a nuclear power station than a coal fired one, or a factory billowing out toxic fumes	Nuclear power has drawbacks but at the end of the day it will be necessary if we want to have a secure energy supply – we can't rely on imported gas and oil
Personally, I try to avoid thinking about or even seeing the power station, so that I'm not reminded of the risks	The presence of the power station is just another example of this area being picked on	Nuclear power is one of the cleanest ways of producing energy	There's no point worrying about the risks, otherwise you'll spend your whole life worrying
I worry something will go wrong because of people cutting corners or making mistakes	If there was a problem, there is a very good, fail-safe system. The power station would just cut out, like pulling a plug out of the wall. It would just shut down, and that would be that	There's nothing to stop terrorists crashing a plane into the power station and causing a major disaster	If there was a major incident at the power station, it would affect me wherever I lived
	The nuclear industry is open and honest	There's so much contradictory information on the risks, in the end you just don't know who to believe	
Bradwell			
As long as you block the nuclear power station from your mind, this is a great place to live	Because of the power station, this will be a polluted, hazardous place forever	I don't like the idea of nuclear power but I reluctantly have to admit that we may need it if we are to have any chance of combating climate change	Nuclear power has drawbacks but at the end of the day it will be necessary if we want to have a secure energy supply – we can't rely on imported gas and oil
The presence of the power station is just another example of this area being picked on	I've never given the power station a thought – it's just part of the landscape	I don't really want nuclear power here, but these things have got to go somewhere	Nuclear power is one of the best forms of electricity generation. The country needs it and will have to build more nuclear power stations
A lot of people are unhappy about the power station but they don't do anything about it. Only a few of us are willing to stand up and be counted	The Greens just get in the way of progress by objecting to everything	I don't like the idea of radioactive waste being stored on the power station site after decommissioning	I'd rather live close to a nuclear power station than a coal fired one, or a factory billowing out toxic fumes
	According to the news, everything is going to give you cancer, so I don't let it worry me	The government is more concerned with money and big business than our best interests	

4.7.4b(iv) Bradwell: There's No Point Worrying (n=2; 5% variance explained)

As expected, this point of view again communicates the broad theme that the risks of nuclear power are exaggerated by the media, and that there is little point worrying about them (Tables 11 & 12). However, the general theme that there is 'no point worrying' is *less* salient than in the TNPW point of view revealed at Oldbury and in Analysis 1. In contrast, there is a strong perception that nuclear power is 'clean' (ranked +5; Table 12), but nevertheless relatively risky when compared to other forms of electricity generation ('There are far less risky ways of generating electricity than nuclear'; ranked +5; Table 12). However, there is also a clearly communicated desire to move towards using renewable energy sources as soon as possible (ranked +5; Table 12). In addition (and again in contrast to Oldbury and Analysis 1), individuals associated with this point of view would welcome the building of a new nuclear power station in the local area (ranked +4) despite their acknowledgement of its risks, and despite their mistrust in relation to the integrity of the nuclear industry's consultation procedures.

Table 11: There's No Point Worrying: Ranks of defining statements at each study location

Statement	Rank (Oldbury)	Rank (Bradwell)
I've never given the power station a thought – it's just part of the landscape	**+5**	**+2**
There's no point worrying about the risks, otherwise you'll spend your whole life worrying	**+5**	**+4**
According to the news, everything is going to give you cancer, so I don't let it worry me	**+4**	**+2**
Any little incident is blown out of proportion by the media and treated as a major nuclear catastrophe	**+4**	**+4**

Table 12: There's No Point Worrying: Highest and lowest ranked statements at each study location

-5	-4	+4	+5
Oldbury			
Because of the power station, this will be a polluted, hazardous place forever	I am reminded of the potential risks of the power station only when I see it, or when someone nearby has got cancer	According to the news, everything is going to give you cancer, so I don't let it worry me	I've never given the power station a thought – it's just part of the landscape
The Chernobyl accident focused my mind on the fact that I was living with that potential danger	We can't let the government think that because we've already got nuclear technology here, this is the best place to put more	The Greens just get in the way of progress by objecting to everything	There's no point worrying about the risks, otherwise you'll spend your whole life worrying
There are lots of cancer risks associated with the power station	In a community like this you have to be careful about expressing your opinions about nuclear power at public meetings	Any little incident is blown out of proportion by the media and treated as a major nuclear catastrophe	There's nothing to stop terrorists crashing a plane into the power station and causing a major disaster
	We can trust the industry to come forward and tell the truth about any discharges and incidents	Lots of the people who complain about the power station chose to move here when it was already here. They knew it was here yet they criticise it or are terrified of it	
Bradwell			
The regulatory authorities in this country are probably the best in the world. There's never any question about nuclear safety at all, in any of the plants	Personally, I try to avoid thinking about or even seeing the power station, so that I'm not reminded of the risks	Any little incident is blown out of proportion by the media and treated as a major nuclear catastrophe	Nuclear power is one of the cleanest ways of producing energy
If there was a problem, there is a very good, fail-safe system. The power station would just cut out, like pulling a plug out of the wall. It would just shut down, and that would be that	I worry something will go wrong because of people cutting corners or making mistakes	There's no point worrying about the risks, otherwise you'll spend your whole life worrying	There are far less risky ways of generating electricity than nuclear
People who oppose protests are frightened of acknowledging the dangers of nuclear power	If they tried to put a permanent radioactive waste store on the power station site, I for one would do whatever I could to stop them	The nuclear industry doesn't really consult – they go through the motions but the important decisions have already been made	We need to move towards using renewable energy sources as soon as possible
	The nuclear industry is open and honest	I would welcome a new nuclear power station being built here	

4.7.5 Discussion

This study suggests that the B&S and T&D factors, as described in Analysis 1, are present in almost identical forms at both study sites (Oldbury and Bradwell). However, it also shows that the two minor factors, RA and TNPW, are statistically dissimilar at these two locations. In relation to the latter, subjective interpretation of the factor meanings suggests that although these respective factors are in fact broadly similar between study locations, there are also important differences between them – some of which appear to reflect specifically local concerns.

With regard to the RA factors, the overall theme of the reluctant acceptance of nuclear power is clearly salient at both study locations. At Oldbury, the RA factor is very similar to the equivalent perspective described in Analysis 1. In this point of view, toleration of the presence of the power station appears to be based on a combination of considering that nuclear power is necessary for the UK's energy security, together with an active refusal to worry about its' potential risks. In contrast, at Bradwell, the perceived necessity of nuclear power and the lack of observable pollutants associated with it seem to be emphasised as reasons why the presence of the power station is tolerated, despite concerns about local waste storage and the motives of the government.

In relation to the TNPW point of view, the general theme that there is no point worrying about nuclear power is also apparent at both study locations. However, while the power station at Oldbury is seen to be 'just part of the landscape' (ranked +5 at Oldbury but only +2 at Bradwell), a strong sense of ambivalence is communicated in this point of view at Bradwell, where support is expressed for the building of a new nuclear power station in the area, despite perceptions that it is a relatively risky technology.

Interestingly, both pairs of factors reflect specifically local concerns. At Oldbury, the main concern appears to be a terrorist attack at the local facility. At Bradwell, concern is expressed in relation to the storage of radioactive waste at the power station site – a concern that can be traced back to the local NIREX controversy in the area during the 1980s (see Section 4.3).

4.7.6 Conclusions

This analysis addresses Aim 2 of this thesis. It demonstrates that statistically, the B&S and T&D points of view, as identified in the overall analysis (Analysis 1) are present at both study locations. In addition, it confirms the hypothesis that there are a number of additional, perspectives on nuclear power, which statistically at least, are unique to each study location. However, analysis of the meanings of these additional points of view suggests that rather than constituting wholly distinct perspectives, these additional points of view can be regarded as variants of the broad RA and TNPW points of view described in Analysis 1. In particular, they reflect some specifically local issues and concerns. The detection of such differences confirms the usefulness of Q as a contextually sensitive research methodology.

Of the range of perspectives on nuclear power and the nearby facility revealed by Study 1, the most relevant and potentially most important is the 'reluctant acceptance' attitude position. The emergence of this as a distinctive point of view was unexpected, and, as discussed in Section 4.4.5c, appears, to some extent, to reflect recent policy discourse on the future of nuclear power in the UK. A final Q-analysis is therefore conducted with the intention of examining the representation of RA in the sample in more detail. The subsequent analysis also has a secondary aim of investigating the implications of applying an alternative approach to statistical analysis to the Q-Study data.

4.8 Study 1, Analysis 3: Reluctant Acceptance: A judgemental Q-Analysis

4.8.1 Background

An interesting, politically relevant, and unexpected point of view to emerge from Analyses 1 & 2 relates to the 'reluctant acceptance' of nuclear power – an attitude position based on concerns about climate change and energy security, and which appears to be associated with non-stakeholders. This perspective is of particular interest due to its direct relevance to recent attempts by the government and industry to 'reframe' nuclear power as part of the solution to concerns about energy security and climate change – a discourse which this point of view seems to directly reflect.

Climate change mitigation has been a prominent theme in UK and international politics for around 20 years, and is consistently linked to the related issue of CO_2 emissions. Likewise, these are linked to domestic and industrial power supply and consumption, which together account for a significant proportion of a country's CO_2 production. Strategies designed to mitigate climate change are therefore commonly centred on the aim of reducing the amount of CO_2 emitted into the atmosphere (Bickerstaff et al., 2008a), with recent UK targets, as set in the Climate Change Act (DEFRA, 2007, 2008) standing at an 80% reduction in emissions of all greenhouse gases by 2050, and a 26% reduction in CO_2 emissions by 2020 (compared to the 1990 baseline). These targets therefore extend beyond the earlier goal, set in the Kyoto Protocol, of a 12.5% reduction in greenhouse gas emissions by 2010. Achieving future targets will be at least partly dependent on decreasing reliance on coal fired power stations, which emit relatively large quantities of CO_2. The situation has therefore provided a window of opportunity for the nuclear industry, which, despite appearing to be in possibly terminal decline for a number of years, has recently reframed itself as a 'green' alternative to established forms of energy production based around the burning of fossil fuels (Bickerstaff et al., 2008a). This is because at the point of production, CO_2 emissions produced by nuclear power stations are close to zero[33]. Thus, the nuclear industry has presented itself as a vehicle through which the UK can continue to consume large quantities of power whilst still working towards meeting its CO_2 reduction targets.

Accordingly, in the early 2000s, a number of arguments were strategically forwarded by the nuclear industry to focus attention on the relative weaknesses of other energy alternatives whilst downplaying its own drawbacks (Leake, 2005; BNIF, 2002). In essence, these argued that a diverse range of energy production forms were required, but that these should be underpinned by a central or 'baseload' level of electricity generation provided by nuclear power:

'The campaign co-ordinated by the NIA was designed to focus not on the historically dubious benefits of nuclear power but on the shortcomings of all the alternatives. Wind power and other renewables were "intermittent and unreliable"; a switch to gas meant relying on "dodgy" foreign exporters; and coal was simply primitive. But the campaign was also carefully finessed: none of the rival energy sources was dismissed outright; instead, the lobbyists stressed the need for a mixture of generating capacity - with a revived nuclear industry at its heart.' (Leake, 2005)

Bickerstaff et al (2008a) investigated the effects of this 'reframing' of nuclear power in a mixed-methods analysis of citizen views of climate change and radioactive

[33] *see e.g.* http://www.energybulletin.net/node/15345

waste. The study was conducted in 2002 and took the form of a nationally representative survey combined with a focus group study. At the time, the climate change mitigation frame had not been widely discussed either politically or in the media. This enabled an analysis to be undertaken of the process by which participants responded to what was, for most, a novel way of framing the case for new nuclear build. The study found that just two of the 32 focus group participants wholeheartedly supported the concept of climate change mitigation through new nuclear build as an acceptable and appropriate policy position, whilst the majority of participants generally decided that nuclear power was the 'lesser of two evils' or 'a devil's bargain' that would bring benefits but also potentially serious consequences. However, these participants generally came to the ultimate conclusion that there was little or no choice in the matter. This 'Reluctant Acceptance' stance was characterised by resignation, discomfort, and 'verging on frustration' that nuclear power was seen to be indispensable for the foreseeable future (Bickerstaff et al. 2008a p.159). Of particular interest, however, is the apparent persuasiveness of the argument. The authors concluded that a policy discourse which framed nuclear power in terms of climate change mitigation would lead people towards adopting a position of reluctant acceptance towards new nuclear build.

There has been little other research into the concept, however. One poll, conducted by MORI for the energy company EDF (Ipsos-MORI, 2005) indicated that 54% of respondents considered that nuclear power, despite its disadvantages, was required alongside coal, oil and gas as part of the UK's energy mix. Crucially however, this frame did not mention climate change or CO_2 reduction targets. It is therefore suggestive of a second reason that might lead citizens to reluctantly accept nuclear power. Known as 'energy security' or 'security of supply', this alternative discourse refers to a number of concepts related to decreasing and finite domestic oil and gas reserves. In essence, energy security relates to the potential problems of fluctuations in global energy prices and being ‘held to ransom’ by energy rich but politically unstable foreign countries. These fears were recently brought into public consciousness, for example, through extensive media coverage when Russia ‘turned off’ the supply of gas to Belarus (BBC News, 2006; 2009). Accordingly, the consultation document ‘The Future of Nuclear Power: The role of nuclear power in a low carbon UK economy’ and the Energy White Paper ‘Meeting the Energy Challenge’ (DBERR, 2008) clearly placed new nuclear build in the context of both climate change mitigation and the potential dangers of the UK becoming increasingly reliant on imported oil and gas.

Public endorsement of the RA point of view is apparent in some recent UK polls, which have noted that although nuclear power is consistently considered to be one of the least favoured forms of electricity generation, it is nevertheless generally regarded to be an important aspect of the ‘energy mix’ (*e.g.* Poortinga & Pidgeon, 2006; Spence et al., 2010). In addition, a number of recent polls commissioned by the nuclear power provider EDF appear to reflect an increasing public acceptance of this idea. For example, agreement with the statement ‘Nuclear power has disadvantages but the county needs it as part of the energy balance with coal, gas and wind power’ rose from 59% in 2007 to 64% in 2010 (EDF/YouGov, 2010). However, the survey by Poortinga et al. (2006) suggested that people in general would prefer to attempt to tackle climate change via means other than nuclear power (i.e. through increased use of renewables or lifestyle changes), and that while people may be more willing to accept nuclear power if it is seen as either a contributor either to climate change mitigation or to energy security, few would actually choose nuclear power over renewable sources of electricity production if given the choice. This is consistent with the conclusions of Bickerstaff et al.'s study, although both sets of authors may have underplayed the potential significance of concerns about energy security as a driving force behind the reluctant acceptance of nuclear power.

The emergence of the RA discourse in this thesis confirms that there is public awareness of this frame, at least within these local samples. However, to fully interrogate the Q-data in this respect, an additional analysis is necessary. This is because Analyses 1 & 2 used an automated rotation procedure (Varimax), which facilitates factor interpretation by rotating to the simplest structure. This approach produces uncorrelated Q-factors which load strongly on one factor and as close to zero as possible on the other. The approach, which is commonly adopted in contemporary Q studies (e.g. Watts & Stenner, 2005; Bryant et al., 2006; Stainton Rogers & Stainton Rogers, 1990), is a form of orthogonal rotation. It has the advantages of prioritising the influence of the participant group on the factor structure, reducing the number of cases with mixed loadings, and minimising the number of null cases (Brown 1980; Watts & Stenner, 2005)[34]. However, such advantages come at the expense of potentially lost detail (Costello & Osborne, 2005). Therefore, to gain a more nuanced and detailed description of the discourse, a further analysis (Analysis 3) is therefore conducted in order to specifically focus on the representation of the RA point of view within the Q-data. This is achieved through the use of a manual or 'judgemental' factor rotation.

Judgemental factor rotations are undertaken in Q studies when the intention of the analysis is to explore meaning, pursue prior theory, or because there may be *a priori* reasons to manually align the Q-sort of a significant individual with a factor axis. For example, the point of view of the manager of a nuclear power station

[34] Oblique rotation, whilst relatively commonplace in *R* analyses, is rarely used in Q studies, and the author has been unable to identify any examples of this approach in the literature.

might be of particular interest, but the use of an automated rotation procedure might cause that sort to fall midway between axes and emerge as a 'mixed case' in the overall factor matrix. By manually rotating the factor axes in order to directly align a particular sort with one axis, however, the point of view of that individual can be treated as a *reference variate*, such that other sorts, representing, for example, the points of view of the other staff in the power station, are viewed from the 'vantage point' of the manager. Their sorts can then be considered in the context of the point of view of the authoritative figure (McKeown & Thomas, 1988). As the main Q analysis suggests that the RA perspective is not associated with any specific stakeholder position, the present analysis focuses on expressions of the RA discourse in the sample through treating the 'purest case' (i.e. the highest loading individual on the RA factor as described in Analysis 1) as the reference variate.

The literature recommends the use of centroid factor analysis (CFA) (as opposed to PCA), when specific theoretical concepts are to be explored, or when an examination of how other points of view relate to the view of a specific individual is to be conducted (McKeown & Thomas, 1988). This is because of the differences between the two factor analytic approaches in terms of conceptual principles. In contrast to PCA, the centroid approach does not produce a mathematically terminal solution, and therefore leaves the experimenter room to further 'explore' the data through manual rotation (McKeown & Thomas, 1988)[35,36]. Accordingly, the

[35] The main difference between FA and PCA is that the latter analyses all of the variance, and seeks to explain the maximum amount of variance using the smallest number of components, whilst FA analyses only the shared variance, and attempts to estimate and account for variance that is either due to error, or unique to each variable (Tabachnick & Fidell, 1996). This raises an important conceptual issue, as the factors derived from factor analysis are regarded by some theorists as 'real world' entities which might relate to 'real' conditions such as depression or anxiety, whilst PCA produces components which, despite explaining the maximum amount of variance, are theoretically uninterpretable (Suhr, 2005), as they are simply geometrical abstractions which may not map easily onto real world phenomena.

present analysis uses CFA (in contrast to PCA, used in Analyses 1 & 2). An additional effect of this choice of analysis is that it allows the factors generated from the application of two alternative but equally valid factor analytic approaches to the same dataset to be contrasted.

4.8.2 Aims

The main aim of the following analysis is therefore to explore the RA discourse in more detail, through performing a third Q-analysis which concentrates specifically on those people in the sample with a point of view that relates to this discourse. As explained above, the use of centroid factor analysis together with a theory-driven 'judgemental' rotation of factors should produce a more detailed factor description. The aims of Analysis 3 are therefore:

1. To a gain a more focused and detailed description of the RA discourse in the sample than has been achieved in Analyses 1 & 2, through performing a theory-guided approach to the statistical analysis of the dataset.
2. To investigate the implications of conducting a centroid factor analysis (as opposed to the PCA approach conducted in Analysis 1) on the results of the study.

4.8.3 Hypotheses

No specific hypotheses are made in relation to this analysis.

---

[36] The factoring method adopted should, in theory, make little difference to the results of a Q study as they are regarded as slightly different ways of arriving at essentially the same conclusion (Burt, 1972; Brown, 1980; McKeown & Thomas, 1988; Costello & Osborne, 2005).

4.8.4 Data analysis

The full data set (n=84) was subjected to centroid factor analysis using PQMethod software. The number of factors selected to be retained for rotation was determined via the same procedure described in Analysis 1. This suggested the retention of 3 factors explaining 32, 13, and 4% of the variance. The basic meaning of each factor was then inferred from an examination of the (unrotated) prototypical factor arrays (*not presented*).

Examination of Factor 1 revealed a bipolar factor which represented, in a broad sense, a pro-/anti-nuclear point of view. This was confirmed through an examination of the factor loadings. Participants expected to have a strongly supportive perspective on nuclear power (i.e. those individuals who were strongly associated with the B&S point of view in Analysis 1) loaded significantly and positively on the factor. Similarly, individuals who communicated a strong objection to the power station (i.e. individuals strongly associated with the T&D perspective in Analysis 1) also loaded significantly on the factor, but the loading was negative.

Examination of Factor 2 revealed a point of view which strongly reflected the key elements of the RA point of view as described in the literature and in Analyses 1 & 2. As expected, examination of individual factor loadings revealed that the highest loading individual on the RA factor in Analysis 1 (participant O15; *see* Table A2a; Appendix 2) was significantly and uniquely associated with the factor. The factor was then manually rotated, relative to Factor 3, in order to align this individual's sort with the Factor 2 axis. This procedure serves to place all of the other sorts associated with the factor in the context of this 'purest case' individual (McKeown & Thomas, 1988). Following rotation, only one respondent remained who loaded significantly on the third factor (loading: .45). As the loading was not high, and also because this participant was not a key individual thought to hold a unique perspective, the third factor was excluded from the analysis at this point. With Factor 3 excluded from the analysis, it was therefore necessary to subject Factor 2 to a second rotation, again in order to align the purest case individual with the Factor 2 axis, only this time, relative to Factor 1. Following this, sorts were manually flagged to factors, using the cut-off procedure described previously, which was optimised at .33 (equivalent to the $p<.01$ level).

4.8.5 Results

The analysis produced two factors which are described below.

4.8.5a Factor 1: Pro/anti-nuclear

This factor was associated with 42 participants, 22 of whom loaded positively on the factor, and 20 who loaded negatively. It explained 32% of the variance and incorporated the individuals with strong pro- and anti- nuclear views from Analysis 1. Former power station workers loaded positively and strongly on this factor (range: .62 - .81)[37]. Those who loaded positively on this factor could broadly be considered to have a 'pro-nuclear' stance, and those who loaded negatively, the opposite. The factor is not described in detail, as it is not the main focus of the analysis

4.8.5b Factor 2: Reluctant acceptance of nuclear power due to concerns about energy security and climate change

This factor is the main focus of the analysis. It was associated with 16 individuals and explained 12% of the variance. In this point of view, nuclear power was, as

[37] With the exception of one former employee who had previously lost a child to cancer (loading .52)

expected, regarded as necessary to improve energy security, and as a way of tackling climate change, despite its drawbacks.

4.8.5d Supplementary measures

Responses to the supplementary attitude measures that were completed by respondents in this factor are informative. One would expect, on average, respondents associated with the Reluctant Acceptance point of view to express a marginal level of overall support for nuclear power and also for new build. Table 13 shows that the mean scores on both measures were therefore broadly as expected.

Table 13: Responses on supplementary questions (Reluctant Acceptance factor only; n=16)

Question	Mean	Mode	Min	Max
A. Overall, how do you feel about Bradwell/Oldbury nuclear power station	3.63	4	1	4
B. To what extent would you support or oppose the building of a new nuclear power station on the existing Bradwell/Oldbury site*?	2.56	3	1	4

* as appropriate to the study location

The most common response to question A was 'Fairly positive' (i.e. point 4 on a 5 point scale). To question B, the most common response was 'Neither Positive nor Negative'. Again, this is as expected, although the mean level of support for new build locally was slightly lower than anticipated. Interestingly, no respondents felt 'Very Positive' about nuclear power or felt that they would 'Strongly Support' the building of a new nuclear power station locally. The range of responses (i.e. from 1-4 on both questions) suggests that there was inconsistency across attitudes to nuclear power and towards new build locally within those associated with the RA point of view.

4.8.5e Comparison with Analysis 1

Tables 14 and 15 contrast the positions of the statements considered most important to the RA point of view.

Table 14: Reluctant Acceptance: Comparative ranks of 'defining' statements' between Analyses 1 & 3

Statement	Rank (Analysis 1)	Rank (Analysis 3)
I don't like the idea of nuclear power but I reluctantly have to admit that we may need it if we are to have any chance of combating climate change	**+5**	**+4**
Nuclear power has drawbacks but at the end of the day it will be necessary if we want to have a secure energy supply – we can't rely on imported gas and oil	**+5**	**+5**
I don't really want nuclear power here, but these things have got to go somewhere	**+4**	**+2**

Table 14 shows that the rankings of the statements considered central to the RA point of view differed only slightly between analyses. Whilst 'Nuclear power has drawbacks but at the end of the day it will be necessary if we want to have a secure energy supply – we can't rely on imported gas and oil' was consistently ranked +5 across studies, 'I don't like the idea of nuclear power but I reluctantly have to admit that we may need it if we are to have any chance of combating climate change' was ranked +5 in Q-study 1 but +4 in the present study, and 'I don't really want nuclear power here, but these things have got to go somewhere', ranked +4 in Analysis 1, was ranked +2 in the present analysis.

Table 15: Reluctant Acceptance: Highest and lowest ranked statements in Analyses 1&3

-5	-4	+4	+5
Analysis 1			
The presence of the power station is just another example of this area being picked on	The power station has provided good jobs for the area - without it, this place would have ceased to exist	There's so much contradictory information on the risks, in the end you just don't know who to believe	I don't like the idea of nuclear power but I reluctantly have to admit that we may need it if we are to have any chance of combating climate change
A lot of people are unhappy about the power station but they don't do anything about it. Only a few of us are willing to stand up and be counted	I find the power station quite comforting rather than a threat	There's nothing to stop terrorists crashing a plane into the power station and causing a major disaster	Nuclear power has drawbacks but at the end of the day it will be necessary if we want to have a secure energy supply – we can't rely on imported gas and oil
I would welcome a new nuclear power station being built here	The Chernobyl accident focused my mind on the fact that I was living with that potential danger	If there was a major incident at the power station, it would affect me wherever I lived	There's no point worrying about the risks, otherwise you'll spend your whole life worrying
	If there was a problem, there is a very good, fail-safe system. The power station would just cut out, like pulling a plug out of the wall. It would just shut down, and that would be that	I don't really want nuclear power here, but these things have got to go somewhere	
Analysis 3			
I find the power station quite comforting rather than a threat	The power station has provided good jobs for the area - without it, this place would have ceased to exist	I don't like the idea of nuclear power but I reluctantly have to admit that we may need it if we are to have any chance of combating climate change	Nuclear power has drawbacks but at the end of the day it will be necessary if we want to have a secure energy supply – we can't rely on imported gas and oil
The presence of the power station is just another example of this area being picked on	I would welcome a new nuclear power station being built here	There's nothing to stop terrorists crashing a plane into the power station and causing a major disaster	There's no point worrying about the risks, otherwise you'll spend your whole life worrying
A lot of people are unhappy about the power station but they don't do anything about it. Only a few of us are willing to stand up and be counted	The nuclear industry is open and honest	I don't like the idea of radioactive waste being stored on the power station site after decommissioning	If there was a major incident at the power station, it would affect me wherever I lived
	Because of the power station, this will be a polluted, hazardous place forever	I'd rather live close to a nuclear power station than a coal fired one, or a factory billowing out toxic fumes	

Table 15 shows the statements awarded highest and lowest rank in relation to the RA perspectives as revealed in Analyses 1&3. The differences between the two sets of results are again relatively minor, although some of these small differences are potentially important. First, a stronger element of distrust of the nuclear industry is emphasised in the present analysis (compared to Analysis 1), through the strong rejection of the statement 'The nuclear industry is open and honest'. Furthermore, there is an apparently lowered sense of 'civic duty' in the present analysis, compared to Analysis 1 (ranked +4 in Analysis 1; +2 in the present analysis). In addition, attempts to minimise or rationalise the risks of nuclear power are more prominent in the present analysis. Thus, whilst 'There's no point worrying about the risks, otherwise you'll spend your whole life worrying' is ranked at +5 in both studies, 'If there was a major incident at the power station, it would affect me wherever I lived' is ranked +5 in the present analysis, but +4 in Analysis 1, and 'I'd rather live close to a nuclear power station than a coal fired one, or a factory billowing out toxic fumes' is ranked +4 in the present analysis, and +2 in Analysis 1. There is, however, apparently less confusion due to contradictory information in the Analysis 1 (ranked +4) compared to the present analysis (ranked +2). Finally, while the effectiveness of the safety systems at the nearby power station are doubted in Analysis 1 (ranked -4), the present analysis emphasised concerns about radioactive waste storage in the nearby area (ranked +4 in the present analysis, +3 in Analysis 1).

Table 16: Participants flagged to the Reluctant Acceptance factor across Analyses 1-3

Participant	Analysis 1	Oldbury (Analysis 2)	Bradwell (Analysis 2)	Analysis 3
O4	-	-	-	X
O7	X	X	-	X
O13	X	X	-	X
O15	X	X	-	X
O16	-	-	-	X
O22	X	-	-	X
O25	-	X	-	X
O30	X	-	-	X
O33	-	X	-	X
O40	-	-	-	X
B45	-	-	X	X
B54	-	-	-	X
B57	X	-	X	X
B61	-	-	X	-
B69	-	-	-	X
B76	-	-	-	X
B83	-	-	-	X

O=Oldbury; B=Bradwell

Table 16 shows the individual respondents associated with the RA factors across the three Q- analyses (Study 1; Analyses 1-3). It shows that the RA factor produced by the present analysis was associated with 16 individuals, compared with just 6 in the main analysis. The RA factor, in the present analysis, is therefore a much broader reflection of shared community opinions than the equivalent perspective presented in Analysis 1, which reflected the views of fewer individuals. It also suggests that elements of the RA discourse are present in a greater proportion of the sample than suggested in Analysis 1, in which this discourse emerged as a minor factor.

The sorts associated with the RA perspective in the present analysis were generally the same individuals associated with the RA perspective in the previous two analyses (1&2). Table 16 shows that all 5 sorts associated with the RA point of view at Oldbury were likewise associated with the RA perspective in Analysis 3. Similarly, 2 of the 3 sorts flagged to the RA perspective at at Bradwell were categorised as representing the RA perspective in Analysis 3. In the present analysis, there were, however, 10 additional sorts (compared to Analysis 1) associated with the RA perspective. Originally (i.e. in Analysis 1) these were flagged to the B&S (n=3) and T&D (n=4) factors, and the remaining 3 sorts were not associated with any factor in Analysis 1.

Table 17: Factor Loadings on Reluctant Acceptance Factor (Analysis 3)

Respondent	Loading	Respondent	Loading
O4	.43	**O40**	.39
O7	.39	**O33**	.47
O13	.56	**B45**	.56
O15	.70	**B54**	.48
O16	.43	**B57**	.50
O22	.70	**B69**	.50
O25	.52	**B76**	.39
O30	.51	**B83**	.49

Mean loading: .50; range: .39-.70; O=Oldbury, B=Bradwell

Table 17 shows the strengths of the factor loadings for individuals associated with the RA perspective in the present analysis. It shows that factor loadings were generally not high, ranging from .39 to .70, with a mean loading of .50.

4.8.6 Discussion

This analysis had two main aims. First, to explore in more detail the nature of an unexpected and policy-relevant point of view (RA) revealed in Analysis 1, through a focused analysis conducted specifically to examine the perspective. Second, to draw a contrast between the results of the PCA analysis of the data conducted in Analysis 1, and an alternative approach to data modelling (Centroid factor analysis).

The differences in factor interpretation between the present analysis and Analysis 1 are also interesting. First, in the present analysis, support for nuclear power on the basis of its perceived contribution to energy security appears to be slightly more important to the perspective than support based on perceptions of its ability to help mitigate climate change (Table 15). Consistent with this, recent research suggests that concern about climate change has declined in recent years, and uncertainty about the reality of anthropogenic climate change appears to have increased (e.g. BBC, 2010; Leiserowitz, et al, 2010; Pew Research Centre, 2009; Spence at al., 2010). In relation to the importance of concerns about the security of energy supplies, reference to the interview transcripts of individuals associated with this point of view is informative. These suggest that nuclear power is considered necessary, at least in part, because renewable sources of electricity production are seen as unreliable, meaning that there is little choice but to tolerate nuclear power. This is illustrated in Excerpts D, E, and F, in response to the interview question “Do you think that nuclear power is necessary to meet the energy needs in the UK?” (Box 4).

In a more general sense, one of the most important results from this analysis is that the present results place slightly more emphasis (than Analysis 1) on (a) attempts to rationalise and normalise the potential risks of nuclear power, (b) concern about radioactive waste, and (c) distrust in the nuclear industry. In addition, the results suggest, in contrast to Analysis 1, that the idea of 'civic duty' (the idea that one might feel morally obliged to tolerate the presence of a nuclear power station for the greater good of society) may not be an important element of this point of view. Collectively, these results, particularly the suggestion that the discourse may not be underpinned by a sense of moral obligation, suggest that the RA point of view may be even more ambivalent and potentially fragile than initially implied.

Finally, it is notable that the prospect of new nuclear build in the nearby area is perceived very negatively in both Analyses. This shows that although the RA point of view implies support (albeit *conditional* support) for nuclear power, this should not be confused with preference or favourability towards the technology. Respondents associated with this point of view are clearly not in favour of new build in the nearby area, even if on other measures, it appears that they may tolerate such a development (see Table 13). In the context of strong denials that the power station has contaminated the local place (Table 15), nuclear power may, therefore, be considered by local residents associated with this point of view not just as the 'least bad' form of electricity generation in a national or international sense, but also the 'least bad' to live near to.

4.8.7 Methodological implications

The second main aim of Analysis 3 was to examine the implications of analysing the Q-data using centroid factor analysis (together with theoretically guided factor rotation) compared to the PCA (with Varimax rotation) conducted in Analysis 1. As discussed earlier, this latter technique, while facilitating factor interpretation, can cause the subtleties of factor meanings to be lost (see Costello & Osborne, 2005). The present analysis appears to confirm this expectation. Analysis 3 produced a point of view that closely reflected the RA discourse, but also places greater emphasis on the potential fragility and ambivalence of the point of view. However, the study also demonstrates the subjectivity, or imprecision of Q-analysis. For example, the equivalent RA factor in Analysis 1 was associated with just 6 individuals, compared to 16 in the present analysis (Table 16), and seven of these 10 additional sorts were originally (i.e. in Analysis 1) classed as representing the B&S (*n*=3) or T&D (*n*=4) points of view. This shows that it is possible for the same sorts to be strongly associated with multiple (but, to an extent similar) points of view in a Q-Study, depending on the method of statistical analysis pursued.

The literature states that the results of a factor analysis (and a Q-Study) should be essentially the same, regardless of whether PCA or centroid factor analysis is performed (Burt, 1972; Brown, 1980; Costello & Osborne, 2005). However, in the present analysis, a two-factor solution was revealed, compared to a four factor solution in Analysis 1. In the present analysis, factor 1 emerged as a bipolar factor on which supporters of nuclear power and/or the local power station loaded positively, and opponents negatively. In Analysis 1, however, separate (but partially correlated) factors reflecting strong support for, and opposition to nuclear power were revealed (labelled B&S and T&D). Whether the B&S and T&D points of view should be considered bipolar (as in Analysis 3) or independent (as in

Analysis 1) is therefore debateable. It would appear that the powerful PCA approach, which maximises factor separation and seeks to explain the maximum amount of variance with the fewest factors, was sufficiently powerful to force separate factors in Analysis 1. In contrast the centroid technique, which analyses the shared variance only, was not (in Analysis 3). According to Suhr (2005), the centroid approach produces more valid solutions which hold greater 'real-world' relevance than those from PCA, which are purely mathematical abstractions. However, both approaches are valid, and each is used appropriately in this study.

A similar issue is raised in respect of the TNPW factor, which emerged as a separate factor in Analysis 1, but was not detected in Analysis 3. In fact, the RA factor contained strong elements of the TNPW point of view in both analyses (in particular, 'There's no point worrying about the risks, otherwise you'll spend your whole life worrying'; ranked +5 in each). Interestingly however, none of the individuals associated with the TNPW point of view in Analysis 1 were associated with the RA factor in the present analysis. This shows that the two perspectives are distinct, and that they were not simply combined into a single factor in Analysis 3. However, as with the issue of whether the B&S/T&D points of view should be considered bipolar or not, the question of whether the TNPW point of view should be considered a valid and distinct perspective also seems to depend on the method of analysis chosen.

Finally, the relatively low factor loadings observed in this study (highest loading =.70; Table 17)[38] shows that the RA point of view described here did not closely match the point of view of any individual participant. The concept of Reluctant Acceptance therefore remains ill-defined and also inconsistent across individuals. This Q-study was, of course, designed as a broad instrument, intended to be

[38] In contrast, on Factor 1 in the present analysis analysis, seven sorts loaded at .80 or above, the highest being .86.

sensitive to as wide a range of points of view as possible: it was not specifically designed to capture the discourse of RA in detail. To fully understand the discourse, future research would be required. However, the relative importance of energy security as part of the point of view in the present study (compared to the original research conducted in 2002) shows that the discourse of reluctant acceptance cannot be assumed to be static. It is likely remain fluid in the context of developing policy arguments, and events and incidents around the world which may also shape public thinking and concerns. Future research is therefore unlikely to uncover the RA discourse in exactly the same form in which it is presented here.

4.9 Study 1: Summary and Conclusions

Through the use of Q-method, Study 1 addresses Aims 1 and 2 of this thesis in detecting and describing the main points of view on nuclear power in two local communities. Collectively, these describe a range of opinions on nuclear power, and go beyond simplistic ‘pro-’ and ‘anti-nuclear’ categorisations. Although some differences were detected between sites in relation to the RA and TNPW points of view, the broad similarity in the results at both locations suggests a degree of transferability of the findings, at least to other UK nuclear communities living in similar circumstances, and further research would clearly be desirable to investigate this possibility. In particular, the three analyses draw attention to the following:

1. As Q-methodology uses theoretical sampling (see Pidgeon & Henwood, 2004), the data do not allow conclusions to be drawn on the extent to which the various points of view described here might be distributed across a larger population of similar individuals.
2. Analysis 1 points to an asymmetry between the bases of trust and distrust, which are associated with the actions of different actors and different aspects (dimensions) of trust. Positive expressions of trust appeared to be based on confidence in the local power station operators, whilst distrust appeared to be connected to perceptions of dishonesty in the nuclear industry.
3. The results, in relation to strong denials that the power station has in some way spoiled or contaminated the local area (strongly evident in the B&S and RA points of view) point to the potential importance of ‘sense of place’ in determining perceptions of risk, and also in shaping perceptions of the power station in the context of the local landscape.

The second main empirical phase of this thesis is designed to explore each of these issues through a quantitative survey design.

Chapter 5: Study 2 Household Survey

5.1 Introduction and Rationale

This section describes the second main empirical phase of this thesis, which takes the form of a large-scale household survey, conducted at communities situated close to the nuclear power stations at Oldbury and also at a third site, Hinkley Point. The survey was designed to build on the previous phase of the project through further investigating some of the main results and themes to emerge from the previous Q-Study (Study 1). In that study, four main points of view were identified and described, representing a range of discourses of support, objection and disinterest in relation to nuclear power and the nearby nuclear facility. Within these, the themes of trust, perceived risks and benefits, and perceptions of place emerged as particularly prominent across the four points of view. The present study (Study 2) further investigates these themes and perspectives through the medium of a major household survey. This enables the main findings from Study 1 to be further examined with the advantages of a fully quantitative methodology. Study 2, like Study 1, also draws in selected places on interviews from the parallel interview study conducted by Parkhill et al., (2010). As in Study 1, this qualitative data is used in selected places in the form of illustrative quotes, which are used, where appropriate, to clarify and exemplify some of the quantitative conclusions.

Study 2 is comprised of via 10 main analyses (Analyses A-J), which are designed to investigate Aims 3-7 of this thesis. These are:

3. To investigate the distributions and characteristics of the four 'points of view' on nuclear power described in Study 1, and the differences between them, in a larger and more representative community sample.

4. To examine the nature of trust relationships between communities and a nearby nuclear power station, and to investigate (a) whether these are consistent across familiar and unfamiliar nuclear risk management institutions, and (b) whether they are consistent across a range of prior attitudes towards nuclear power.
5. To investigate the role of Salient Value Similarity in local people's trust relationships with a nearby nuclear power station.
6. To investigate the associations between risk perceptions, trust, sense of place, and residential proximity to a nearby nuclear power station.
7. To investigate the factors associated with support for new nuclear build in the local area.

These aims are addressed through a number of specific hypotheses (listed separately for each analysis). First, Analyses A-C examine the four points of view on nuclear power in more detail. Analysis A investigates the 'prevalence' of these across a broader and more representative local sample. Analysis B then examines the similarities and differences across the four points of view on a range of psycho-social and demographic variables. Analysis C investigates the relationships between the representation of the four points of view in the sample and residential proximity to the power station.

Next, Analyses D-G examine the role of Trust in community relations with the nearby nuclear facility. Analysis D investigates the dimensionality of trust in relation to nuclear power, and Analysis E examines the differences in the dimensionality of trust between the four attitude groups. Analysis F investigates the relationships between proximity to the power station and the dimensionality of trust, and Analysis G investigates the implications of using an alternative approach to the data analysis.

Analyses H&I then turn to the concept of Sense of Place, its relationship with perceived risks and residential proximity to the power station. Finally, the Chapter closes with an investigation into the factors associated with support for the building of a new nuclear power station in the nearby area (Analysis J).

5.2 Design

5.2.1 Questionnaire Design: Overview

A questionnaire was designed to address the aims of the study. It was conceived as part of a broader 5-year ESRC-funded project, 'Living with Socio-Technical Risk: A Mixed-methods Approach' (LWSTR), and contained some additional items which are not the specific focus of this thesis. The complete questionnaire can be found in Appendix 3. It was divided into seven main sections, which assessed the following:

(a) Project information

(b) General environmental concern

(c) The extent to which 4 vignettes, each describing one of the four points of view from the previously conducted Q study matched the respondent's own point of view on nuclear power

(d) Trust in the UK government's risk regulation of nuclear power

(e) Trust in the British Nuclear Industry

(f) Trust in the local plant operators at Hinkley Point/Oldbury nuclear power stations (as appropriate to study location)

(g) Risk/benefit judgements; judgements of the acceptability of nuclear power; attitudes towards local and national new nuclear build; and sense of place.

(h) Preferences with regard to future policy directions relating to national energy choices.

(i) Demographic information

The following sections describe the questionnaire in more detail.

5.2.1a. Project information

Information about the project was printed on the front cover of the document and contained brief information about the project and questionnaire. More detailed information about the project was included on a separate sheet that was placed inside the questionnaire. Participants were thanked for agreeing to take part in the study, which was described as a 'study on nuclear power'. It emphasised that the study was conducted independently by Cardiff University, used ratings scales requiring tick-box answers, and should take about 15 minutes to complete. The anonymity of the data was also emphasised, and a phone number was provided through which participants could contact the researcher for further information if necessary.

5.2.1b. General Environmental Concern

This section incorporated 10 questions replicated exactly from the study by Poortinga & Pidgeon (2006), which assessed concern in relation to a range of global, national, and local environmental issues. These were: climate change, crime in the neighbourhood, deforestation, genetically modified food, litter in the nearby area, new development in the countryside, nuclear power, radioactive waste, using up energy resources that are not replaceable, and increases in road traffic. Not all of these items were used in subsequent analyses. The items of particular interest in relation to this thesis were those relating to concern about climate change, and concern in relation to different forms of energy production and related concepts (i.e. nuclear power, radioactive waste, and using up energy resources that are not replaceable).

5.2.1c. 'Points of view' on living near to a nuclear power station

This section contained four vignettes, which briefly described each of the four points of view identified and described in Study 1 (Analysis 1). Respondents were asked to read all four points of view and to indicate, on a 5-point response scale ranging from 'not at all like my point of view' to 'very like my point of view', the extent to which each was similar to their own perspective on nuclear power. Respondents were also required to indicate which of the points of view was most similar to their own. The design of this section of the questionnaire is described in detail in Section 5.5.1. of this thesis.

5.2.1d-f. Trust (in the UK government's regulation of nuclear power; the nuclear industry; and the local plant operators)

This extensive section assessed trust in three of the institutions responsible for nuclear safety. Sixteen items were developed to represent 8 'dimensions' of trust (identified from previous literature). Two items, one worded positively and one negatively were included in relation to each dimension, in order to measure trust and distrust respectively. The same set of 16 items was repeated 3 times, once for each of the 3 institutions. This section is described in more detail in Section 5.5.2. An additional item assessing 'normalisation' in relation to the staff at each of the three institutions was included as part of the broader 'Living with Socio-technical Risk' project and is not analysed in this thesis.

5.2.1g Perceptions of Oldbury/Hinkley Point Nuclear Power station (as appropriate to study location) and the local area

This section of the questionnaire concentrated on perceptions of the nearby nuclear power station and the local area. Perceived risks and benefits were measured individually, and also in relation to each other (i.e. respondents also indicated the extent to which they felt that the risks of the nearby power station outweighed the benefits, or vice-versa). Consistent with Poortinga et al., (2006), this latter concept is referred to as 'acceptability' in this thesis. Overall attitudes in relation to the nearby power station were assessed through the item 'Overall, how do you feel about Oldbury/Hinkley Point nuclear power station?' which was responded to on a 5-point scale ranging from 'very negative' to 'very positive'. Respondents were also asked to indicate the extent to which they would support or oppose the building of a new nuclear power station at the existing nuclear site. The section also contained a number of items designed to quantitatively measure Sense of Place (SoP). These latter items are described in more detail in Section 5.5.3.

5.2.1h Nuclear Power in the UK and future UK energy policy preferences

The first 4 questions in this section replicated those of the previous section of the questionnaire, but referred to nuclear power in the national context of the UK, rather than the individual nuclear facility which respondents lived close to. For example, respondents were asked to indicate the extent to which they would support or oppose the building of new nuclear power stations 'in the UK' (as opposed to at the existing nearby site). These items were replicated from the previous survey by Poortinga et al., (2006) and were included primarily to provide a tracking element with that survey for the broader LWSTR project. The section also included a series of 6 items (again replicated from the previous survey by Poortinga et al) which assessed agreement with a number of policy related statements on future electricity production in the UK. These items reflected the arguments forwarded by the government, nuclear industry and 'green' groups in relation to nuclear power. As with the other questions in this section, these items were included primarily to track responses from the previous 2006 survey for the LWSTR project and are not used in this thesis.

5.2.1i Demographic information

Data was collected on: gender; age (assessed in 6 categories: 18-24; 25-34; 35-44; 45-54; 55-64; and 65+ years); the town or village that the respondent lived in (this enabled a 'proximity' variable to be calculated; see section 5.5.4); and the respondent's length of residence in the area. A question also was included to examine respondents' connections with the nuclear industry. This question had 6 categories: "I work, or I have worked at a nuclear power station"; "I have family or friends who work, or have worked at a nuclear power station"; "I work, or I have worked for the British nuclear industry"; "I have family or friends who work, or have worked for the British nuclear industry"; "No connections"; and "Other, please specify" (open ended). This item was designed to assess familiarity at two levels, reflecting personal experience (e.g. "I work, or I have worked at a nuclear power station") and also a secondary level of affiliation (when friends, or members of the respondent's family had worked either at a nuclear power station or for the nuclear industry). These constructs are referred to as 'Personal Affiliation' and 'Affiliation (friends and family)' in this thesis. Additional items collecting information on the presence of dependent children in the household and respondents' care-giving responsibilities were included to test a number of hypotheses pertaining to the relationships between gender, parental roles, and risk perceptions, but again, these are not the focus of the present thesis.

5.2.2 Response Scales

In most cases, the questionnaire used a 5-point response scale. The 5-point scale was chosen because scales using 5-7 response choices are considered optimal and can be normally be analysed with statistical approaches requiring continuous data without major problems (Betz, 1996; Bentler & Chou, 1987). Section (B) of the questionnaire used a 4-point scale in order to retain consistency with the previous study by Poortinga et al., (2006).

5.2.3 Counterbalancing

To avoid effects on the data from question order known as ‘order effects’ or ‘framing’ (see e.g. McFarland, 1981; Schuman et al., 1981), the questionnaire was comprehensively counterbalanced. The section of the questionnaire assessing agreement with the four points of view on nuclear power (described in detail in Section 5.5.1), was located either at the front of the questionnaire (i.e. immediately following General Environmental Concern; section B) or at the back, immediately preceding section I (Demographic Information). The order of vignettes within the task was also rotated two ways, such that the order of presentation was either (1) Reluctant acceptance, (2) There’s no point worrying, (3) Beneficial and safe, (4) Threat, or (1) Beneficial and safe (2) Threat, (3) Reluctant acceptance, (4) There’s no point worrying.

In addition, the 3 sections on Trust (Sections D, E & F of the questionnaire; described in detail in Section 5.5.2) were systematically counterbalanced (6 permutations). In total, therefore, there were 24 different versions of the questionnaire (i.e. 2x2x6=24).

5.3 Pilot Study

5.3.1 Design

A small (postal) pilot study was conducted by sending the questionnaire, with a covering letter and stamped addressed envelope, to individuals who had participated in the Q-study (Study 1) at Bradwell (n=42). In addition to the questions described previously, the pilot questionnaire also contained an item asking the respondent how long the questionnaire took to complete, and the final page of the questionnaire contained space for 'any other comments'.

5.3.2 Pilot Study Results

Twenty eight pilot questionnaires were completed and returned (response rate: 67%). No problems with the questionnaire were raised by respondents, and no changes were suggested. A considerable amount of information was conveyed in the 'any other comments' section, but these mostly expressed respondents' personal views on nuclear power and did not therefore raise any concerns which justified making changes to the questionnaire. Frequency analysis of responses and response distributions to the questionnaire items did not highlight any problematic issues: data was normally or close to normally distributed and there were very little missing data. The time taken by respondents to complete the questionnaire was most commonly either 10 (24% of respondents) or 15 minutes (28% of respondents), with 76% of respondents completing the questionnaire within 20 minutes[39]. The design of the questionnaire was therefore not changed for the main study.

5.4 Main Questionnaire Study

5.4.1 Study Locations

The main questionnaire study was conducted at communities close to the nuclear power stations at Oldbury[40], South Gloucestershire, and Hinkley Point, Somerset. There are two nuclear power stations at the Hinkley Point site. Hinkley B, an example of the AGR reactor type, opened in 1976 and at the time of writing was fully active, with decommissioning scheduled to begin in 2016. The other, Hinkley A, is of the twin Magnox design. This reactor began operation in 1965 and has been undergoing decommissioning since 2000. The Hinkley Point site was selected for a number of reasons. First, it is broadly similar to the Oldbury and Bradwell sites, being situated close to a major town (Bridgwater, 8 miles from the power station) and the major arterial transport routes of the M4 and M5. In addition, consistent with Oldbury (but not Bradwell), the facility at Hinkley Point was active at the time of data collection. Hinkley Point is the only site of the three sampled in this thesis that has seen any major organised opposition. This, however, occurred some 25 years prior to the present study and took the form of demonstrations against a proposed new pressurised water reactor, Hinkley C, which gained planning permission but in eventuality was not built. A second set of considerations related to funding and time constraints, which dictated that a site

[39] A small number of outliers (n=4; 12%) took between 30-60 minutes to complete the questionnaire. However, these were mostly respondents who provided extensive additional comments (i.e. which therefore took extra time which would not be a factor in the main study).
[40] Oldbury was selected as a location for the reasons described in Section 4.3.

within relatively easy travelling distance of Cardiff University would be necessary for a survey of the planned size to be conducted effectively.

5.4.2 Confidentiality and Participant Incentives

In order to maintain respondent anonymity, no personally identifying information was collected in the questionnaire. Participants were, however, offered the incentive of entry into a prize draw for £100 of high street shopping vouchers. They were also asked whether they were interested in participating in future research, and if they would like to be invited to a local feedback event later in the year. Participants who wished to be involved in any of these were asked to provide their contact details on a separate sheet, so that it was not possible to link this information with individual questionnaires.

5.4.3 Sampling

Questionnaires were distributed to communities situated near to the nuclear power stations at Oldbury (Oldbury-upon-Severn; Oldbury Naite; Thornbury) and Hinkley Point (Stogursey; Nether Stowey; Stockland Bristol; Cannington; Fiddington; Spaxton; Combwich; Bridgwater) in July-August 2008. A researcher called at private addresses at each location on a weekday, between 4pm and 8pm, and asked the respondent if they would be willing to complete the questionnaire. Completed questionnaires were then collected by a researcher 3 days later. Participants who had not completed the survey by this time were provided with a stamped, addressed envelope and asked to post the completed questionnaire back at their earliest convenience. In small villages (Oldbury-upon-Severn; Oldbury Naite; Stockland Bristol; Fiddington; Spaxton), a researcher called at all households. At Oldbury village, Oldbury Naite, and Stogursey, households at which no response was initially gained were revisited up to three times (or until a response was gained) in order to maximise the number of responses from the sparsely populated areas situated very close to the power station. In larger conurbations, every third household was selected, and addresses from which no response was gained were not revisited. As the town of Bridgwater was too large to cover in its entirety by this approach, approximately 150 residences were visited in each of the 6 main districts in the town (Hamp; Parkway; Chiltern Trinity; Wembdon; Durleigh; Colley Lane).

It is not the intention of this thesis to draw a detailed contrast between the two study sites. For illustrative purposes, Table 18 shows a detailed breakdown of the characteristics of the survey samples. The table shows that there were no significant demographic differences between the Oldbury and Hinkley Point samples in relation to age or gender, although the Hinkley Point sample comprised a greater number of respondents with connections to the nearby power station or nuclear industry.

Table 18: Sample Demographics

Demographics		**Location**		**Total (n=1327)**	**Sig (χ^2)**
Demographic Category	**Demographic Information**	**Oldbury (n=680)**	**Hinkley Point (n=647)**		
Age	18-24	2.4%	3.3%	2.9%	ns
	25-34	5.1%	6.1%	5.6%	ns
	35-44	18.3%	14.6%	16.5%	ns
	45-54	18.0%	18.2%	18.2%	ns
	55-64	24.3%	25.2%	24.7%	ns
	65+	31.7%	32.6%	32.1%	ns
Gender	Male	52%	48%	51%	ns
	Female	51%	49%	49%	ns
Power Station Affiliation	Work/have worked at nuclear station/for BNI	10.3%	12.7%	11.5%	ns
	Have family or friends who work/have worked at nuclear station/for BNI	38.6%	51.4%	44.8%	*p*<.001
	None	51.1%	35.9%	43.7%	*p*<.001
Total (n)		**51%**	**49%**	**-**	**-**

5.4.4 Sample limitations

Although the survey incorporated a large number of people across a range of local towns and villages, it was not strictly representative of the local population. Younger people, for example, were under-represented in the samples from both Oldbury and Hinkley Point. Thus, the 18-24 age bracket comprised approximately 3% of the total sample, and the 25-34 years age bracket comprised 5.6%. Census data (2001) suggests that representative figures in the Oldbury and Hinkley Point areas would be closer to 7.2% (Oldbury: 6.8%; Hinkley Point: 7.6%) and 12.4%, respectively (Oldbury: 10.7%; Hinkley Point: 14.1%). Similarly, approximately 56.8% of the sample for this study was aged 55 years or over, whilst a representative proportion would be closer to 27.7% (Oldbury: 28.9%; Hinkley Point: 26.5%). Subsequent analyses do not weight the data to correct for this.

5.4.5 Response rates

Table 19: Response Rates

	Oldbury	**Hinkley Point**	**Total**
Addresses visited	1839	2079	3918
Doors answered	1129	1273	2402
Questionnaires distributed	813	824	1637
Questionnaires returned	680	647	1327
Response rates – as a proportion of:			
Addresses visited (a)	36.9%	31.1%	33.8%
Doors answered (b)	60.1%	50.7%	55.1%
Questionnaires distributed (c)	83.5%	78.4%	80.9%

Response rates, which were similar between study locations (Table 19), were calculated in three ways: returned questionnaires as a proportion of (a) the number of addresses visited (b) the number of doors answered, and (c) the number of questionnaires distributed. The second of these figures (i.e. b) is the most informative, as it includes those who actively refused to participate, having answered the door, but excludes those who were not at home, and who therefore did not have a chance to consider participating in the study. On this measure the response rate was 55%.

It was difficult to acquire large sample sizes from the areas situated very close to the power stations, as these areas were sparsely populated. As described previously, additional steps were therefore taken to maximise returns from these areas (see Section 5.4.3). Reflecting this extra effort, response rates from these very proximate areas were extremely high[41]. At the village of Oldbury-on-Severn, for example, 130 households were visited, and a response was gained from 116 of these. Of those 116, 106 agreed to participate in the study and took a questionnaire. All 106 of those returned a completed and useable questionnaire. Using formula (b) as presented above, the response rate for this area was therefore 106/116*100= 91.4%. Nevertheless, the sample size from this area was still relatively small (i.e. n=106), due to the low number of households in the area. In order to maximise statistical power, all subsequent data analyses in Study 2 are conducted on the dataset as a whole. This approach, whereby datasets are aggregated across sparsely populated but similar areas in order to maximise sample size is consistent with some previous research addressing similar issues and facing similar difficulties. For example, a recent study of public attitudes towards proposed new nuclear waste storage facilities in Sweden combined data from four affected communities (Sjoberg, 2004b).

[41] The variations in response rates in the present survey will inevitably have introduced bias to the data. Poortinga et al. (2008) found that responses to a postal survey investigating radiation risks from overhead power lines and indoor radon gas were greater amongst ‘exposed’ households, suggesting that increased salience, or greater concern in relation to a potential risk issue may lead to increased response rates. This suggests that the present survey may overemphasise the responses of (a) individuals to whom nuclear power is an important or salient issue, regardless of whether they support or oppose it; and (b) those who perceive nuclear power to be a high risk issue. It is not, however, possible to make accurate predictions as to how variations in response rates may have affected the results of the present study.

5.5 Scale Construction and 'Points of View' on nuclear power

The analyses presented in Study 2 utilise a range of individual, composite, and otherwise constructed variables. The following sections (5.5.1-4) describe in detail how these were constructed.

5.5.1 'Points of View' on nuclear power

Four vignettes were constructed to reflect the four main perspectives on nuclear power identified by the Study 1, Analysis 1 (Box 5). These were short paragraphs, designed to succinctly capture the most important aspects of the overall factor meanings. The construction of the 4 vignettes was a largely qualitative procedure. As they were intended to convey the overall factor meaning, they were generally based on the highest and lowest ranked statements associated with the factor. However, they were not necessarily limited to or necessarily defined by those statements.

An important methodological issue was, however, raised when planning this aspect of the study. One of the aims of the questionnaire study was to examine in detail the relationships between agreement with the four different points of view on nuclear power and the dimensionality of trust (see Section 5.11). A decision was therefore made to exclude references to trust from the vignettes, in order to avoid directly influencing the results of that study. This affected the factor descriptions for the B&S and T&D[42] groups, of which trust relationships were a central component, but did not affect RA and TNPW points of view, in which trust was relatively unimportant. When considering their responses to the vignettes in the present analysis, respondents were not, therefore, explicitly considering trust issues. However, as trust is often thought to be a consequence of prior attitudes

[42] The point of view label 'Threat and Distrust' (T&S) is therefore truncated to 'Threat' when reference is made to this point of view in Study 2.

(see Section 2.6.4), it was expected that this would not significantly affect responses to the vignettes.

Respondents were required to read all 4 points of view, and then to indicate (a) the extent to which each of the four points of view was similar to their own perspective (on a 5-point scale ranging from 'Not at all like my point of view' to 'Very like my point of view), and (b) the perspective that was *most* like their point of view.

Box 5: 'Points of View' on nuclear power

Beneficial and Safe	Nuclear power is not perfect, but I believe that it is the best option we have for electricity generation. I believe that nuclear power is safe and clean, and brings many benefits to the local community. I would much rather live near to a nuclear power station than a coal-fired one! I believe that we need nuclear power for the UK's energy security and I think we should build more nuclear power stations. Renewable energy is not reliable enough, and I consider that it should only be used alongside at least some nuclear power generation. There is no need to worry at all about nuclear power. People who fear it do so mostly because they don't understand how it works.
Threat	I believe that we should stop using nuclear power and switch to renewable sources of energy as soon as possible. I do not believe that nuclear power is clean, and I do not accept the argument that it will help combat climate change or improve energy security. Nuclear power stations are not safe: terrorism, day to day emissions, and waste storage are concerns for me. If they tried to put a permanent waste storage facility at Oldbury/Hinkley Point*, I would do whatever I could to stop them. We can't let the government think that this is a good place for a new nuclear power station.
Reluctant Acceptance	I reluctantly accept that nuclear power may be necessary to combat climate change and ensure a secure energy supply for the UK. Nuclear power is efficient and relatively clean, but it may also come with some risks. I am concerned about things such as the potential risks of terrorism and waste storage, but I believe that we must look beyond our personal concerns and see the bigger picture. We may all need nuclear power in the future whether we like it or not.
There's No Point Worrying	I've not really thought about nuclear power and I definitely don't worry about it at all. I regard it as relatively clean but there may be some risks as well. Sometimes there are minor incidents at nuclear power stations, but the media blows the slightest thing out of proportion and turns them into major catastrophes. Everything is going to give you cancer according to the news! The possibility of a terrorist attack at a nuclear power station concerns me slightly, but I don't ever worry that there might be a big accident like there was at Chernobyl in the 1980s.

**as appropriate to study location*

5.5.2 Trust

Neither the study by Poortinga & Pidgeon (2003) nor that of Metlay (1999) used a systematically designed and balanced set of items which ensured both that (a) all dimensions were included, and (b) one positively and one negatively valenced item was included for each dimension. This has led to problems of interpretation in relation to these studies, and one of the aims of this thesis was therefore to design a set of trust items that fulfilled both of these criteria. Items were therefore replicated from these two previous studies, and were adapted only when necessary, in order that they were applicable to the three institutions under study (the Government's regulation of nuclear power, the Nuclear Industry, and the Local Plant Operators). Thus, items from the previous two studies that related to the specific activities of a given institution (e.g. the setting of policy by government), and which were therefore not relevant to all three institutions, were either adapted or discarded, in order that a set of items was developed which, by substituting the name of each institution, could be universally applied (Box 6). Novel items were therefore formulated only if none of the items used by Metlay (1999) or Poortinga & Pidgeon (2003) were suitable or could be appropriately adapted. Responses to each item were recorded on a 5-point scale ranging from 'Strongly disagree' to 'Strongly agree'. The mid-points were labelled 'Tend to disagree', 'Neither agree nor disagree' and 'Tend to agree'. The questionnaire required each respondent to answer the same set of items three times, once in relation to each institution.

A total of 16 items were devised to assess trust in 8 dimensions across three institutions. These examined levels of trust in the Government (with regard to the effective regulation of nuclear power), the Nuclear Industry, and the Local Plant Operators. Respondents were not provided with a definition of each institution. Rather, the study examined overall perceptions of these institutions as broad entities. Judgements of trust in the Government were assumed to relate to the

Government's regulation of nuclear power in the UK[43]. Evaluations of the Nuclear Industry were assumed to refer to the various commercial and industrial institutions involved with nuclear power in the UK, and evaluations of the local operators, to the specific group of individuals responsible for manning the nearby power station.

Box 6: Questionnaire Items* and respective trust dimension

…is open and honest	**Honesty**
…does not tell the truth about nuclear incidents and radioactive discharges	
We can rely on…not to cut corners or make mistakes	**Reliability**
We cannot rely on…to ensure that nuclear power stations are safe	
…has the necessary skills to manage nuclear power stations safely	**Competence**
…is not competent enough to manage nuclear power stations	
…does the right thing with regards to the safety of nuclear power	**Integrity**
…puts profit before public safety	
…is prepared to take account of studies linking nuclear power stations with elevated rates of cancer in nearby towns and villages	**Credibility**
…distorts the facts to make its case for nuclear power	
When making decisions about nuclear power, … considers all sides of the argument	**Fairness**
Decisions made by … are usually unfair and unjust	
We can trust… to act in the public interest	**Care**
…is not interested in what ordinary people think about nuclear power	
…has the same opinions as me about nuclear power	**Salient Value Similarity**
…has different ideas about nuclear power to me	

**'The government', 'The British nuclear industry', or 'The plant operators at Oldbury/Hinkley Point nuclear power station' (as appropriate to the study location) was substituted as appropriate to each section of the survey.*

[43] The UK government regulates nuclear power via The Health and Safety Executive (HSE), which itself operates through the Nuclear Directorate (ND). The ND encompasses HM Nuclear Installations Inspectorate (NII), which is the nuclear safety regulator covering both civil and defence nuclear industries, and the Office for Civil Nuclear Security (OCNS), which is the nuclear security regulator for the UK's civil nuclear industry (LSE, 2008).

To investigate item scaling, the 16 items were subjected to three separate PCAs with Varimax rotation: one for each of the three institutions (Table 20).

Table 20: Scale Construction: Trust in the Government, the Nuclear Industry, and the Local Plant Operators

Item	Government	Nuclear Industry	Plant Operators
…is open and honest	**.77**	**.85**	**.81**
…does not tell the truth about nuclear incidents and radioactive discharges	**-.66**	**-.75**	**-.78**
We can rely on…not to cut corners or make mistakes	**.76**	**.80**	**.81**
We cannot rely on…to ensure that nuclear power stations are safe	**-.68**	**-.65**	**-.69**
…has the necessary skills to manage nuclear power stations safely	**.63**	**.71**	**.74**
…is not competent enough to manage nuclear power stations	**-.70**	**-.72**	**-.76**
…does the right thing with regards to the safety of nuclear power	**.79**	**.81**	**.78**
…puts profit before public safety	**-.76**	**-.79**	**-.81**
…is prepared to take account of studies linking nuclear power stations with elevated rates of cancer in nearby towns and villages	**.68**	**.73**	**.63**
…distorts the facts to make its case for nuclear power	**-.79**	**-.84**	**-.81**
When making decisions about nuclear power, … considers all sides of the argument	**.78**	**.81**	**.80**
Decisions made by … are usually unfair and unjust	**-.79**	**-.81**	**-.80**
We can trust… to act in the public interest	**.80**	**.84**	**.84**
…is not interested in what ordinary people think about nuclear power	**-.76**	**-.80**	**-.79**
…has the same opinions as me about nuclear power	**.73**	**.79**	**.78**
…has different ideas about nuclear power to me	**-.71**	**-.77**	**-.77**
Eigenvalue	**8.71**	**9.76**	**9.63**
Variance Explained (%)	**54.44**	**60.99**	**60.17**
Interpretation	**Overall trust in the UK Government**	**Overall trust in the nuclear industry**	**Overall trust in the local plant operators**

Table 21: Cronbach's α scores for Overall Trust Scales

Institution	α
Government	.94
Nuclear Industry	.96
Local Plant Operators	.96

Table 20 shows when the dataset was examined as a whole, one overall trust factor was found for each institution. To compute composite variables, positive and negatively valenced items were summed to form 3 overall scales, representing overall levels of trust separately in relation to each institution. Table 21 shows that the scales were internally consistent.

5.5.3 Sense of Place (SoP)

Scales were also developed with the aim of measuring SoP, and perceptions of the presence of the power station in the context of the local place. With respect to the former, previous literature describes various ways of measuring the concept. For example, Williams & Vaske (2003) present a two-dimensional scale of place attachment based on place identity and place dependence (subsequently used in the study by Brown & Raymond, 2007). Alternative approaches are also described in the literature (e.g. Lewicka, 2008). In this thesis, items were adapted from Bonaiuto et al., (2002), Twigger-Ross & Uzzell (1996), Wester-Herber (2004) and Knez, (2005) and reflect the four processes of place identity as described by Knez (2005), which are based on Breakwell (1986; 1992; 1993). These are: Distinctiveness; Continuity; Self-esteem; and Self-efficacy (see Section 2.7.5).

The items used to measure SoP in this thesis were: (1) 'I feel like I belong to the community where I live'; and (2) 'For me, this is the ideal place to live'. An additional item was included to emphasise local place-related values: (3) 'I strongly value the place where I live'. Four further items were specifically included to assess perceptions of the nearby nuclear power station within the local SoP: a concept which has not, to the author's knowledge, been previously measured in a quantitative study[44]. First, the extent to which the power station was regarded as contributing to the *Distinctiveness* of the local place was measured by (4) 'The power station is part of our community here'. Second, *Place-Congruent Continuity* was measured in the context of the power station through the item (5) 'If I was to move, I would want to live somewhere like this, except without a nuclear power station nearby'[45]. Third, the contribution of the power station to place-related *Self-Esteem* was assessed through a 6th item: 'I am proud to have the nuclear power station in our area'. In addition, the extent to which the power station contributed to *Self-Efficacy* was assessed through (7) 'Having the power station here helps me to live my life the way I want to'. Finally, two additional items were included. These assessed first, the impact of the power station on place-related self-identity: (8) 'For better or for worse, the power station has featured strongly in my life' and second, the salience of the power station within the local place: (9) 'The power station has featured strongly in our area'.

[44] It was not considered possible to generate items that could address Place-Referent Continuity via a questionnaire format. Knez (2005) used the item 'This part of the town reminds me of the environment of my childhood'. However, adapting the item to incorporate the presence of the power station would have required relating the presence of the power station to childhood memories. It was considered that such a wording would lack face validity and make little intuitive sense. For these reasons, *Place-Referent Continuity* was not measured in the present study.

[45] This item was reverse scored, such that disagreement with the item suggested that if the respondent were to move, they would want to move to somewhere close to a different nuclear power station.

Table 22: Principle Components Analysis (with Varimax rotation) of Sense of Place Items, and Scale Reliabilities

Item	Subdomain	Factor 1:	Factor 2:
(a) I feel like I belong to the community where I live	Distinctiveness	.10	**.82**
(b) For me, this is the ideal place to live	Place-Congruent Continuity	.18	**.80**
(c) I strongly value the place where I live	Place Attachment	.05	**.85**
(d) If I was to move, I would want to live somewhere like this, except without a nuclear power station nearby*	Power station related Place-Congruent Continuity	**.66**	.20
(e) I am proud to have the nuclear power station in our area	Power station related Self-Esteem	**.86**	.14
(f) Having the power station here helps me to live my life the way I want to	Power station related Self-Efficacy	**.82**	.01
(g) For better or for worse, the power station has featured strongly in my life	Power station related place identity	**.70**	.20
(h) The power station has featured strongly in our area	Salience of power station in place	**.63**	.24
(i) The power station is part of our community here	Power station related Distinctiveness	**.73**	.28
Cronbach's α		.84	.79
Interpretation		**Power station-related sense of place (PSSoP)**	**Sense of place (SoP)**

* Reverse-scored, see Footnote 41)

The data was subjected to Principle Components Analysis (PCA) with Varimax rotation, in order to investigate item scaling. As expected, two clear factors emerged (Table 22). Items a-c factored into a single scale with high reliability (Cronbach's α=.79). The scale was independent of items d-i, which formed a second scale, again with high reliability (Cronbach's α =.84). These scales were labelled 'Sense of place' (SoP) and 'Power station related sense of place' (PSSoP) respectively. As scale reliabilities were high, the items within each factor were summed to produce two composite scales. On the SoP scale, individual scores therefore ranged from 3 (min) to 15 (max), and on the PSSoP scale, scores ranged from 6-30. The SoP scale was not normally distributed, however, being positively skewed, and was therefore subjected to Log-10 transformation prior to subsequent multivariate analyses[46].

5.5.4 Proximity

A proximity scale was formulated in order that the association between various key factors and residential proximity to the power station could be investigated. Table 23 shows the distance, to the nearest half mile, of each sampling location from the nearby power station. Distances were estimated by measuring from an approximately central point at the power station site, to the approximate centre of each settlement[47].

Table 23: Proximity of sampling locations to the nearby nuclear power station

Study Location	Actual distance from power station to settlement centre (to nearest ½ mile)	n	Sample	Code
Oldbury on Severn/Naite	1.0	95	Oldbury	1
Stogursey	2.0	87	Hinkley Point	2
Stockland Bristol	2.5	20	Hinkley Point	2
Combwich	3.5	82	Hinkley Point	2
Fiddington	3.5	11	Hinkley Point	2
Thornbury	3.5	570	Oldbury	2
Nether Stowey	4.0	93	Hinkley Point	3
Cannington	5.0	57	Hinkley Point	3
Spaxton & Four Forks	5.5	34	Hinkley Point	3
Bridgwater	8.0	247	Hinkley Point	4

[46] Log transformation has the effect of 'squeezing' larger values together and 'stretching' smaller values (Simon, 2002) in order to transform skewed or kurtosed data into an approximately normal distribution. The Log-10 type transformation was selected for use in the present analysis as this approach produced skewness and kurtosis levels on both variables that were closest to zero (Tabachnick & Fidell, 2001). Bland (1996) notes that it is sometimes asked whether transforming data is 'cheating'; this is not the case: as statistical techniques generally require normally distributed data, analysis involving a transformed scale that was formerly skewed or kurtosed is *more*, not less valid, than an analysis of the original, non-normally distributed data.

[47] All distances were estimated using Google Maps

A number of methodological problems arose when considering proximity. As the source of the questionnaire was identified only by the name of the town or village from which it originated, this was the finest level of post-hoc coding that could be applied when determining proximity to the power station. Therefore, the diameter of the largest sampling area represented the finest level of coding that could be applied to the data. This was Bridgwater, where sampling was undertaken across an area approximately 2 miles in diameter. Distances to the power station were therefore coded in 2 mile bands, according to the formula 0-1.9=1; 2.0-3.9=2; 4.0-5.9=3; 6.0+=4 (Table 23). In addition, as a consequence of the local geographies, the Oldbury sample was not represented at proximity codes 3&4, and there was no data from Hinkley Point at proximity point 1. When considered in aggregate, however, the two datasets represent a broad range of distances from the power station. Finally, the proximity data was bimodal, as (reflecting the local geography and the sampling points utilised) it reflected a relatively large number of responses gained from the towns of Thornbury and Bridgwater. In order to enable valid multivariate statistics to be conducted, the data was subjected to a Log-10 transformation (see Footnote 46).

5.5.5 Treatment of missing data

The proportion of missing data was low (mean across all variables: 3.8%; Tabachnick & Fidell, 2001). The highest proportions of missing data were observed in relation to indications of agreement with the four vignettes (Box 5), where respondents were required to indicate the extent to which each point of view matched their own opinion on nuclear power. However, the proportion of missing data on these variable was not high (proportion of missing data: B&S: 5.9%; Threat: 6.6%; RA: 6.0%; TNPW: 7.7%). In addition, on the subsequent question, where respondents were asked to indicate which points of view was *most* like their own, the proportion of missing data was very close to the overall mean (3.9%). This suggests that the slightly higher levels of missing data observed on the preceding four questions may have been a result of respondents misunderstanding the task, rather than actively refusing to answer this section of the questionnaire. Tabachnick & Fidell, (2001) suggest that where there is little missing data overall (<5%), and patterns of missing data either appear to be random, or are concentrated on a few non-critical variables, it is appropriate to exclude missing cases listwise (i.e. to only analyse 'complete cases'). This approach is therefore adopted in this thesis. It is the most straightforward method of dealing with missing data, as although it assumes a random pattern of missing values, it avoids the potentially complex implications of alternative solutions such as imputing predicted values into the dataset (Howell, 2009).

5.6 Study 2 Analyses A-C: Points of View on Nuclear Power

The first three analyses of Study 2 aim to investigate the four points of view on living close to a nuclear power station, as revealed in Study 1, Analysis 1, in more detail. First, Analysis A investigates the representation of the four points of view on nuclear power in the survey sample. Compared to the theoretically structured sample used in the Q-Study, this provides a much clearer picture of the relative proportions of the sample associated with each point of view, compared with Study 1. Second, Analysis B aims to identify the psycho-social and demographic variables which differentiate between the four points of view. Third, Analysis C investigates whether there are associations between the representation of the four points of view in the sample and residential proximity to the power station.

5.7 Study 2 Analysis A: Points of view on nuclear power – representation amongst nearby communities

5.7.1 Rationale

A limitation of Study 1 was that the samples were small (n=84; i.e. 42 cases were sampled at each study location), and, being theoretically structured, were designed to capture a broad range of points of view, rather than aiming to be representative in a statistical sense. On the basis of Study 1, it is therefore not possible to assess the extent to which the four points of view on nuclear power might be represented in a larger, more representative sample. The present study aims to address this issue by investigating responses to the four vignettes (representing the four points of view) in the survey sample. To the author's knowledge this is a novel methodological procedure.

The main aim of this analysis is therefore:

1. To investigate the frequency of the four points of view revealed in Study 1a, in a larger and more representative local sample.

A secondary aim of the analysis is:

2. To investigate whether the inclusion of a novel vignette-based task incorporating the results of the Q-Study (Study 1a) in the survey design represents a valid and useful way of gathering additional quantitative information on those groups.

5.7.2 Hypotheses

No specific hypotheses were made in relation to the expected frequencies of the four points of view. However, it was expected that all four attitude groups would be well represented in the survey sample.

5.7.3 Procedure

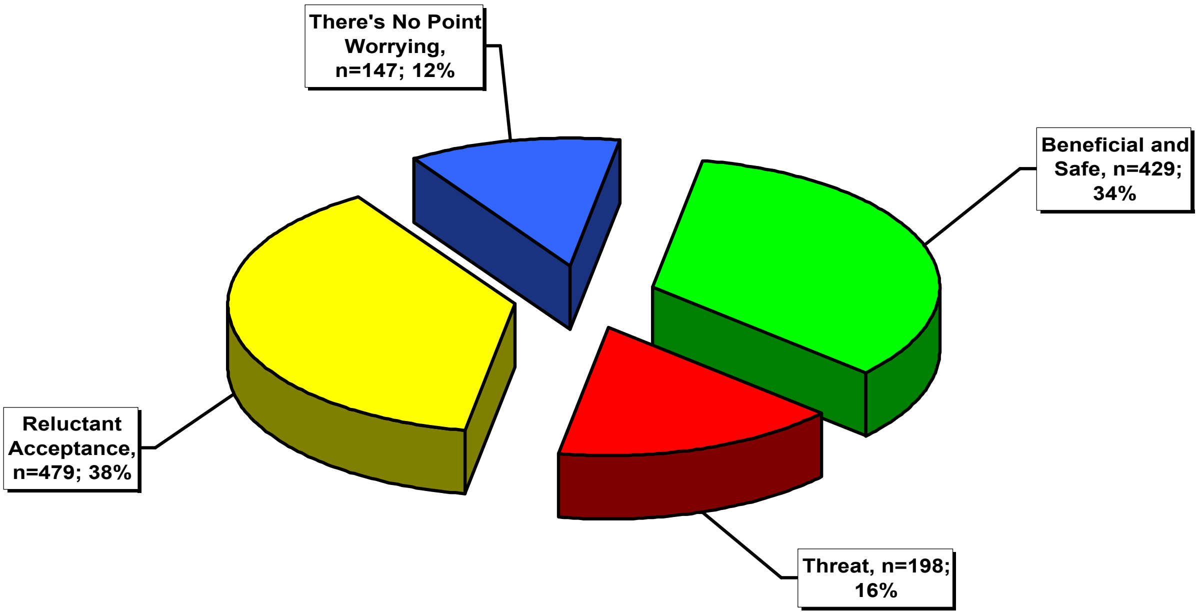
Respondents were required to read the four vignettes presented in Box 5. They were: (1) 'Beneficial and Safe', a position which emphasised the local and national benefits, and the perceived safety of nuclear power; (2) 'Threat', a strongly anti-nuclear point of view which emphasised the perceived dangers of nuclear power and a desire to use only renewable sources of energy production; (3) 'Reluctant Acceptance', a position in which respondents indicated that they would accept nuclear power, but only reluctantly, due to concerns about climate change and energy security; and (4) 'There's No Point Worrying', a disinterested attitude indicating that although there may be some risks associated with nuclear power, these are not worth dwelling on. In the questionnaire, the points of view were labelled 'Point of View A' through D and the descriptive titles presented in Box 5 were omitted. Respondents were then asked to indicate:

a. The extent to which each of the four points of view was similar to their own perspective (on a 5-point scale ranging from ‘Not at all like my point of view’ to ‘Very like my point of view).
b. The perspective that was *most* like their point of view.

5.7.4 Results

The most commonly selected perspective was ‘Reluctant Acceptance’, which 491 (38%) respondents indicated was *most* like their own point of view on nuclear power (Figure 2). This proportion was significantly higher than the second most commonly selected point of view (B&S), which accounted for 34% of total responses (n=429; χ^2=6.40; p<.01). In turn, this proportion was significantly greater than the 16% of respondents (n=230) who selected the ‘Threat’ point of view as closest to their own opinion (χ^2=79.94; p<.001), which again constituted a significantly higher proportion than 12% (n=150) who indicated that the ‘There’s No Point Worrying’ perspective was most like their own point of view on nuclear power (χ^2=19.66; p<.001).

Figure 2: Distribution of Points of View on nuclear power



One way of assessing the validity of the task is to examine the mean levels of agreement with the vignette indicated as being most like the point of view of the respondent. Here, it was important that respondents indicated a high level of agreement with the vignette they selected as being most like their point of view, and that this was consistently the case across the four options. Reassuringly, an analysis of the mean levels of agreement for each vignette (which respondents had indicated was most like their own point of view) confirms that this was the case (Table 24). These results suggest that where respondents selected a point of view as being most like their own perspective, they considered that the selected description corresponded closely to their actual attitude. Importantly, agreement was uniformly high across the four factor descriptions (see Section 5.5.1), suggesting that the removal of trust information from the B&S and Threat points of view did not significantly compromise the validity of their respective vignettes. Had that been the case, one would expect mean agreement to be lower in relation to those points of view compared to the RA and TNPW perspectives. Additional t-tests (not presented) showed that there were no significant differences in mean levels of agreement with each point of view between study locations, either overall, or amongst those indicating that the specific point of view was most like their own.

Table 24: Mean level of agreement with each vignette (where the respondent indicated that the vignette was 'most like my point of view')

	Mean level of agreement			
Point of view	**Beneficial and Safe**	**Threat and Distrust**	**Reluctant Acceptance**	**There's No Point Worrying**
Beneficial and Safe	**4.60**	1.32	3.49	3.28
Threat	1.73	**4.37**	2.60	1.91
Reluctant Acceptance	3.18	2.15	**4.39**	2.61
There's No Point Worrying	3.56	2.12	3.74	**4.44**

5.7.5 Discussion

The application of the four points of view from the Q-Study (Study 1) to a larger and more representative sample via the presentation of four vignettes is, to the author's knowledge, a novel methodological procedure. The above analyses suggest that this approach was successful in leading to the identification of distinct subgroups for further statistical analysis, and that they reflect a range of attitudes to nuclear power in the survey dataset.

A further aim of the study was to gain an insight into the prevalence of the four points of view in a broader and more representative sample. As described earlier, the sample is not strictly representative of the local population. Nevertheless, as hypothesised, each of the points of view was well represented in the sample, and it is sufficient to provide an estimation of the distribution of the four points of view on nuclear power amongst these communities. Indeed, the proportion of respondents expressing strong opposition to nuclear power (the Threat group; 16%) is similar to that found in a poll subsequently conducted for EDF (EDF, 2010) suggesting that 18% of local communities (within 25 miles) at Hinkley Point have an unfavourable opinion of the nuclear energy industry. Figure 2 shows an unexpected result in relation to the RA perspective, in suggesting that this may be the most common perspective on nuclear power amongst these local communities, with 38% of respondents indicating that this point of view was most like their own.

This finding is particularly important because of the apparent ambivalence associated with the point of view, as discussed in Study 1. It suggests that over one third of what might appear to be local support for nuclear power in an opinion poll might actually reflect a highly conditional and ambivalent attitude position, which may also be fragile and subject to change. This result, therefore, carries potentially important implications in relation to the nature of the presumed support for new nuclear build in such communities.

However, the methodology used in this study raises important issues, which relate to the literature on 'framing' effects. Framing occurs when a subject is presented with a focus on a specific subset of potentially relevant considerations. It causes recipients of that information to focus on those considerations, and in turn may lead to attitude change (Druckman, 2001; Chong & Druckman, 2007). In the original study of RA by Bickerstaff et al, (2008a), participants did not realise the frame independently – it was introduced by the researchers as an intervention which seemed to cause initially negative individual and group positions on nuclear power to become more ambivalent when nuclear power was considered in the context of climate change mitigation.

The effects of framing have been investigated in numerous previous studies. For example, the survey by Ansolabehere (2007) notes that the provision of different information frames can impact on people's perceptions of nuclear power. Although some studies have suggested that framing may not act to change people's views (Hardeman et al, 2002; Levin et al, 1998), it is possible that there are differential impacts on different subgroups of individuals. For example, Kahan et al (2007) found that whilst the provision of balanced information about nanotechnology produced no overall shift in people's perceptions of this new technology, significant differences were noted when the sample was divided into sub-groups according to their cultural worldviews, political stance, and gender. It is possible those associated with the RA point of view may not have held well-formed attitudes on nuclear power, and may, therefore, have been relatively open to the effects of a potentially persuasive frame. Thus, the introduction of the RA discourse might have caused a framing effect in relation to this subgroup of respondents, which may in turn have resulted in an inflated estimate of agreement with the point of view in the present results, and may also reflect only a short-term change in attitude.

There is, however, an additional possible explanation for the popularity of the RA point of view in the present study, which is connected to issues of social desirability, especially given the local level at which the present study was conducted. The data suggests that around 16% of the local population are strongly opposed to nuclear power, whilst just over one-third of the population (34%) are strongly supportive of it. The issue of nuclear power can therefore be seen to be divisive, and this may discourage those who are in favour of nuclear power from outwardly articulating supportive attitudes (Baxter & Lee, 2004). The RA discourse, however, provides socially acceptable reasons for supporting nuclear power, as it facilitates an argument that one has no choice but to accept nuclear power due to societal-level concerns about climate change and/or energy security (*see also* Pelletier & Sharp, 2008). Eiser et al., (2010) note, in relation to public attitudes to wind farms in Poland, that environmental and political arguments were apparently adopted by sections of the public to use as justifications for their attitudes towards wind energy developments. Similarly, in the present study, it may be that the discourse of RA is adopted by some individuals as a set of socially acceptable, *post-hoc* justifications for their support of nuclear power.

Finally, the apparent popularity of the discourse can be related to work by Slovic et al., (2002a,b) who describe two systems in risk perception: a relatively slow, effortful 'Analytic system', in which risk is assessed through logic, probability and risk assessment, and an 'Experiential system' which is fast, intuitive and mostly automatic, and 'relies on images and associations, linked by experience to emotion and affect' (p.1). This latter system, the 'Affect heuristic', is thought to be essentially primitive, but remains the most natural and common response to risk, and can be thought of as referring to the 'goodness' or 'badness' of an entity (Slovic et al., 2002a,b). The relative popularity of the RA frame in the present analysis suggests that recent framings of nuclear power, in which a logical and appealing case for nuclear expansion is presented, may therefore represent a situation where analytic considerations of nuclear power are in tension with the largely negative affective responses that many individuals experience in relation to nuclear technology (Corner et al., *under review*)[48].

Further research would be required to clarify these issues. For example, a better understanding of the extent to which the RA discourse represented new information to participants (and therefore constituted a novel 'reframing' of nuclear power to those participants) would assist greatly in clarifying the extent to which these results may reflect a framing effect. A further interesting possibility would then be to assess the extent to which the apparently persuasive effect of the RA discourse persisted over time in a follow-up study.

[48] Some authors, such as Lennart Sjoberg, dispute the significance of affect in risk perception, arguing that its apparent importance is a consequence of imprecise definitions of the term, which can be taken to refer either as 'emotion' or 'liking'. In this thesis, the term is used to refer to an emotionally based response, whether positive or negative. The issue is discussed in detail in Wardman (2006).

5.8 Study 2 Analysis B: Points of View on Nuclear Power - Characteristics of the four groups

5.8.1 Rationale

Study 2 Analysis A shows that in general, survey respondents appeared to identify with the four points of view on nuclear power, as agreement with the vignette selected as 'most like my point of view' was consistently high for all four points of view. The present analysis is conducted with the aim of using quantitative statistics to gain a more robust understanding of the characteristics associated with each attitude group. The aims of Analysis B are therefore:

1. To further investigate the nature of the four points of view on nuclear power described in Analysis A by examining their characteristics across a range of psycho-social concepts including trust, perceptions of risks and benefits, and sense of place.
2. To identify the psycho-social variables and demographic dimensions which differentiate between the four points of view.

It was hypothesised that:

1. Significant differences would be observed between the four attitude groups across a range of psychological and demographic variables (Box 7).

5.8.2 Method

A series of 1x4 ANOVAs and Chi-square tests were conducted to analyse differences across the four groups on a range of potentially important variables (Box 7).

Box 7: Independent variables used in the analysis

Psychological constructs and attitudes
- Concern about climate change
- Concern about nuclear power
- Concern about radioactive waste
- Concern about using up energy resources that are not replaceable
- Trust in the UK government
- Trust in the nuclear industry
- Trust in the local plant operators
- Perceived risks (to local people from nearby power station)
- Perceived benefits (to local people from nearby power station)
- Acceptability (i.e. the benefits outweigh the risks) of local station
- Support for new nuclear build on existing local site
- Sense of Place (SoP)
- Power station-related Sense of Place (PSSoP)

Demographic characteristics
- Gender
- Age
- Personal affiliation to nuclear industry
- Friends or family have affiliations to nuclear industry

5.8.3a Results - ANOVA

The results of the initial analyses are presented in Table 25.

Table 25: Mean scores/frequencies for the four points of view on key variables (ANOVA)

Point of View	Concern (Climate Change)	Concern (Nuclear Power)	Concern (Rad. waste)	Concern (Using up energy res.)	Trust* (Gov)	Trust * (Nuc Ind)	Trust* (Local Ops)	Perceived Risks
Beneficial and Safe	2.93	1.75	2.69	3.34	3.48	4.13	4.29	2.46
Threat	3.33	3.31	3.75	3.62	2.32	2.65	2.93	4.02
Reluctant Acceptance	3.16	2.46	3.32	3.50	2.96	3.44	3.65	3.44
There's No Point Worrying	2.90	2.17	3.01	3.22	3.07	3.68	3.79	2.85
Main Effect	F=17.04 df=1269 p<.001	F=176.40 df=1270 p<.001	F=91.76 df=1264 p<.001	F=16.26 df=1267 p<.001	F=134.16 df=1187 p<.001	F=233.70 df=1169 p<.001	F=208.36 df=1194 p<.001	F=116.41 df=1252 p<.001

Point of View	Perceived Benefits	Accept-ability	Support for New Build locally	SoP*	PSSoP*	Age (bracket)	Gender (% male)	Affiliation (personal) (%)	Affiliation (family & friends) (%)
Beneficial and Safe	4.24	4.51	4.29	4.30	3.62	4.83	67.6	23.7	51.9
Threat	3.04	2.07	1.69	3.99	2.19	4.15	36.8	5.4	34.0
Reluctant Acceptance	3.78	3.55	3.23	4.10	2.85	4.55	48.0	5.1	44.1
There's No Point Worrying	3.65	3.74	3.41	3.97	3.08	4.15	39.0	8.0	50.0
Main Effect	F=79.40 df=1252 p<.001	F=223.70 df=1235 p<.001	F=300.99 df=1255 p<.001	F=14.43 df=1231 p<.001	F=222.54 df=1245 p<.001	F=16.14 df=1257 p<.001	χ^2=73.0 df=3 p<.001	χ^2=90.0 df=3 p<.001	χ^2=19.42 df=3 p<.001

** To facilitate interpretation, composite scores presented here are divided by the number of component items to produce a score from 1-5.*

Table 25 shows that significant differences were observed across the four groups (i.e. the ANOVA showed a significant main effect) in relation to all of the independent variables considered. This suggests, as expected, that dividing the sample on the basis of responses to the vignette task successfully produced four subgroups reflecting a range of different attitudes to nuclear power. The large sample size (and subsequently high statistical power of the survey) results in significant differences being consistently observed across the independent variables. This makes it difficult to ascertain where the greatest differences across the four points of view on these variables lie. However, given that the *df* value is fairly consistent across the variables presented in Table 25 (range: *df*=1169-1270), the size of the *F* statistic can be used as a broad indicator of between-group variability. The highest levels of variability were observed in relation to trust (in the Nuclear Industry and Local Operators), acceptability (i.e. the perceived balance of risks and benefits), support for new build locally, and PSSoP (the contribution of the nearby power station to perceptions of sense of place) (F>200.00 in each case). The least variation across the four groups was observed in relation to: concern about climate change, concern in relation to using up energy resources that are not replaceable; and SoP, each of which were associated with relatively low F values (F<20.00 in each case) although all were nevertheless highly significant. In addition, the χ^2 analyses presented in the final three columns of the table suggest that endorsement of the B&S perspective is associated with increasing age, male gender, and affiliation to the nuclear industry.

Rather than conducting post-hoc tests on each variable, a discriminant analysis was conducted as the most parsimonious way of differentiating between the four attitude groups on these variables[49]. This procedure examines the patterns of differences between predictor variables, and attempts to describe as much of the between-group variance as possible using a limited number of variables (Tabachnick & Fidell, 1996). The subset of variables on which groups can be discriminated is known as the discriminant function, and, in the same way as factor analysis, this is assigned an overall meaning through a consideration of the independent variables with which it is associated. The dependent variable used for this analysis was the point of view selected by respondents as being most like their own perspective on nuclear power. The same independent variables were used (as shown in Box 7).

Study 1 and Table 25 suggest that the B&S and Threat points of view differ markedly on the grounds of: trust (particularly in relation to the nuclear industry and local operators): perceived risks; attitude towards new build; and acceptability. In addition, Table 25 suggests that these groups differ considerably in their considerations of PSSoP. Finally, both Study 1 and Table 25 suggest that the B&S point of view is predominantly male, whilst the Threat point of view appears to be predominantly female. It was therefore expected that the main discriminant function (i.e. which explained most of the variance) would discriminate mostly between the B&S and Threat groups, and that:

[49] Alternative statistical approaches were considered. A linear regression, which would have revealed the factors that predicted agreement with each of the four points of view was conducted, but is not presented because it was considered that the inclusion of a large number of inter-correlated independent variables (Box 7) may have compromised the validity of the analysis. Logistic regression was also considered as a possible alternative. Compared to discriminant analysis, logistic regression makes fewer assumptions about the data but also is less powerful (and is therefore more likely to result in Type II [false negative] errors) (Garson, 2008). Ultimately, discriminant analysis was chosen as the most appropriate statistic method as it is a relatively powerful technique in relation to which the issue of intercorrelated variables is not seriously problematic.

1. The B&S and Threat groups would be discriminated between on the basis of trust (in the Nuclear Industry and Local Operators), perceived risks, acceptability, support for new build locally, PSSoP, and gender.

In relation to the RA group, Study 1 suggests that this group was associated with a high level concern about climate change (although Table 25 does not confirm this). Also, Table 25 suggests that the point of view is associated with individuals with no affiliation to the nuclear industry. It was therefore hypothesed that:

2. The RA group would be differentiated from the other three groups on the basis of concern about climate change and (an absence of) affiliation with the nuclear industry.

Finally, Study 1 suggests that the TNPW group is characterised by cynicism, generally low levels of environmental and risk concern, and a lack of engagement with the issue of nuclear power. Although this expectation was not wholly confirmed by Table 25, it was hypothesised that:

3. It would be possible to discriminate between the TNPW point of view and the rest on the grounds of (a lack of) general concern (i.e. in relation to: radioactive waste, nuclear power, climate change, and using up energy resources that are not replaceable).

5.8.3b Discriminant Analysis

The analysis showed that Box's M was significant (*M*=518.65; *p*<.001), indicating that the patterns of covariance between groups were significantly different. This problem is not considered critical when sample sizes are large, as they are in the present study (Burns & Burns, 2008). As the stepwise method tends to capitalise on chance associations (see www.statsoft.com), variables were entered into the analysis together. Three discriminant functions were revealed, explaining 90.5, 6.6, and 3.0% of the variance, respectively, all of which were significant at the *p*<.001 level (Table 26).

Table 26: Summary of discriminant function properties

Function	Eigenvalue	Variance Exp. (%)	Wilk's Lambda	χ^2	*df*	Sig.
1	1.10	87.5	.41	928.34	51	*p*<.001
2	.10	7.9	.86	157.08	32	*p*<.001
3	.06	4.6	.95	58.97	15	*p*<.001

Table 27: Functions at group centroids

Point of View	Centroids		
	Function 1	**Function 2**	**Function 3**
Beneficial and Safe	**1.33**	-.21	.14
Threat	**-2.02**	-.38	-.12
Reluctant Acceptance	-.24	**.43**	.02
There's No Point Worrying	.16	-.19	**-.66**

Table 27 shows the group centroids for each attitude group. The values for Function 1 show that this function strongly discriminates between the B&S and Threat perspectives, which load positively and negatively on the function respectively. The RA and TNPW groups both lie between these two extremes, and relatively close to zero, indicating that the function discriminates only weakly between these attitude groups. Function 2 is relatively weak compared to function 1, but can be seen to clearly discriminate primarily between the Reluctant

Acceptance perspective (which loads positively at .43) and the other three groups, all of which are negatively associated with the function. Function 3 discriminates between the There's No Point Worrying perspective (loading: -.66) and the other three groups, the loadings of which are close to zero on this function.

The structure matrix is used to infer the meaning of the functions. This is shown in Table 28, which shows the variables associated with each discriminant function, and the (non-standardised) correlations between these and each function. The strength of the correlations indicate the importance of the variable in contributing to the function[50].

The discriminant functions were interpreted as follows:

Function 1: Support for/opposition to nuclear power

This is the main function that accounts for most of the variance, and can be interpreted in a general sense as representing support for/opposition to nuclear power locally. The function is based on attitudes towards new nuclear build in the nearby area, trust, concern about nuclear power and radioactive waste, perceived risks and benefits, and PSSoP. It distinguishes mainly between the B&S and Threat points of view (Table 27).

[50] There is disagreement in the literature as to whether the standardised or non-standardised function coefficients should be used to determine the importance of the contribution of each variable (Field, 2000). The unstandardised coefficients are reported here.

Table 28: Structure matrix[51]

Variable	Correlation with Function 1*	Correlation with Function 2*	Correlation with Function 3*
Support for new nuclear build on existing local site	**.84**	-.13	.05
Trust in nuclear industry	**.75**	-.11	.11
Acceptability (benefits vs risks) of local station	**.72**	-.19	.06
Trust in the local operators	**.72**	-.16	.17
PSSoP	**.70**	-.33	.11
Concern about nuclear power	**-.62**	.01	.26
Trust in the government	**.56**	.00	.08
Perceived risks (to local people from nearby power station)	**-.50**	**.46**	.21
Concern about radioactive waste	**-.44**	.32	.06
Perceived benefits (of local station)	**.42**	.16	.25
Personal affiliation with nuclear industry	.23	**-.57**	.34
Concern about using up energy resources that are not replaceable	-.12	.17	**.47**
Age	.17	.11	**.44**
SoP	.15	-.08	.39
Concern about climate change	-.20	.12	.36
Gender	-.22	.13	-.35
Affiliation with power station or nuclear industry (via family or friends)	.11	-.14	-.18

*The convention of *R*=.40 was adopted as the cut-off for significance

Function 2: Concern, amongst the general public, about nuclear risks

This smaller function discriminates between Reluctant Acceptance and the other three perspectives. The function is based on perceived risks in relation to the nearby facility and an absence of personal affiliation with the nuclear industry. The function shows that the RA perspective is associated with high levels of perceived risk in relation to the nearby nuclear power station when compared to the B&S and TNPW points of view, but not the Threat attitude group (as perceived risks are also a significant component of Function 1).

[51] As with factor analysis, the structure matrix can be rotated. In the present study, the unrotated matrix is presented, as the literature warns that function rotation in discriminant analysis raises complex statistical issues and is best left to experienced users (Tabachnick & Fidel, 1996).

Function 3: Lack of concern, in younger people, about finite energy resources

This is a very minor function that discriminates mainly between TNPW and the other three points of view. Only two variables loaded significantly (.40 or greater) on the function (Concern about using up energy sources that are not replaceable, and Age). As the TNPW group was negatively associated with the function, this can be interpreted as a lack of concern about finite energy resources, combined with an association with younger people. This function is difficult to interpret solely on the basis of these two variables. One possibility is that a section of younger people may have few concerns about finite nature of fossil fuel resources, which may indicate a preference for continuing to use them as an energy source. It may also simply reflect, as suggested in Study 1, a general disinterest in the issue of nuclear power or environmental issues in general.

Table 29 shows the proportions of each of the four attitude groups that could be correctly classified on the basis of the independent variables entered into the analysis.

Table 29: Group membership predictions based on the identified discriminant functions

	Predicted Group Membership			
Original Group Membership	**Beneficial and Safe**	**Threat**	**Reluctant Acceptance**	**There's No Point Worrying**
Beneficial and Safe	64.6	-	-	-
Threat	-	82.8	-	-
Reluctant Acceptance	-	-	43.9	-
There's No Point Worrying	-	-	-	50.8

Overall: 57.8% of cases correctly classified

Probabilities were calculated equally across groups, rather than taking group size into account, as the results of the survey are assumed to be broadly representative of the sampled communities (www.statsoft.com). Burns & Burns (2008) suggest that a hit rate that is 25% greater than that due to chance is acceptable. Using that criterion, the acceptable rate in the present analysis is 50%. Table 29 shows that the majority of cases in the B&S, Threat, and TNPW groups could be correctly classified on the basis of the independent variables entered into the model. However, membership of the RA group was less well predicted, being correctly classified in under half of cases (44%). This shows that membership of the RA perspective is associated with additional factors not included in the analysis.

5.8.4 Discussion

This study has investigated the variables and the combinations of variables on which individuals associated with the four points of view on nuclear power can be distinguished. The first analysis suggests that the main differences between the four groups are related to trust, acceptability, support for new build locally, and PSSoP. The subsequent discriminant analysis largely confirms this suggestion. The hypothesis that a discriminant function would be identified which differentiated between the B&S and Threat groups on the basis of trust, perceived risks, acceptability, attitudes towards new build locally, PSSoP and gender was largely supported, as Function 1 discriminates between the two groups on the basis of all these variables except gender. The absence of gender in this function is somewhat surprising, given that the points of view it differentiates between represent positions of strong support and objection in relation to the nearby nuclear power station. A long history of literature suggests that women tend to perceive higher levels of risk than men when considering environmental issues, especially local ones, and in particular with regard to nuclear power (Davidson & Freudenberg, 1996; Hitchcock, 2001; Venables & Pidgeon 2006). It was therefore expected that gender would be strongly associated with this function, but the analysis shows that this was not the case.

Consistent with some, but not all previous research, the analysis finds that perceived risks are a slightly more powerful explanatory concept than perceived benefits (Brody & Fleishman, 1993; Desvousage et al., 1993; Dunlap et al., 1993; Slovic et al., 1993) (Table 29). This pattern of results suggests that 'acceptability', a judgement of whether the benefits of the nearby nuclear power station outweigh the risks (or vice-versa) is a more powerful explanatory concept than perceptions of the risks and benefits of nuclear power individually (Table 29). It therefore appears that it is the relative importance, or weighting assigned to each that matters most (Otway et al., 1978; Eiser et al., 1995) in determining broader attitudes towards nuclear power.

Finally, it is reassuring that the expected relationships were observed in relation to trust. The confirmation of the centrality of trust (and distrust) in relation to the B&S and Threat groups, respectively, illustrates that the removal of trust-based information from the vignette study (Study 2, Analysis A) does not appear to have compromised the validity of the vignettes in identifying subgroups of individuals with the same, or very similar characteristics to the equivalent subgroups described in Study 1. This finding is consistent with the predictions of the Associationist view of trust (Eiser et al., 2002), which suggests that trust is a consequence, rather than a determinant of attitudes.

The second prediction for this study was that a function would be found that differentiated the RA group from the others on the basis of concern about climate change and (an absence of) affiliation to the nuclear industry. This hypothesis was only partially confirmed. Discriminant function 2 distinguishes between the RA perspective and the other points of view on the basis of affiliation, but not, however, on the grounds of concern about climate change (Table 28). In addition, perceived risks are seen to be important in discriminating the RA group from the other attitude groups, a result that was not predicted. These results suggest a number of important points. First, and consistent with Study 1, Analysis 3, the absence of concern about climate change as a discriminatory variable might be because concerns about energy security may play a more important role in determining the reluctant acceptance of nuclear power (*c.f.* Bickerstaff et al., 2008a). Unfortunately, concern about energy security was not directly measured in the study, and this is an area in which future research is therefore required. Second, the prominence of perceived risks in this context reiterates the inherently ambivalent nature of the RA point of view, as suggested in Study 1. Third, the analysis confirms the suggestion made in Table 25 that this is a 'lay' point of view associated with individuals without connections to the nearby power station or the broader nuclear industries. It is also interesting to note that consistent with Study 1, trust is seen to be a relatively unimportant factor in relation to this point of view, at least with regard to the B&S and Threat perspectives on nuclear power.

The final prediction was that a function would be identified that discriminated between the TNPW group and the others on the basis of a lack of general concern (in relation to radioactive waste, nuclear power, climate change, and using up energy resources that are not replaceable). Again, this expectation was only partially supported. The third discriminant function is observed to differentiate between the TNPW group and the other three perspectives, but only on one of these variables (concern about using up energy resources that are not replaceable). This result did not therefore reiterate the general lack of concern that was expected to be uniquely associated with the group. It suggests that rather than an absence of concern, the point of view may be associated more with disinterest and disengagement - concepts alluded to in relation to this group in Study 1, but which were not specifically measured by the present survey. In addition, the identification of (younger) age as a discriminatory variable was unexpected. Recent research is inconsistent on the issue of whether age is associated with support for nuclear power. The study by Whitfield et al., (2009) reports no significant association, but a recent, nationally representative UK study by Corner et al., (*under review*) suggests that older individuals tend to have more favourable attitudes towards nuclear power. The present association, together with the absence of age as a significant discriminant factor in relation to the B&S and Threat groups suggests that age may be associated with some specific attitudes to nuclear power (or to a preference for other forms of electricity production) but not necessarily with support or opposition for nuclear power *per se*.

A further important consideration is the 'hit rate' (Table 29), which reports the proportion of correct classifications for each group on the basis of the independent variables entered into the analysis. This was fairly high in relation to the B&S, Threat, and TNPW points of view (64.6%; 82.8% and 50.8%, respectively) but was relatively poor in relation to the RA group (43.9%). This shows that more so than the other three points of view, the RA perspective is associated with additional factors not measured in this study. These might relate, for example, to political ideology, faith in technology, or knowledge about nuclear power (Kuklinski et al., 1982), and it may be that the introduction of variables intended to measure these would improve the analysis. Another possibility suggested by previous research is that values may be as, or more important in predicting attitudes towards nuclear power than specific factors such as perceived risks, perceived benefits, and trust (van der Pligt, 1985). It may be, therefore, that agreement with the RA point of view is based largely on such values. For example, Whitfield et al (2009), (referring to the Schwartz value scales (Schwartz, 1992)), report that individuals with more traditional beliefs are more likely to support nuclear power, and those with more altruistic values are more likely to oppose it. The present study suggests that further research is needed to investigate the values and other possible explanatory concepts that may be associated with attitudes to nuclear power, especially the more nuanced perspectives that do not represent straightforward pro- or anti-nuclear attitude positions.

5.9 Study 2 Analysis C: Points of view on nuclear power - Relationship with proximity

This study represents the final analysis conducted specifically to explore the four points of view on nuclear power. It examines the relationship between the four attitude groups and (residential) proximity to the nearby power station – i.e. whether the proportions of respondents who identified most closely with each of the four different points of view varied on this basis.

5.9.1 Aims and Hypotheses

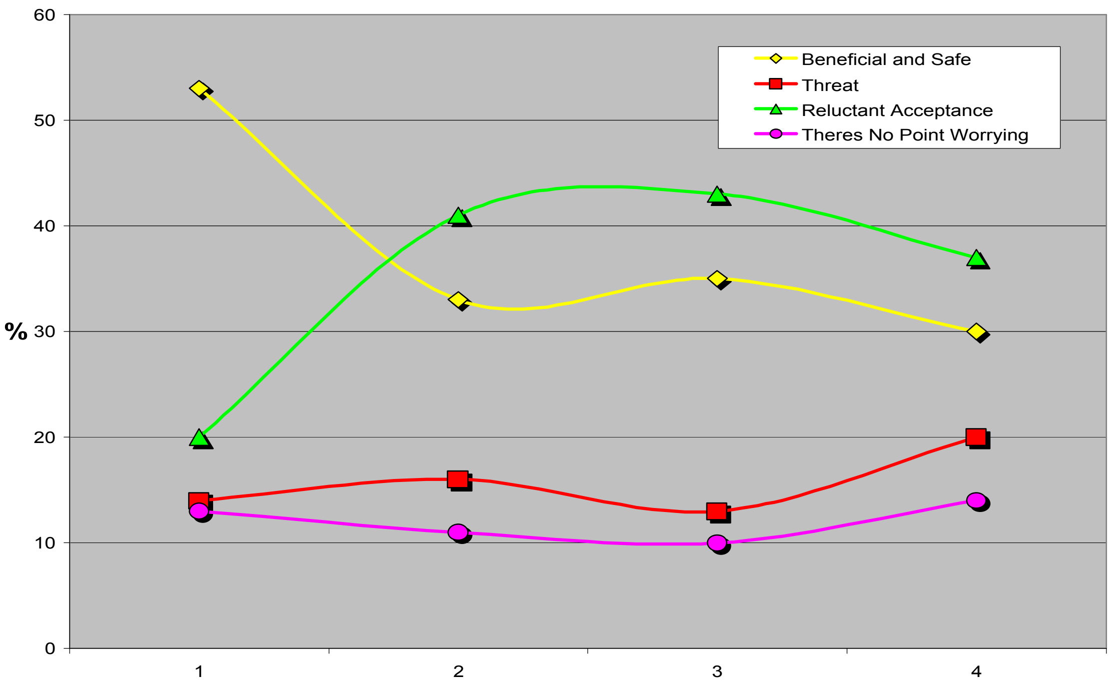
The aim of this study is to investigate whether the proportions of the sample associated with each of the four points of view on nuclear power vary with proximity to the power station. In accordance with literature suggesting that levels of perceived risk tend to reduce with proximity to existing hazardous sites, and that support for nuclear power may correspondingly increase, the following hypotheses were made:

1. The proportion of the sample associated with the B&S point of view will increase with proximity to the power station (the closer the sample point to the power station, the greater the proportion of individuals associated with the B&S point of view).
2. The proportion of the sample associated with the Threat point of view will decrease with proximity to the power station (the closer the sample point to the power station, the lower the proportion of individuals associated with the Threat point of view).
3. There will be no relationship between proximity to the power station and representation of the RA and TNPW points of view in the sample.

5.9.2 Results

The proportion of the sample indicating that each of the four points of view on nuclear power was most like their own was plotted against the four proximity points (construction of the proximity scale is described previously in Section 5.5.4). Figure 3 shows the proportion of the sample that selected each point of view as most like their own across the four proximity points.

Figure 3: Proportion of respondents associated with each point of view by proximity to the power station



Nearest to Power Station **Furthest from Power Station**

The main point of interest in Figure 3 is the difference in the proportion of respondents selecting the B&S and RA points of view between proximity points 1 and 2. The results therefore show that the main proximity-related variations relate to those two points of view, and occur between those living immediately adjacent to the power station and the rest. Thus the proportion of the sample selecting the B&S point of view is observed to be fairly consistent across proximity points 2-4, but rises sharply in settlements immediately adjacent to the power station (points 1-2). In contrast, selection of the RA point of view is observed to decrease substantially in the most proximate settlements. Contrary to expectations, the distribution of the Threat point of view is fairly constant with proximity (between 13% and 20%), although selection of this point of view is observed to rise slightly as distance from the power station increases. Selection of the TNPW point of view is also observed to be fairly uniform with proximity to the power station.

The significance of the differences in proportions of individuals associated with each point of view were subjected to a series of χ^2 analyses. The results of these tests showed that the only significant differences occurred in relation to the proportion of individuals associated with the B&S and RA points of view between proximity points 1 and 2 (B&S: χ^2=63.09; p<.001; RA: χ^2=22.99, p<.001). This shows that the proportion of the sample who selected the Beneficial and Safe as most like their own point of view is significantly higher, and the proportion who identified most with the RA point of view significantly lower, in the settlements that are closest to the nuclear power station (i.e. within 2 miles), compared to those situated further away (more than 2 miles distant). The results regarding the Threat and TNPW points of view show that there is no significant relationship between either of these points of view and proximity to the nearby power station.

5.9.3 Discussion

This study was conducted to investigate the representation of the four points of view on nuclear power in communities situated at a range of different distances from the nuclear power station. As expected, it shows that the proportion of the sample that identified most closely with the strongly supportive B&S point of view increases significantly with proximity to the power station. However, the anticipated negative relationship between the prevalence of the Threat point of view and proximity was not found. This pattern of results is consistent with literature suggesting that support for nuclear power is likely to be higher in the communities situated in close proximity to an existing nuclear facility. However, the 'proximity effect', as illustrated in Fig 3, is not a gradual increase in the proportion of those associated with the B&S point of view, but rather, a leap from approximately 30% of the sample to over 50% in the most proximate settlements (Oldbury and Oldbury Naite, both situated within two miles of the Oldbury power station). The pattern of results also suggests that whilst support for nuclear power increases sharply in the immediately proximate communities, strong objection to the facility remains fairly constant with distance, with the present results suggesting that around 15-20% of the local population hold strongly anti-nuclear attitudes regardless of how near or far they live from the power station. Consistent with these results, the survey conducted subsequent to this thesis for EDF at Hinkley Point (EDF, 2010) found that favourable attitudes to the nuclear energy industry rose from 56% (amongst those living between 15 and 25 miles from the power station) to 61% amongst those living within 10 miles of it, whilst unfavourable attitudes remained more consistent across geographical distance (19% at 15-25 miles; 17% within 10 miles). The results of the present study are, therefore, only partially consistent with previous research suggesting that attitudes towards nuclear power become more polarised in proximate communities (Benford et al., 1993; Eiser et al., 1995). They are, however, consistent with the suggestion that a proportion of the population can be expected to be extremely favourable towards nuclear power in such localities (Eiser et al., 1995).

Also interesting is the pattern of results in relation to the RA point of view. The representation of this attitude group is fairly consistent across proximity points 2-4 but is observed to fall sharply in the most proximate communities (from approximately 40% to around 20% of the sample). Thus, whilst RA was the most commonly selected point of view overall, the proportion of the sample associated with this perspective is similar to that of the Threat and TNPW points of view in the most proximate sampling areas. The predominance of this point of view in the sample overall is, therefore, largely a reflection of its prevalence in the least proximate communities. This is consistent with the results of Study 1 and Study 2, Analysis B, which suggest that this point of view is associated with an absence of connections to the nearby power station and the wider nuclear industry.

With regard to the siting of new nuclear power stations, these results carry a potentially important message. The data suggest that whilst support for nuclear power may increase in communities situated in very close proximity to a nuclear power station, strong objection does not appear to decrease. Therefore, whilst a policy of siting new nuclear power stations at existing nuclear sites may experience greater levels of support than would be expected at non-host sites, these results do not suggest that a correspondingly decreased level of opposition would also be experienced.

5.10 Study 2 Analyses A-C: Overall summary and conclusions

The study is subject to a number of limitations. First, it assumes that the results of the Q-Study are comprehensive in representing an accurate summary of the full range of local community views in the sampled areas. Second, each of the points of view, presented as vignettes in the questionnaire, contain multiple statements regarding nuclear power. Analysis of the responses to these assumes that respondents indicated an overall level of agreement with each point of view. However, it is possible that respondents' decisions may have been based on one or two salient aspects of the factor descriptions only (e.g. the first sentence of each), with little attention afforded to the remainder. Finally, the main point of interest in Study 2 Analysis C is the change in the proportions of each point of view within 2 miles of the power station. Data from these very proximate settlements were collected at Oldbury only, as there is no significant population situated very close to the Hinkley Point power station. It can be assumed, however, that this effect is related to proximity, rather than a broader difference between the Oldbury and Hinkley Point datasets. This is because it is the difference in the data between proximity points 1 and 2 that is of interest, and proximity point 2 is represented in both samples. In contrast, if the effect was due to a difference between the Oldbury and Hinkley Point datasets, one would expect the 'break' in the data to occur at proximity point 3, the first point on the scale at which the Oldbury sample is not represented.

These analyses have a number of implications for this thesis. Overall, and consistent with Study 1, they suggest that a number of concepts may be central in shaping local peoples' experiences of living with nuclear power. In particular, Analysis B shows that positions of strong support or opposition towards the nearby power station appear to be closely tied to (a) perceptions of risk (and the balance of perceived risks and benefits); (b) Trust (especially in the nuclear industry and the local plant operators), and (c) perceptions of the nearby power station in the context of local experiences of place (PSSoP). In addition, consistent with previous research suggesting that support for nuclear power and experiences of risk may interact with residential proximity to a nuclear power station, Analysis C shows that strong support for nuclear power appears to increase significantly in the most proximate communities. This suggests that the communities at Oldbury and Hinkley Point may be subject to a 'proximity effect' whereby perceptions of risk are sometimes observed to be very low in communities situated immediately adjacent to sources of socio-technical risk. The remaining analyses in this thesis are conducted with the aim of investigating these concepts, and the relationships between them, in more detail. First, Analyses D, E & F of this thesis investigate the role of trust in the relationships between communities and the nearby nuclear power station. Next, Analyses G-H examine the influence of SoP and PSSoP on such relationships in more detail. Analysis I then investigates the factors that are associated with support and opposition for new nuclear build in the nearby area.

5.11 Public Trust and the nearby Nuclear Power station

5.11.1 Rationale

Study 1 suggests that perceptions of (un)trustworthiness in relation to the government, the nuclear industry and the local plant operators are important aspects of how sections of the public (particularly those that strongly support or oppose a nearby facility) live with nuclear power. The main theoretical approaches to the study of trust are described in Chapter 2. Interestingly, Study 1 also suggests that different segments of the public may place differential emphases not just on the salience or importance of the various institutions responsible for nuclear safety, but also on different qualitative aspects of trust itself. As summarised in Chapter 2, these are known as the 'dimensions' of trust (for example, honesty, competence, and integrity).

The following series of analyses aim to explore the nature of local trust relationships with the nearby nuclear power station in more detail. As the qualitative characteristics of trust are highlighted in Study 1 (specifically, strong opposition to nuclear power was associated with perceptions of dishonesty in relation to the nuclear industry, and strong support was associated with perceptions of competence in the local plant operators), the dimensional approach to the study of trust is adopted in this thesis.

First, Analysis D explores the dimensionality of trust in respect of local community perceptions of the regulation, governance and day to day running of the nearby nuclear power station. Subsequently, Analysis E investigates whether it is possible to discriminate between the four points of view on nuclear power on the basis of the dimensions of trust only. Analysis F then examines whether residential proximity to the nuclear power station is associated with fluctuations in levels of trust and variations across the different trust dimensions. Finally, Analysis G investigates the implications of applying an alternative approach to statistical modelling to the trust data.

5.12 Study 2 Analysis D: Nuclear Power and the Dimensionality of Trust in Risk Regulation

Study 1 suggests that trust between communities and a nearby nuclear power station is an important aspect of how communities live with nuclear power. Gaining a more complete understanding of the nature of such trust relationships is therefore of central relevance to this thesis. Previous research suggests that trust between people and a nearby hazard may be in some way different when familiarity with a trust target is high, as opposed to when trust judgements are made in relation to a distant, unfamiliar, or abstract institution. One would therefore expect the trust relationships between an established nuclear power station and the communities situated in very close proximity to it to be different to those between people and more abstract and distant institutions such as the government and the broader nuclear industry. This expectation stems from a range of previous research, including: qualitative studies emphasising the importance of context in 'local' trust relationships (e.g. Fitchen et al., 1987; Macgill, 1987); studies describing the associations between perceptions of salient value similarity and levels of familiarity with, or knowledge of the trust target (e.g. Langford, 2002; Siegrist et al., 2000; 2001); and also the conflicting results of two previous studies by Poortinga & Pidgeon (2003) and Metlay (1999).

The latter two studies, (discussed in detail in Section 2.6.4a), used samples that varied in terms of their familiarity with the trust target: Metlay used a specifically defined sample that can be assumed to have been highly familiar with the issue of nuclear power, whilst Poortinga & Pidegon used a 'general public' sample that would have been relatively unfamiliar with the various risk issues investigated in that study. The differences between the two sets of results two may therefore reflect these variations. Specifically, the two studies suggest that when a trust target is specific and/or familiar to the truster, judgements of trust should be based on Affective and Cognitive considerations (Metlay, 1999), and when a trust target is unfamiliar and/or non-specific, judgements should be structured in a way that reflects considerations of General Trust and Scepticism (Poortinga & Pidgeon, 2003). Therefore, in this thesis, the dimensionality of trust, when expressed in relation to the familiar and specific institution of the local plant operators, should resemble Metlay's results, whilst trust between the same communities and the relatively unfamiliar and non-specific institution of the government should be more similar to Poortinga and Pidgeon's model. The present analysis is designed to investigate this possibility.

A second aim of Analysis D is to investigate whether the dimensionality of trust is consistent across a range of attitudes towards nuclear power. As discussed in Section 2.6.4b, previous research suggests that the criteria on which trust-related evaluations are based may vary across individuals, and that such criteria may become more specific when hazards are personally important to the individual. It was therefore anticipated that groups of participants with strongly supportive or opposing attitudes towards nuclear power (i.e. the B&S and Threat perspectives, respectively) may show qualitatively different dimensionalities of trust from those with more moderate views (the RA and TNPW points of view). Finally, the analysis also considers the role of Salient Value Similarity (SVS) in the dimensionality of trust, which some previous literature suggests may be of particular importance under conditions of high familiarity and social integration (see Section 2.6.4c).

5.12.1 Aims

Analysis D therefore consists of a series of exploratory analyses with the following aims:

1. To investigate the dimensionality of trust between communities situated close to the power station and three institutions responsible for nuclear safety, chosen to represent three levels of specificity and familiarity, from non-specific and unfamiliar (the UK Government) to highly familiar and specific (the Local Plant Operators). In a general sense, it was expected that discrimination between the dimensions of trust would increase with increased levels of familiarity and specificity. More specifically, it was expected that the UK Government would be evaluated in terms resembling General Trust and Scepticism (Poortinga & Pidgeon, 2003), whilst the Local Plant Operators, being a specific institution with which local communities would be relatively familiar, would be evaluated in terms similar to the Cognitive and Affective components described by Metlay, (1999). No specific expectations were made in relation to the nuclear industry, which was intended to represent a mid-point of familiarity and specificity lying between the two other institutions.
2. To explore whether the dimensionality of trust is consistent across the four points of view on nuclear power. In accordance with some previous research suggesting that the criteria on which trust-related evaluations are based may vary across individuals, and that trust-related judgements may become more specific when hazards are personally important to the individual, it was anticipated that groups of participants with strongly supportive or opposing attitudes towards nuclear power (i.e. the B&S and

Threat perspectives, respectively) would show qualitatively different dimensionalities of trust to those with more moderate views (the RA and TNPW points of view).

3. The third aim of the study is to explore the role of SVS in the dimensionality of trust.

5.12.2 Method

This study focuses on an extensive battery of items designed to measure perceptions of trust between local communities and (a) the UK Government's regulation of the nuclear power, (b) the Nuclear Industry's management of UK nuclear power stations, and (c) the running of the nearby nuclear power station by the Local Plant Operators (sections D, E & F of the questionnaire, see Section 5.5.2; Box 6). The previous studies by Poortinga & Pidgeon and by Metlay both used PCA to explore the data, and statistical literature suggests that the choice of factor model can cause major artifactual differences between studies (Rummell, 1970). Therefore, a decision was made to also use PCA in the present analysis. This enables a degree of analytical consistency to be retained across the three studies, and facilitates as valid a comparison as possible to be made between them.

5.12.3 Results

5.12.3a Overall Levels of Trust: differences across points of view

Mean levels of trust across attitude groups for each of the three institutions are contrasted in Table 25 (Analysis B), which shows significant variation across the attitude groups in relation to all three institutions. As expected, the B&S attitude group expressed the highest levels of trust in all three institutions and the Threat attitude group the least. However, the levels of trust expressed by the RA and TNPW attitude groups were fairly similar.

5.12.3b Overall levels of trust: relationship with perceptions of risks and benefits

A well established research finding is that in conditions of high trust, perceived risks are generally considered to be lower or more acceptable (see section 2.6.1). Low trust should therefore be associated with high levels of perceived risk and concern. A series of correlations was therefore conducted (Pearson's *R*) in order to confirm that the data conformed to this well established finding. Table 30 shows that the expected relationships were indeed found: higher levels of trust were negatively associated with concern and perceived risks, and positively associated with acceptability. Trust was more strongly associated with perceived risks than perceived benefits, and (compared to trust in the Government), trust in the Nuclear Industry and Local Operators was relatively strongly associated with perceived risks and benefits, concern about nuclear power, concern about radioactive waste, and acceptability. The correlation coefficients were of medium strength (range: .30-.63). Affiliation was included as a controlling variable in order to ensure that the observed relationships were not simply due to chance fluctuations in employment or social links to the nuclear industry or the nearby power station.

Table 30: Partial correlations* between trust in the three institutions, concern, perceived risks & benefits, and acceptability**

Institution	**Concern about nuclear power (*R*)**	**Concern about radioactive waste (*R*)**	**Perceived risks (of local station) (*R*)**	**Perceived benefits (of local station) (*R*)**	**Acceptability (*R*)**
Government	-.40	-.37	-.46	.30	.49
Nuclear Industry	-.51	-.44	-.56	.44	.63
Local Operators	-.51	-.43	-.57	.44	.62
Total	-51	-45	-.58	.43	.63

** controlling for Affiliation (i.e. employment links with the nuclear industry or local power station, whether personal or via friends and family).*
*** all correlations significant at p<.001.*

5.12.3c Factor analysis

To examine the dimensionality of trust, a series of exploratory PCAs were conducted. First, three separate PCAs were conducted (one in relation to each institution) on the dataset as a whole (i.e. irrespective of attitude group). This revealed just one factor was found for each institution (i.e. there was little apparent discrimination between items, either on the basis of dimension or item valence). These factors, which contained all trust items, were labelled *Overall Trust* (Table 20).

Next, a second series of exploratory analyses was conducted to investigate whether the dimensionality of trust was consistent across the four attitude groups. The data were therefore subjected to 12 separate PCAs, each with Varimax rotation: i.e. for each of the three institutions, and by each of the four attitude groups (Tables 31-33). Factors with Eigenvalues greater than 1 were initially considered for retention in the factor solution. Cattell's Scree test (Kline, 1994), was adopted as a second consideration, and an interpretability criterion was also applied. Ultimately, two factors were retained in each instance. To facilitate interpretation, the data was then reanalysed, specifying the retention of two factors in each case (Field, 2000). This series of analyses produced a detailed set of results. In all cases, items factored into a dominant component explaining approximately half of the variance, together with a secondary factor explaining approximately 7-10% of the variance. Individual dimensions were flagged to factors when they loaded significantly and uniquely on one factor (.4 or greater on one factor only). These results are now described in more detail.

5.12.3d Dimensionality of Trust in Government

Table 31 shows that there was little differentiation between the dimensions of trust in evaluations of the Government, analysis of which produced broad, general factors for each attitude group. The RA, B&S and Threat groups produced two factors consisting of positively and negatively valenced items, with little apparent discrimination between the various dimensions of trust. These factors were interpreted as General Trust, and General Distrust, respectively. Responses from the TNPW attitude group produced a small SVS component alongside an undifferentiated factor, interpreted as Overall Trust.

5.12.3e Dimensionality of Trust in the Nuclear Industry

Table 32 shows the dimensionality of trust for the nuclear industry, again differentiated by the four attitude groups. A very different pattern of results, compared to those examining trust in the government (Table 31), is apparent. For all four attitude groups, trust items tended to factor into a set of considerations reflecting Honesty, Credibility, Fairness, Care, and SVS (labelled ‘Affective’), and a set of more ‘Cognitive’ judgements (Reliability, Competence, and Integrity). When considered in the context of the results for the Government, these results suggest an increasing level of discrimination between the dimensions of trust as the specificity of the institution increases.

5.12.3f Dimensionality of Trust in the Local Plant Operators

Table 33 shows the dimensionality of trust in the local operators for each attitude group. In general, the factoring for the B&S, RA and Threat groups group is consistent with the results for the Nuclear Industry, showing an apparent distinction between Affective-Cognitive components of trust. In contrast, the TNPW group appears to revert to generalised evaluations at this level of specificity and familiarity.

Table 31: Dimensionality of Trust in the Government for each Attitude Group

Item	Reluctant Acceptance		There's No Point Worrying		Beneficial and Safe		Threat	
	F1	**F2**	**F1**	**F2**	**F1**	**F2**	**F1**	**F2**
…is open and honest	**.67**	-.38	**.68**	-.26	.59	-.40	-.40	.59
…does not tell the truth about nuclear incidents and radioactive discharges	-.15	**.69**	-.29	.24	-.23	**.75**	**.66**	-.04
We can rely on…not to cut corners or make mistakes	**.63**	-.36	**.85**	-.09	.64	-.45	-.16	**.80**
We cannot rely on…to ensure that nuclear power stations are safe	-.22	**.69**	**-.63**	.28	-.23	**.70**	**.49**	-.22
…has the necessary skills to manage nuclear power stations safely	**.60**	-.22	**.75**	-.06	**.53**	-.37	-.01	**.78**
…is not competent enough to manage nuclear power stations	-.32	**.69**	**-.76**	.21	-.26	**.71**	.33	**-.41**
…does the right thing with regards to the safety of nuclear power	**.73**	-.35	**.79**	-.17	.62	-.47	-.23	**.73**
…puts profit before public safety	-.38	**.63**	**-.69**	.27	-.35	**.72**	**.61**	-.12
…is prepared to take account of studies linking nuclear power stations with elevated rates of cancer in nearby towns and villages	**.66**	-.24	.41	-.39	**.69**	-.23	**-.58**	.14
…distorts the facts to make its case for nuclear power	-.30	**.68**	**-.51**	.37	-.40	**.72**	**.79**	-.19
When making decisions about nuclear power, … considers all sides of the argument	**.74**	-.23	.64	-.47	**.68**	-.38	-.59	.46
Decisions made by … are usually unfair and unjust	-.42	.57	-.59	.52	-.43	.64	.67	-.41
We can trust… to act in the public interest	**.79**	-.27	.69	-.47	**.75**	-.30	-.42	.61
…is not interested in what ordinary people think about nuclear power	-.41	.58	**-.69**	.18	-.37	**.70**	**.61**	-.36
…has the same opinions as me about nuclear power	.48	-.46	.10	**-.92**	**.77**	-.15	**-.61**	.26
…has different ideas about nuclear power to me	-.29	**.66**	-.12	**.90**	**-.63**	.29	**.65**	-.22
Eigenvalue	7.52	1.09	7.58	1.53	8.17	1.10	6.46	1.46
Variance Explained (%)	47.00	6.81	47.38	9.53	51.09	6.88	40.37	9.11
Interpretation	**General Trust**	**General Distrust & SVS**	**Overall Trust**	**SVS**	**General Trust & SVS**	**General Distrust**	**General Distrust & SVS**	**Cognitive**

Table 32: Dimensionality of Trust in the Nuclear Industry for each Attitude Group

Item	Reluctant Acceptance		There's No Point Worrying		Beneficial and Safe		Threat	
	F1	F2	F1	F2	F1	F2	F1	F2
…is open and honest	.72	-.40	-.47	.58	.52	-.62	**.76**	-.30
…does not tell the truth about nuclear incidents and radioactive discharges	**-.61**	.28	.50	-.40	-.44	.57	-.50	.45
We can rely on…not to cut corners or make mistakes	.45	-.57	-.74	.40	.33	**-.73**	.59	-.51
We cannot rely on…to ensure that nuclear power stations are safe	-.38	**.55**	**.48**	-.29	-.14	**.64**	-.11	**.62**
…has the necessary skills to manage nuclear power stations safely	.11	**-.75**	**-.85**	.10	.36	**-.63**	.18	**-.75**
…is not competent enough to manage nuclear power stations	-.16	**.82**	**.80**	-.20	-.18	**.76**	-.11	**.80**
…does the right thing with regards to the safety of nuclear power	.40	-.72	**-.79**	.22	.38	**-.69**	.42	-.60
…puts profit before public safety	-.37	**.67**	.46	-.54	-.39	**.65**	-.50	.51
…is prepared to take account of studies linking nuclear power stations with elevated rates of cancer in nearby towns and villages	**.65**	.-24	-.24	**.70**	**.64**	-.23	**.81**	-.14
…distorts the facts to make its case for nuclear power	-.61	.43	.49	-.61	-.68	.51	-.61	.43
When making decisions about nuclear power, … considers all sides of the argument	**.73**	-.27	-.23	**.77**	**.75**	-.29	**.80**	-.24
Decisions made by … are usually unfair and unjust	-.48	.52	.66	-.49	-.64	.48	-.48	.46
We can trust… to act in the public interest	.63	-.46	-.58	.58	**.69**	-.37	**.84**	-.24
…is not interested in what ordinary people think about nuclear power	-.54	.43	.49	-.53	-.59	.48	-.51	.49
…has the same opinions as me about nuclear power	**.78**	-.12	-.03	**.72**	**.81**	-.25	**.73**	-.18
…has different ideas about nuclear power to me	**-.74**	.20	.36	**-.55**	**-.80**	.21	**-.66**	.15
Eigenvalue	7.84	1.22	7.98	1.22	8.54	1.11	7.68	1.38
Variance Explained (%)	49.00	7.60	49.90	7.65	53.35	6.91	48.00	8.62
Interpretation	**Affective & SVS**	**Cognitive**	**Cognitive**	**Affective & SVS**	**Affective & SVS**	**Cognitive**	**Affective & SVS**	**Cognitive**

Table 33: Dimensionality of Trust in the Local Operators for each Attitude Group

Item	Reluctant Acceptance		There's No Point Worrying		Beneficial and Safe		Threat	
	F1	**F2**	**F1**	**F2**	**F1**	**F2**	**F1**	**F2**
…is open and honest	-.49	.54	-.31	**.75**	.67	-.46	-.52	.54
…does not tell the truth about nuclear incidents and radioactive discharges	.52	-.45	.63	-.47	-.51	.60	**.59**	-.14
We can rely on…not to cut corners or make mistakes	-.62	.40	-.39	**.68**	.49	-.57	-.53	.62
We cannot rely on…to ensure that nuclear power stations are safe	**.66**	-.37	.49	-.45	-.09	**.71**	.36	-.33
…has the necessary skills to manage nuclear power stations safety	**-.82**	.05	-.38	**.66**	.35	**-.68**	-.07	**.85**
…is not competent enough to manage nuclear power stations	**.86**	-.07	.63	-.46	-.23	**.79**	.18	**-.86**
…does the right thing with regards to the safety of nuclear power	**-.72**	.30	-.36	**.67**	.46	-.59	-.30	**.72**
…puts profit before public safety	.65	-.40	**.68**	-.32	-.47	.67	**.59**	-.31
…is prepared to take account of studies linking nuclear power stations with elevated rates of cancer in nearby towns and villages	-.14	**.61**	.09	**.71**	**.59**	-.22	**-.68**	.16
…distorts the facts to make its case for nuclear power	.43	-.57	.69	-.47	-.53	.53	**.75**	-.21
When making decisions about nuclear power, … considers all sides of the argument	-.37	**.62**	-.50	.48	**.74**	-.37	**-.76**	.24
Decisions made by … are usually unfair and unjust	.59	-.40	**.71**	-.35	-.43	.69	.49	-.44
We can trust… to act in the public interest	-.49	.53	-.35	**.65**	.64	-.56	-.62	.54
…is not interested in what ordinary people think about nuclear power	.40	-.56	**.72**	-.19	-.65	.46	.65	-.40
…has the same opinions as me about nuclear power	-.12	**.82**	**-.50**	.20	**.84**	-.23	**-.64**	.23
…has different ideas about nuclear power to me	.13	**-.81**	**.79**	.01	**-.82**	.19	**.70**	-.16
Eigenvalue	7.59	1.44	7.70	1.26	8.94	1.04	7.39	1.37
Variance Explained (%)	47.44	8.97	48.10	7.9	55.89	6.51	46.20	8.56
Interpretation	**Cognitive**	**Affective & SVS**	**General Distrust & SVS**	**General Trust**	**Affective & SVS**	**Cognitive**	**Affective & SVS**	**Cognitive**

5.12.4 Discussion

This series of analyses has investigated the nature of trust between local communities and three of the institutions responsible for nuclear safety in the UK: the Government, the Nuclear Industry and the Local Plant Operators. The first aim of the study was to investigate whether the trust between local communities and a nearby nuclear power station is structured differently from trust between those communities and the more distant and unfamiliar institution of the UK Government (i.e. the UK's government's regulation of nuclear power). Initial analysis showed that when the data was analysed as a whole, there was no evidence of discrimination between the dimensions of trust. Rather, a single 'Overall trust' component was revealed consistently across the three institutions. This result is surprising, given that numerous previous studies of the dimensionality of trust have identified multiple factors. Nevertheless, the results suggest that in a general sense (i.e. without taking prior attitudes into account), individuals do not appear to discriminate either between trust and distrust, or between the dimensions of trust. Rather, as expressed in aggregate by large samples, trust in institutions appears to be a broad, non-differentiated construct.

One possible explanation for this is that the initial 'whole sample' analysis produced a 'mean' set of factors that may have obscured variation across subgroups[52]. The data were therefore split according to the four attitude groups and subjected to further exploratory analysis (Tables 31-33). This

[52] An alternative explanation, however, is that as the subgroup analyses were performed on groups comprised of fewer cases, the results are, next to the initial analysis, relatively unstable and therefore less reliable. This explanation is arguably the less plausible of the two, as according to the literature (Kline, 1994), the subgroups should still be of sufficient size to produce reliable results (i.e. they were between n=147 and n=479, depending on the attitude group).

analysis produced a more detailed set of results which, contrary to the previous analyses, were broadly aligned with the expectations of this study. In relation to trust in the Government, Poortinga & Pidgeon (2003) found that trust consistently factored into two components: General Trust, and a Scepticism component comprised of negatively valenced items relating to the dimensions of Reliability, Credibility, and Integrity. This result was partially replicated in the present study (Table 31). The Government was consistently evaluated in general terms, suggesting that respondents may have tended to focus on broad considerations of the political-administrative system (Christensen & Laegreid, 2003). In addition, and consistent with Poortinga & Pidgeon, a distinction tended to be drawn between positively valenced items signalling trust, and negatively valenced items indicating distrust. Poortinga & Pidgeon found that Scepticism comprised Reliability, Credibility and Integrity, but crucially, these were the only negatively valenced items included in that study. Therefore, the present results suggest that the Scepticism component identified by Poortinga & Pidgeon is likely to represent a subset of items from a broader, undifferentiated General Distrust (or General Scepticism) component, rather than comprising those three specific dimensions alone. This analysis therefore provides greatest support for models discussing trust and distrust as two broad but separate constructs (e.g. Lewicki et al., 1998; Burns et al., 2006).

Trust in the Nuclear Industry was conceptualised in the present study as representing a mid-point of familiarity and specificity falling between the institutions of Government and the Local Plant Operators. Poortinga & Pidgeon (2003) suggest that trust-based judgements may become increasingly differentiated as the familiarity and specificity of the evaluated subject increases. This expectation was confirmed, as it is clear that as the transition is made from considering trust in the non-specific and relatively unfamiliar institution of Government, through to the Nuclear Industry and the Local Plant Operators, fewer non-differentiated, general trust evaluations are observed (Tables 31-33). Interestingly, however, the change from general to differentiated considerations occurs between the Government and the Nuclear Industry, and evaluations of the latter are similar to those made in relation to the Local Operators. This suggests that the Nuclear Industry and the Local Operators are evaluated on similar dimensions, whilst the Government is subject to a separate, broader set of considerations. This may represent the effects of group perceptions and their interactions with macro-scale societal forces (Kasperson, 1992a). That is, the distinction between 'system' or 'societal' trust (characteristic of large-scale, complex societies) and micro-scale interpersonal or neighbourhood trust (Luhmann, 1980; Greenberg & Williams 1999). Such effects of scale may be evident in communities where a risky facility and its associated personnel are not only nearby, but also considered, whether positively or negatively, to be part of that community. Thus trust in 'local' sources of potential risk may be based primarily on interpersonal dimensions, whilst trust-based assessments of more distant institutions may be based on systemic considerations.

In relation to the relatively specific and familiar institution of the Local Operators, the results were similar to those of Metlay (1999), who investigated trust in a specific government department with which the sample was highly familiar. Metlay's study concluded that trust comprised a primary General

Trust factor (referred to as the 'Affective' components) together with a secondary 'Cognitive' factor (Competence only). In the present analysis, a similar set of results was observed. Three of the four attitude groups distinguished between these 'Affective' and 'Cognitive' dimensions, but there was also an important difference between the present results and those of Metlay. In Metlay's study, the Cognitive component was formed of Competence only, whereas the present results suggest that Competence tends to factor together with Reliability and Integrity. Nevertheless, the results of the present study for both the Nuclear Industry and the Local Operators were similar to Metlay's in broad terms. Indeed, the additional dimensions of Reliability (i.e. 'We can rely on…not to cut corners and make mistakes') and Integrity (i.e. '…does the right thing with regards to the safety of nuclear power') are generally consistent in relating to perceptions of a skilled, competent, and dependable workforce. This pattern of results is also consistent with previous research suggesting that trust is formed of affect- and cognition-based components (e.g. Jungermann et al.,1996; McAllister, 1995; Erdem & Ozen, 2000), which can be also summarised as relating to considerations of Competence and Care (Johnson, 1999).

5.12.4a Effects of Prior Attitudes on the Dimensionality of Trust

The second aim of this analysis was to examine whether the dimensionality of trust varies across a range of different attitudes towards nuclear power. Some previous research has suggested that the evaluative dimensions that people consider when making trust-related judgements may differ between individuals, especially when personal involvement is high (Eiser, 2002;

Johnson, 2007, Earle et al., 2007). Consistent with the Associationist view of trust, which regards trust as a reflection of the prior attitudes of the perceiver (Eiser et al., 2002; Poortinga & Pidgeon, 2006), it was anticipated in this study that respondents holding a range of different attitudes towards nuclear power might show different dimensionalities of trust. The results of this exploratory analysis (Tables 31-33) permit only qualitative interpretations of the dimensionality of trust and the similarities and differences between them[53]. It is, however, notable that although the dimensionality of trust is generally consistent across the B&S, Threat and RA attitude groups, the TNPW group tends to be anomalous in relation to the other three. As this group is the most disinterested and disengaged of the four points of view, the results suggest, consistent with some previous studies, that the dimensionality of trust may vary according to the level of engagement that an individual has with the issue (Eiser, 2002; Johnson, 2007, Earle et al., 2007).

Examination of item valence within the Affective and Cognitive components is also informative. Depending on the attitude group, both the Affective and Cognitive constructs are often seen to be either exclusively positive (i.e. trusting) or negative (sceptical) in nature. Typically, it was found in the present study that the Cognitive component was sceptical in nature and the Affective positive. However, this pattern is reversed in the evaluations of the Local Operators by the Threat attitude group, whose results factored into a negatively valenced (sceptical) Affective component, alongside a positively valenced (trusting) Cognitive factor. These results therefore suggest that

[53] In the absence of a well fitting *a priori* model, it is acceptable to compare factor structures resulting from EFA (of which PCA is a form) across subgroups (Levine, 1977; Rummel, 1970). The results, however, require future study and should be subject to confirmatory analysis before substantive conclusions can be drawn.

Trust may not be as simple a concept as has recently been argued, as they suggest that either construct can represent trust or scepticism. The overall pattern of results is therefore not dissimilar to those of Viklund & Sjoberg (2008), who note three general dimensions of trust (in various institutions, including the Swedish Nuclear Power Inspectorate) relating to General Competence (competence, efficiency, and commitment to goal), Perceived Corruption (acts in self-interest, and is part of the power elite) and General Morality (how an organisation works in everyday life). Reflecting Poortinga & Pidgeon's (2003) idea of critical trust, Sjoberg (2008; also Sjoberg & Wester-Herber, 2008) argues that it is possible for an individual to perceive an organisation as competent and efficient, but nevertheless not trust it. Those authors give the example of advertising agencies: as their purpose is to generate revenue for their clients through increased sales, it may be that the more competent they are, the worse things are for the consumer. In the present study, evaluations of the Local Operators by the Threat attitude group (who have an antagonistic relationship with nuclear power in general) show a similar pattern. This suggests that opponents of nuclear power may sometimes concede that a power station is competently managed and run, although they might still question the inherent safety or morality of the technology (de Groot & Steg, 2010). The present research therefore supports the notion of critical trust, although, as argued earlier, it does not conceive Scepticism as being limited to a subset of just three dimensions (*c.f.* Poortinga & Pidgeon, 2003).

5.12.5 Conclusions, limitations and future research

This study finds that trust relationships between local communities and the institutions responsible for nuclear safety appear to differ depending on the familiarity and specificity of the trust target. As anticipated, the dimensionality of trust in the non-specific and unfamiliar institution of Government was found to be broadly similar to the results reported by Poortinga & Pidgeon, whilst for the relatively specific and familiar institutions of the Nuclear Industry and the Local Operators, the results resembled those reported by Metlay. This therefore largely reconciles the conflicting results of those studies. Rather than being due to cross-cultural influences between the UK and US, the differences between them appear likely to reflect variations in the degree of familiarity between the sample and the institution. In addition, the results suggest that SVS may be an important aspect of local trust relationships. Even under conditions of high familiarity with the trust target, the results suggest that SVS may form part of a set of Affective trust-based considerations.

The study is also subject to a number of limitations. First, the analysis investigates trust specifically with regard to an established nuclear power station and the communities situated in close proximity to it. Different risk issues are thought to engender different patterns of lay understanding, which extend to perceptions of distrust and vested interests (Walls et al., 2004, p.135). Therefore, although the study by Poortinga & Pidgeon (2003) suggests that the dimensionality of trust may be consistent across a variety of potential hazards, it cannot be assumed that the evaluative dimensions utilised by the public towards different sources of risk, or between national and local risks, will necessarily be uniform. Second, the analysis relies on the assumption that the nuclear industry and local operators will be perceived as relatively familiar institutions by communities situated in close geographical proximity to them. A better approach may have been to include a direct measure of familiarity in the questionnaire. Third, in the questionnaire, positive and negatively valenced items were alternated throughout the relevant sections, and manual observation of the completed questionnaires suggested that this may have encouraged response sets. Therefore, although the order in which each institution was presented was counterbalanced, the study may have further benefitted from presenting the individual trust items for each institution in an initially randomised order. Finally, as with previous studies examining the dimensionality of trust, the analysis relies on qualitative assessments of the similarities and differences across points of view and institutions, and also between the present results and existing models. This issue is addressed later in this thesis (Analysis G).

There are also two further important issues that this study does not fully address. First, although the overall structure of the factors appeared generally similar across the points of view on nuclear power, the extent to which the Affective and Cognitive components of trust may be differentially important or salient to each remains unclear. Second, the study confirms the expectation that SVS may play an important role in trust judgements. Analysis E is therefore designed to further explore these issues.

5.13 Study 2 Analysis E: The dimensionality of trust in risk regulation: differences across the four 'points of view' on nuclear power

5.13.1 Rationale

Analysis D suggests that the overall structure of trust, at least in relation to local community perceptions of the Nuclear Industry and the Local Plant Operators, is generally split into two clusters of dimensions, or 'components', representing (a) a set of Affective dimensions (including SVS), and (b) a set of Cognitive judgements. These two components can be regarded as representing the evaluative dimensions considered by respondents when making judgements relating to trust in the risk regulation of nuclear power. Analysis D suggests that these evaluative dimensions are found across a range of points of view on nuclear power. Despite this consistency, however, Analysis B shows that overall *levels* of trust differ considerably between attitude groups (Table 25). This raises the question of whether the Affective and Cognitive components, and expressions of SVS rise and fall in a relatively uniform manner across groups, or whether some attitude positions may be characterised by particularly strong (or weak) expressions of each. The present analysis is therefore conducted to investigate this issue in more detail.

5.13.2 Aims and Hypotheses

The first aim of this analysis is to construct 'trust profiles' for each point of view, in order to examine whether these appear to vary across the four attitude groups. Study 1 suggested an asymmetry of trust: positive expressions of nuclear safety appeared to be related to relatively high levels of perceived competence, particularly in relation to the local operators (a trend observed in relation to the B&S group). In contrast, distrust appeared to be associated with perceptions of dishonesty, particularly in relation to the nuclear industry (observed with regard to the Threat group). Another trend observed in Study 1, and reiterated in Study 2 (Analysis B; Tables 27 & 29) was that trust does not appear to be a particularly important component of the RA point of view.

In the present analysis, it was therefore hypothesised that:

1. The B&S point of view would be distinct from the other groups on the basis of strong endorsement of the cognitive dimensions of trust, relative to the affective dimensions.

2. The Threat point of view would be distinct from the other groups on the basis of low endorsement of the affective dimensions of trust, relative to the cognitive dimensions.

3. No specific hypotheses were made in relation to the RA or TNPW points of view, as no clear patterns have been observed in previous analyses, which have also suggested that trust is a relatively unimportant aspect of the RA attitude position.

4. The final aim of the study was to investigate the relative contributions of the various components of trust to respondents' overall impressions of the nearby power station. In accordance with the suggestion that perceptions of SVS may be important determinants of trust in situations where an institution is highly integrated into a local community, it was anticipated that SVS would play an important role in this context, particularly in relation to the Nuclear Industry and the Local Plant Operators.

5.13.3 Method

Composite variables, consisting of a positively valenced item added to its corresponding negatively valenced item (reverse-scored) were computed for each of the seven individual dimensions of trust, and for SVS. These were plotted against the three institutions, for each of the four attitude groups.

5.13.4 Results

5.13.4a Trust Profiles

Figures 4-6 show 'trust profiles', which were constructed for each of the four attitude groups. Contrary to expectations, the graphs show a very similar profile for all groups and institutions. This is interesting, as it suggests that overall, the relative weights afforded to the different dimensions of trust are fairly similar across a range of attitudes towards nuclear power, and also across the three institutions (and therefore across different levels of familiarity). Interestingly, the Competence dimension is consistently relatively high across points of view and institutions. Also, expressions of trust in relation to the Affective components and SVS are generally lower than the Cognitive components. In addition, it is the Affective dimensions and SVS that appear to fluctuate most across attitude groups. This can be seen most clearly in relation to the Threat point of view, where perceived honesty and SVS are observed to be particularly low in comparison to the other points of view. This pattern of results therefore suggests that the main differences between trust-based evaluations of the three institutions by the four points of view may lie on the Affective dimensions (and SVS). This possibility was investigated further through a discriminant analysis. The dependent variable in the analysis was the point of view on nuclear power that respondents indicated was most like their own. The independent variables were the same as those used in Figures 4-6 (described in Section 5.13.3).

Figure 4: Trust profile: Government

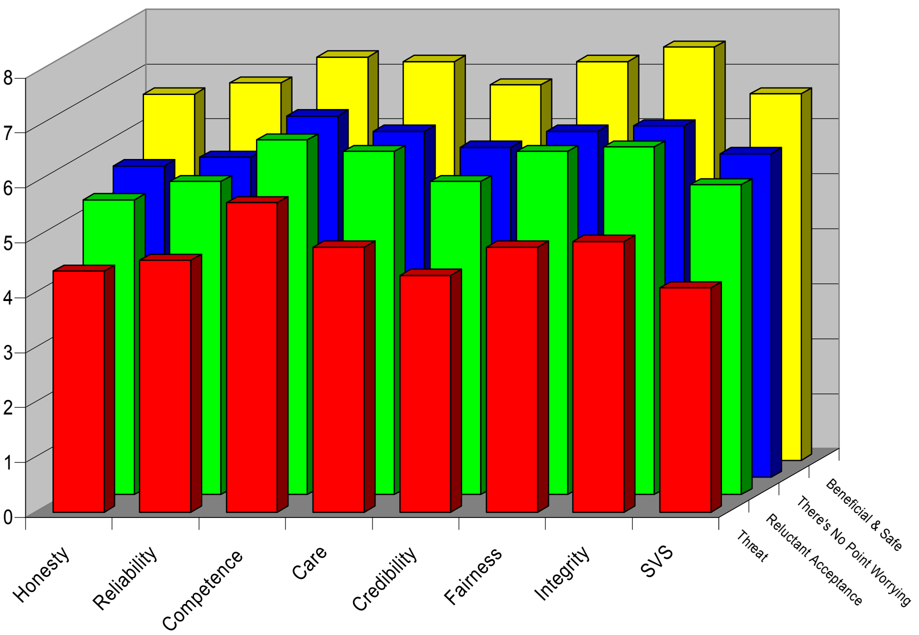


Figure 5: Trust Profile: Nuclear Industry

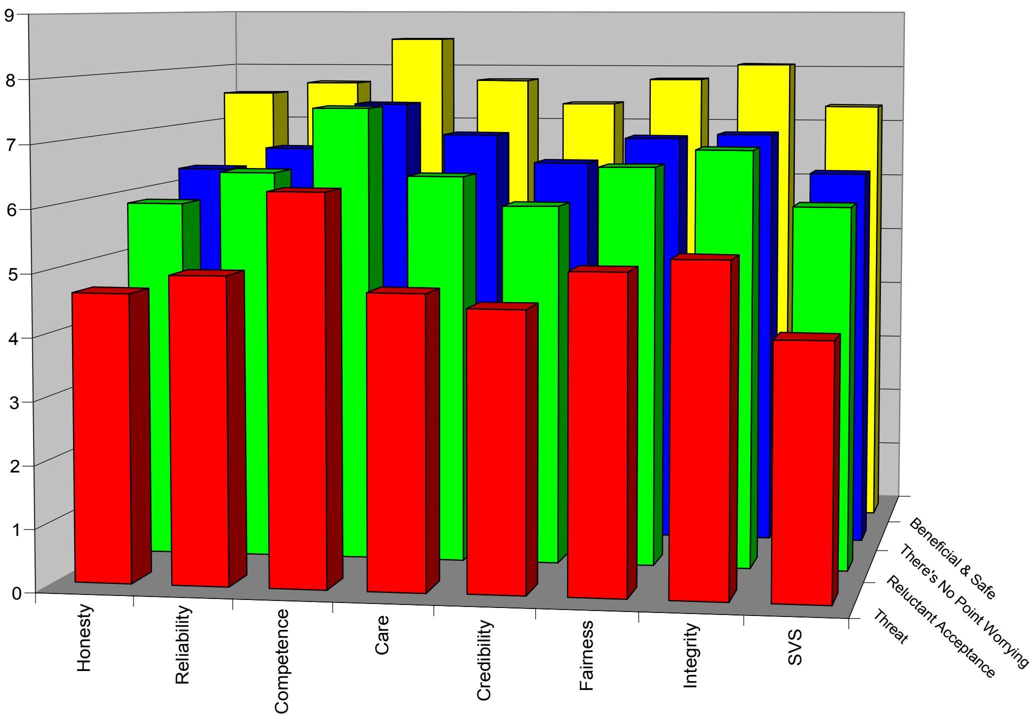
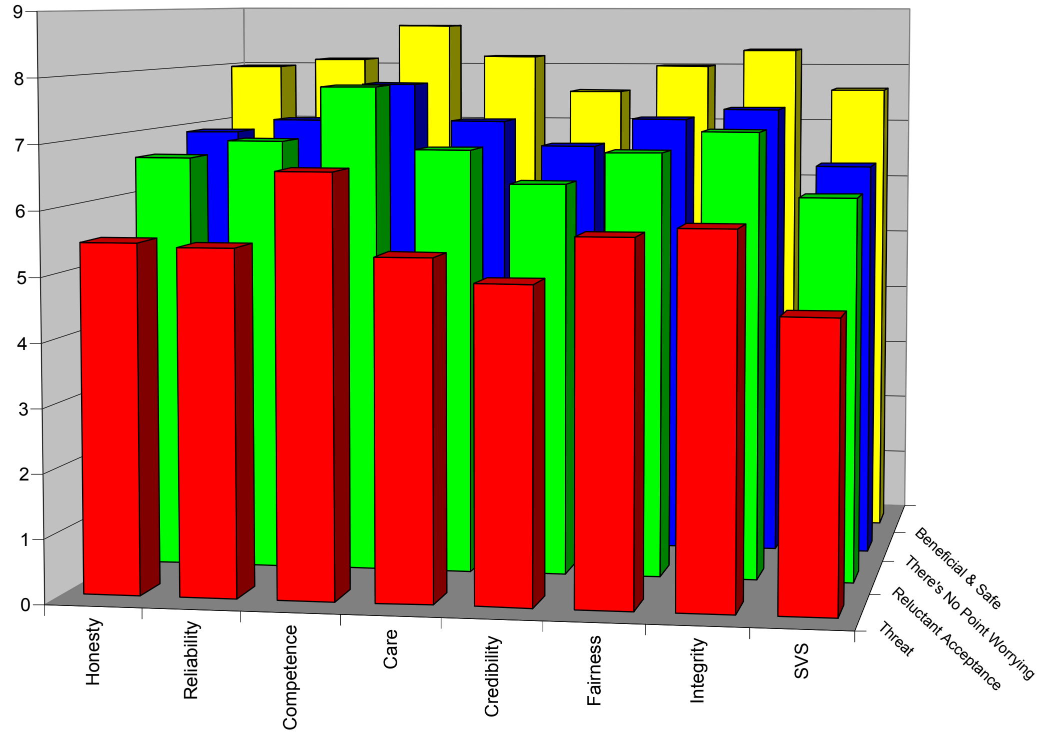


Figure 6: Trust Profile: Local Plant Operators



5.13.4b Discriminant analysis

Consistent with the discriminant analysis presented previously in this thesis (Study 2, Analysis B), patterns of covariance were found to differ between groups (Box's M= 226.06; $p<.001$), an issue that is not considered to be a serious problem when sample sizes are large (Burns & Burns, 2008). Also consistent with Study 2 Analysis B, variables were entered simultaneously into the model to avoid undue emphasis being placed on chance associations. The analysis revealed two discriminant functions, explaining 89.5, and 3.8% of the variance, respectively, and both were significant at the $p<.001$ level (Table 34).

Table 34: Summary of discriminant function properties

Function	Eigenvalue	Variance Exp. (%)	Wilk's Lambda	χ^2	*df*	Sig.
1	.71	89.5	.54	670.7	69	$p<.001$
2	.05	3.8	.92	88.7	44	$p<.001$

Table 34 shows the two discriminant functions identified by the analysis. However, the second function explained just 3.8% of the variance, and analysis of the structure matrix (Table 36) showed that no variables were significantly associated with it. This function was therefore discarded from the analysis.

Table 36: Functions at group centroids

Point of View	Group Centroids
	Function 1
Beneficial and Safe	**.92**
There's No Point Worrying	.04
Reluctant Acceptance	-.21
Threat	**-1.61**

The group centroids for the discriminant function are shown in Table 35. The function can be seen to discriminate mostly between the B&S and Threat points of view, which are associated positively and negatively with the function, respectively. The RA and TNPW groups are only weakly differentiated by the function. The meaning of the function can be inferred from the structure matrix (Table 36). As in Study 2 Analysis B, non-standardised correlations are reported, and the matrix is not rotated (see Footnote 47). The strength of the correlation coefficient indicates the importance of the variable in contributing to the discriminant function.

Table 36: Structure matrix

Dimension	Component	Institution	Correlation
SVS	**SVS (Affective)**	Nuclear Industry	.81
SVS	**SVS (Affective)**	Plant Operators	.81
Care	**Affective**	Nuclear Industry	.80
Fairness	**Affective**	Nuclear Industry	.79
Credibility	**Affective**	Nuclear Industry	.78
Honesty	**Affective**	Nuclear Industry	.76
Care	**Affective**	Plant Operators	.75
Integrity	Cognitive	Nuclear Industry	.75
Credibility	**Affective**	Plant Operators	.74
Fairness	**Affective**	Plant Operators	.72
Honesty	**Affective**	Plant Operators	.69
Integrity	Cognitive	Plant Operators	.68
Reliability	Cognitive	Nuclear Industry	.66
Reliability	Cognitive	Plant Operators	.65
Competence	Cognitive	Nuclear Industry	.64
Credibility	**Affective**	Government	.63
Integrity	Cognitive	Government	.63
SVS	**SVS (Affective)**	Government	.62
Care	**Affective**	Government	.61
Fairness	**Affective**	Government	.61
Competence	Cognitive	Plant Operators	.59
Honesty	**Affective**	Government	.56
Reliability	Cognitive	Government	.50
Competence	Cognitive	Government	.40

**The convention of R=.40 was adopted as the cut-off for significance*

The discriminant function was interpreted as reflecting General Trust, as it was significantly associated with all trust dimensions. In such instances it is informative to examine the independent variables that are most strongly correlated with the function, which indicates the factors that most successfully discriminated between the groups. Table 36 clearly shows that the most important discriminatory variables are Affective in nature, and are associated with the Local Plant Operators and the Nuclear Industry, but not the Government. In addition, SVS, in relation to the Local Plant Operators and the Nuclear Industry is observed to be of particular importance in discriminating between the four points of view.

Table 37 shows the proportions of each of the four attitude groups that could be correctly classified on the basis of the independent variables entered into the study. As in Analysis B, probabilities were calculated equally across groups. The table shows that for the B&S and Threat points of view, the majority of cases were correctly classified. Membership of the RA and TNPW categories were less well predicted on the basis of trust-related variables, however, and the proportion classified correctly fell below the recommended cut-off of (100%/4)+25%=50% (Burns & Burns, 2008; see Section 5.8.3).

Table 37: Group membership predictions based on the identified discriminant function

	Predicted Group Membership			
Original Group Membership	**Beneficial and Safe**	**Threat**	**Reluctant Acceptance**	**There's No Point Worrying**
Beneficial and Safe	61.7	-	-	-
Threat	-	68.3	-	-
Reluctant Acceptance	-	-	38.9	-
There's No Point Worrying	-	-	-	43.5

Overall: 51.8% of cases correctly classified

Finally, a set of analyses were conducted to investigate the relative contributions of the various components of trust to respondents' overall impressions of the nearby power station. The analysis examined the proportions of variance explained by the 'traditional' dimensions of trust (i.e. all dimensions except SVS; Poortinga & Pidgeon, 2003); by the Affective dimensions only (not including SVS); by the Cognitive dimensions only, and by SVS separately. The analyses were conducted in relation to the Government, Nuclear Industry and Local Plant Operators (Table 38). As expected, the results suggest that trust in the Nuclear Industry and the Local Plant Operators is more important than trust in the government in predicting attitudes towards the nearby power station. In addition, the table shows that the Affective and Cognitive components explain very similar amounts of variance in overall attitude to nuclear power. Furthermore, whilst SVS alone adds little explanatory power to the traditional dimensions of trust, it is observed to explain almost as much of the variance as the Affective and Cognitive components combined. Finally, the explanatory power of both the traditional dimensions of trust and SVS can be seen to increase with additional familiarity and specificity.

Table 38: Comparison of SVS and the other dimensions of trust in predicting overall attitude to the nearby power station* (R^2)

Predictors**	**Govern ment**	**Nuclear Industry**	**Local Plant Operators**	**Total*****
All dimensions	.32	.49	.49	.51
Affective components	.32	.47	.46	.51
Cognitive components	.27	.43	.44	.48
SVS	.26	.40	.41	.45
Explanatory power added to the 'traditional' dimensions model through the inclusion of SVS	.03	.02	.02	.02

** The dependent variable was 'Overall, how do you feel about Oldbury/Hinkley Point nuclear power station?' (as appropriate to study location) answered on a 5-point scale ranging from 'Very Negative' to 'Very Positive'*
*** All predictors significant at p<.001*
**** Combined predictive effect of the relevant predictor with regard to all three institutions*

5.13.5 Summary and Discussion

This analysis began with the expectation that (1) the B&S point of view would be distinct from the Threat attitude group on the basis of high levels of trust in relation to the cognitive components, and (2) that the Threat point of view could be differentiated from the B&S point of view on the basis of the Affective components of trust. The results confirm that only the B&S and Threat groups can be clearly differentiated on the basis of the dimensions of trust. However, the main differences between these groups are not Cognitive – they lie on SVS and the Affective dimensions, and relate to expressions of trust in the Nuclear Industry and the Local Operators only (Table 36).

The results therefore suggest that expressions of strong trust and distrust in the nearby nuclear power station are primarily affective issues, based mostly on perceptions of SVS in relation to the Plant Operators and SVS, Care, Fairness, Credibility and Honesty in relation to the broader nuclear industry. The results do not therefore wholly support the assertions of Study 1. They are, however, consistent with previous research suggesting that trust judgements are not generally made on the basis of perceived technical excellence (Cvetkovich, 1999). They are also broadly compatible with the model proposed by Lewicki (1988), in which trust and distrust are seen as separate concepts. In addition, they are consistent with the idea that it is possible to perceive an institution as competent, but not trust its motives (Sjoberg, 2008; Sjoberg & Wester-Herber, 2008), and therefore with the concept of critical trust – the idea that one can generally trust an institution but retain a degree of scepticism towards it (Pootinga & Pidgeon, 2003).

The results of this study also have potentially important implications for theories of SVS. Table 36 shows that SVS is of particular importance in relation to the Local Operators and the Nuclear Industry (i.e. the more familiar of the three institutions), yet SVS should, according to theory, become *less*, not more important as knowledge and familiarity in relation to a trust target increases (Siegrist et al., 2000, 2001; Langford, 2002). A set of regression analyses was therefore conducted in order to test the possibility that SVS may play a greater, rather than lesser role in determining attitudes towards nuclear power under conditions of higher familiarity (Table 38). The results of this analysis show that when considered independently, SVS and the ‘traditional’ dimensions of trust (i.e. all dimensions other than SVS) are both seen to explain significant proportions of the variance in overall attitude to nuclear power. The table also shows that the explanatory power of SVS, and also trust in general, appears to *increase* with additional familiarity (from .26 [Government] to .41 [Local Operators]). In addition, whilst SVS can be seen to add little explanatory power to the traditional dimensions of trust (consistent with Poortinga & Pidgeon, 2003), perceptions of SVS alone are almost as good a predictor of overall attitude to the nearby nuclear power station as are the combined traditional dimensions. These data therefore suggest that (a) SVS may be a more parsimonious way of measuring trust than the traditional dimensions; and (b) that perceptions of SVS may be particularly important at a local level, where familiarity with an institution is high.

The literature is not unsupportive of this possibility. Earle & Cvetkovich (1995) suggest that the conventional dimensions of trust may be articulated as *reasons* for trust in an institution, in circumstances where outward expressions of value similarity may be regarded as socially inappropriate. However, in studies of local risk sources such as the present analysis, where key personnel may be known to research participants, expressions of SVS with individuals or groups who actually work at the power station are not only likely to be relatively socially acceptable, but may also be informed perceptions, based on interpersonal relationships between research participants and the actual individuals in question. Expressions of SVS may therefore reflect ‘pluralistic’ or ‘thick’ trust (Earle and Cvetkovich, 1995; Williams, 2000), and may be more freely expressed in the context of the local communities studied in this thesis. Consistent with Study 1, (see also Venables et al., 2009; Parkhill et al, 2010; Pidgeon et al., 2008) these results suggest that the development of SVS may be related to the formation of such social networks. Those researchers suggest that as community bonds have developed over time, segments of the population have come to consider that they share values and moral orderings with the power station personnel, and together these processes lead to the generation of social trust between nearby communities and the local power station operators. Thus, risk perceptions regarding a nearby nuclear facility may relate not just to a good safety record, but also to the social networks through which local people come to know and trust the individuals who work there (Freudenberg & Davidson, 2007). Interestingly, Parkhill et al., also note that familiarity can lead to concern about safety as well as reassurance, as for some people, the accumulation of knowledge and familiarity highlights the potential for human error. Likewise, the present study suggests that distrust expressed by local opponents of nuclear power can be based on perceptions of *not* sharing values with the local operators.

5.14 Study 2 Analysis F: Nuclear Power and the dimensionality of trust in risk regulation: Relationship with Proximity

5.14.1 Rationale

Analysis E suggests that positive expressions trust in relation to a nearby nuclear power station may be based largely on Affective judgements related to familiarity with the facility, and the presence of the local social networks associated with it. This enables a number of predictions relating to trust and residential proximity to the power station to be made. First, as strong support for the power station is observed to increase sharply in the most proximate communities (Analysis C), one would expect trust as an overall concept to do likewise. Second, as such expressions seems to be primarily based on SVS and the Affective dimensions of trust, one would expect these to show a stronger relationship with proximity than the Cognitive dimensions. Finally, if expressions of trust in a nearby nuclear power station are borne of familiarity with that facility, one would anticipate a trust-based proximity effect in relation to that specific facility, but not necessarily in relation to trust in the nuclear industry or the UK government's risk regulation of nuclear power.

5.14.2 Aims & Hypotheses

The aims of this study are therefore first, to investigate whether overall levels of trust in the three institutions increase with proximity to the power station. The second aim of the study is to investigate which of the Affective and Cognitive components of trust are most strongly associated with proximity to the power station. The following hypotheses are made:

1. Overall levels of trust in the local operators will be positively correlated with residential proximity to the power station (i.e. the closer one lives to the power station, the higher the level of expressed trust). However, there will be no significant relationship between residential proximity to the power station and trust in the UK Government or trust in the Nuclear Industry.
2. The strongest associations between the dimensions of trust and proximity will be observed in relation to the Affective dimensions of trust (and SVS).

5.14.3 Results

5.14.3a Overall Relationships between Trust and Proximity

Proximity was operationalised as described in Section 5.5.4. To ensure that any observed relationships were not simply due to generally higher or lower levels of trust in the Oldbury or Hinkley Point samples, the separate scores for each dimension of trust were summed for each institution, and overall, in order that levels of general trust could be contrasted between samples at the point of overlap on the proximity scale. The results of this analysis are reassuring, as they show that at equidistant points from the two power stations, levels of trust were similar, and none of the differences between sites were significant (Table 39).

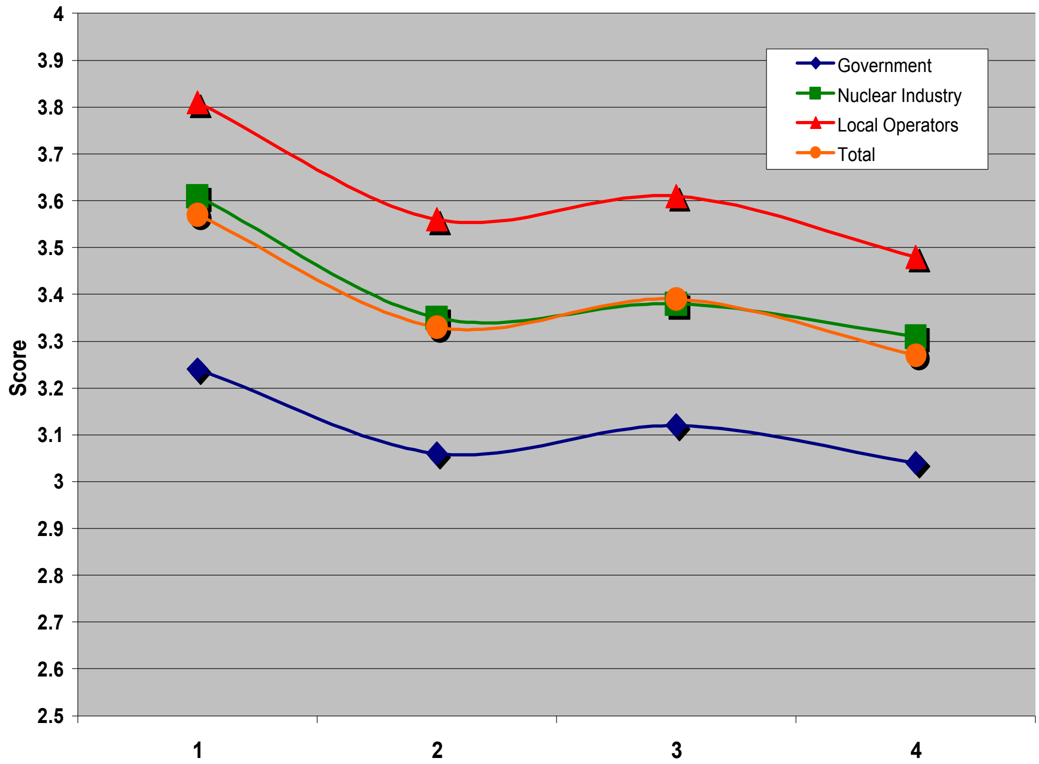
Table 39: Mean levels of trust (overall, and in the Nuclear Industry and Local Operators) at the point of overlap (Proximity point 2; see Table 23)

Trust Construct	Oldbury Sample (mean)	Hinkley Point Sample (mean)	*t*	*p*
Total Trust	3.45	3.46	-.18	.86
Trust in the government	3.03	3.05	-.20	.84
Trust in the nuclear industry	3.54	3.60	-.81	.39
Trust in the local plant operators	3.75	3.80	-.75	.45

Figure 7 shows the relationship between 'total' trust (i.e. all dimensions summed across institutions) and trust in each of the 3 institutions separately, and residential proximity to the power station. Consistent with the results of Analysis C (Figure 3), it is notable that although levels of trust are observed to increase with proximity generally, there is a very small decrease in trust between proximity points 2 and 4, and the main difference is observed between points 1 and 2 (i.e. levels of trust appear to rise relatively sharply in communities situated less than 2 miles from the power station). It is also notable that the sizes of the observed differences are small and are detected due to the high statistical power of the survey.

Partial correlations were then conducted to investigate whether the relationships shown in Figure 7 were statistically significant (Table 40). Indicators of affiliation (whether personal, or via friends and family) were entered as controlling variables in these analyses, in order to ensure that any detected effects were not simply due to fluctuations in these factors.

Figure 7: Relationship between trust and proximity to the power station*



Nearest to power station **Furthest from power station**

**For clarity, the means presented in this analysis are divided by the total number of dimensions (i.e. 8). This converts the computed total scores for each institution back to a 5-point scale.*

Table 40: Partial correlations* between proximity to the power station and trust (n=1327)*

Construct	*R*	*p*
Total Trust	.07	<.05
Trust in the government	.03	ns
Trust in the nuclear industry	.07	<.05
Trust in the local plant operators	.08	<.01

** controlling for Affiliation*

Table 40 shows that, as expected, total levels of trust (i.e. a composite score computed by adding all trust variables from all three institutions together), were weakly but significantly correlated with proximity (R=.07; p<.05). This correlation was also observed in relation to trust in the Nuclear Industry and the Local Plant Operators separately, but not in relation to the Government.

5.14.3b Relationship between the Affective and Cognitive components of trust and Proximity

To examine the effects of proximity on the Affective and Cognitive components of trust, composite scores for these were constructed separately for the Nuclear Industry and the Local Operators by summing the individual dimensions of trust associated with each concept to form two scales (i.e. the Openness and Honesty, Credibility, Fairness, Care, and SVS variables were added together to form the Affective component; and the Reliability, Competence, and Integrity dimensions were summed to create the Cognitive component). Partial correlations were then conducted between these constructs and proximity, again with Affiliation entered as a controlling variable. As described previously, it was anticipated that the strongest associations would be observed on the Affective component. Trust in government was not included in the analysis as this variable did not show a significant proximity effect (Table 40). The results of this analysis are shown in Table 41.

Table 41: Partial correlations* between institution and trust component, and proximity to the power station**

Institution (Component)	*R*	*p*
Nuclear Industry (Affective)	.07	<.05
Nuclear Industry (Cognitive)	.03	ns
Local Plant Operators (Affective)	.07	<.05
Local Plant Operators (Cognitive)	.04	ns

**controlling for Affiliation to the Nuclear Industry and nearby power station*

Table 41 shows that for both the Nuclear Industry and the Local Operators, there was a weak but significant correlation between the Affective component of trust and proximity to the nuclear power station, but there was no significant relationship between proximity to the power station and the Cognitive component of trust. These results therefore show that in general, the Affective dimensions of trust and SVS (in relation to both the Nuclear Industry and the Local Plant Operators) increase with proximity to the power station, but the Cognitive component (i.e. Competence, Reliability and Integrity) does not.

A final set of analyses was conducted to investigate whether the associations shown in Table 41 were explained mostly by a relatively large increase in Affective trust at the closest settlements (Proximity Point 1), as suggested in Figure 7. To test this, two ANOVAS were conducted, one for each institution. The dependent variable in each analysis was the Affective trust composite variable, and the independent variable was the 4-point proximity scale. As expected, there was a main effect of proximity in each case (Nuclear Industry: F=3.55, p<.05; Local Operators: F=4.98, p<.01). The results of the post-hoc comparisons (Tukey HSD tests) for both institutions can be seen in Table 42.

Table 42: Nuclear Industry and Local Plant Operators - post-hoc comparisons of Affective Trust between proximity points* (Tukey HSD tests)

Comparison across proximity points 1-4	Mean Difference**	Sig.
Nuclear Industry		
3 and 4	.13	ns
2 and 3	-.05	ns
1 and 2	.25	p<.05
Local Operators		
3 and 4	.17	ns
2 and 3	-.06	ns
1 and 2	.25	p<.05

** Point 1 represents settlements that are closest to the power station. Point 4 represents those that are furthest.*

***For clarity, the means reported here are divided by the number of dimensions comprising the component, in order to convert the scores back to a 5-point scale.*

Table 42 shows that although there is a significant overall trend for Affective trust in the Nuclear Industry and the Local Operators to increase with residential proximity to the nearby nuclear power station, the only significant increases between specific proximity nodes are observed at the most proximate settlements (within 2 miles of the power station). This is consistent for trust in both the Nuclear Industry and the Local Operators[54].

5.14.4 Summary and Discussion

This study confirms the hypothesis that trust in the Local Plant Operators increases with residential proximity to the power station. In addition however, a significant effect was also seen in relation to trust in the Nuclear Industry. Furthermore, the hypothesis that the strongest relationships between trust and proximity would be observed in relation to the Affective components of trust and SVS was also supported.

Consistent with previous research, these results suggest (when considered in the context of Analysis C) that trust judgements may be preceded by the influence of prior attitudes to nuclear power. In other words, community members may tend to interpret new trust-related information in a manner consistent with their prior beliefs about nuclear power, using existing attitudes as a frame of reference for this process (Sherif and Hovland, 1961; Eiser et al., 2002). It is, however, not possible to establish the direction of causality in the observed relationships. It may be that individuals who place trust the

[54] Consistent with Study 2, Analysis C, data from proximity point 1 represents Oldbury only, whilst data at proximity point 2 was collected at both sites (i.e. Oldbury and Hinkley Point). However, if the observed effect was due to a difference between the Oldbury and Hinkley Point datasets, one would expect to observe a significant difference in levels of trust between sites at equidistant proximity points. However, this was not the case (Table 45). In addition, one would expect the ‘break’ in the data to occur between proximity points 2 and 3, as point 3 is the first point on the scale at which the Oldbury sample is not represented. This is also not the case (Figure 7; Table 48).

Nuclear Industry and/or Local Operators tend to live closer to the power station, or that residential proximity to the power station leads, over time, to the generation of trust. Similarly, those who do not trust the Nuclear Industry or Plant Operators may choose to live further from it. However, in the context of the observed relationship between proximity and the Nuclear Industry and Local Operators, the lack of a proximity effect in relation to the Government is interesting. It suggests that the physical presence of the power station in the local geography may be important in affecting attitudes towards it, and the people who operate it. It is unclear, however, why this might be associated with positive evaluations of nuclear power. One possibility, however, lies in research exploring theories of place. These are investigated in Analyses H-J.

5.15 Study 2 Analysis G: Confirmatory Factor Analysis of the two dimensional models

5.15.1Rationale

Analysis D investigated the dimensionality of trust using PCA as the method of statistical analysis. PCA is an appropriate approach for exploratory analyses, and is also consistent with the approach to analysis used in the previous studies by Poortinga & Pidgeon (2003), and Metlay (1999). The use of PCA in Analysis D therefore also permits a degree of analytical consistency with those previous studies to be retained, as it avoids the potential introduction of artifactual differences to the results through the inconsistent use of data modelling techniques (Rummell, 1970).

An alternative view, however, is that the expectations of Analysis D, being based on two sets of results from previous research, should be treated as hypotheses and analysed as such. In such circumstances, an exploratory form of data analysis would not be the most appropriate approach - rather, one would conduct a form of Confirmatory Factor Analysis. The two approaches work on very different principles. PCA operates through examining the data for subsets of correlated variables, which are then grouped together as factors which reflect aspects of the same underlying construct. In contrast, confirmatory factor analysis operates by testing the 'fit' of hypothesised statistical models to the data[55]. The present analysis describes the results of applying this alternative approach to the present data set. It treats the expectations of Analysis D as constituting clear hypotheses,

[55] Confirmatory factor analysis has been criticised, however. Rummell (1970) argues that it attempts to 'shoehorn' data into a predetermined model, thus violating the Popperian principles of falsification and hypothesis testing (Rummell, 1970).

and therefore as leading to statistical models that can be tested against the data using confirmatory factor analysis.

5.15.2: Hypotheses

In accordance with the rationale set out in Analysis D, it is hypothesised that:

1. The General trust/Scepticism model of the dimensionality of trust (Poortinga & Pidgeon, 2003) will accurately model the data relating to trust in the UK government's regulation of nuclear power, but not the data relating to trust in the local plant operators.
2. The Affective/Cognitive model of the dimensionality of trust (Metlay, 1999) will accurately model the data relating to trust in the local plant operators, but not the data relating to trust in the UK government's regulation of nuclear power.

5.15.3 Results

Data analysis was conducted using Amos v.6.0. First, a model reflecting the General Trust and Scepticism model proposed by Poortinga & Pidgeon (2003) was applied to the data. Table 43 shows that the fit between this model and the data was poor in relation to all three institutions[56].

Table 43: Fit of General Trust and Scepticism model (Poortinga & Pidgeon, 2003) to trust in the three institutions

Institution	χ^2	Sig*
Government	976.6	$p<.001$
Nuclear Industry	1083.9	$p<.001$
Local Operators	1173.0	$p<.001$

**df=64; at which a χ^2 value of 104.7 equates to the significance level of p=.001*[57]

[56] In contrast to most statistical procedures, *non-significant* χ^2 values denote a 'good' fit of the hypothesised model to the data in CFA analyses.
[57] Figures sourced from: http://home.comcast.net/~sharov/PopEcol/tables/chisq.html

A second set of confirmatory factor analyses were then conducted to test the Affective-Cognitive model proposed by Metlay. Table 44 shows that Metlay's model also fitted poorly against the data in relation to all three institutions.

Table 44: Fit of Affective-Cognitive model (Metlay, 1999) to trust in the three institutions

Institution	χ^2	Sig*
Government	1379.7	p<.001
Nuclear Industry	1551.7	p<.001
Local Operators	1376.0	p<.001

**df=103; at 100 df, a χ^2 value of 149.5 equates to the significance level of p=.001 (see footnote 55)*

These results are not surprising, however, as the initial exploratory analyses of the trust data (Table 20) showed that contrary to expectations, there was no evidence of factoring when the dataset was analysed as a whole. Subsequently, Analysis D showed that the expected results were observed only when the data was split by the four points of view on nuclear power. Accordingly, in the present analysis, the data was again split by the four attitude groups and analysed separately for each (Tables 45 & 46).

Table 45: Fit of General Trust and Scepticism model (Poortinga & Pidgeon, 2003) to trust in the three institutions by attitude group.

Institution	χ^2	Sig*
Beneficial and Safe		
Government	477.0	*p*<.001
Nuclear Industry	488.3	*p*<.001
Local Operators	469.3	*p*<.001
Threat		
Government	174.8	*p*<.001
Nuclear Industry	290.2	*p*<.001
Local Operators	248.9	*p*<.001
Reluctant Acceptance		
Government	416.9	*p*<.001
Nuclear Industry	531.8	*p*<.001
Local Operators	588.3	*p*<.001
There's No Point Worrying		
Government	237.0	*p*<.001
Nuclear Industry	189.8	*p*<.001
Local Operators	205.9	*p*<.001

**df=64; at which a χ^2 value of 104.7 equates to the significance level of p=.001 (see footnote 55)*

Table 46: Fit of Affective-Cognitive model (Metlay, 1999) to trust in the three institutions by attitude group.

Institution	χ^2	Sig*
Beneficial and Safe		
Government	652.5	*p*<.001
Nuclear Industry	684.5	*p*<.001
Local Operators	599.3	*p*<.001
Threat		
Government	307.2	*p*<.001
Nuclear Industry	420.1	*p*<.001
Local Operators	309.5	*p*<.001
Reluctant Acceptance		
Government	586.4	*p*<.001
Nuclear Industry	753.7	*p*<.001
Local Operators	673.7	*p*<.001
There's No Point Worrying		
Government	343.0	*p*<.001
Nuclear Industry	292.3	*p*<.001
Local Operators	307.4	*p*<.001

**df=103; at 100 df, a χ^2 value of 149.5 equates to the significance level of p=.001 (see footnote 55)*

Tables 45 & 46 show that when split by point of view on nuclear power, neither dimensional model represented a good fit to the data.

5.15.4 Discussion

This final trust analysis presents a series of confirmatory factor analyses. In contrast to the exploratory approaches used in Analysis D, confirmatory techniques illustrate whether a model 'fits' a particular dataset. The results of the present analysis show, however, that neither Poortinga & Pidgeon's nor Metlay's dimensional model of trust accurately modelled the present data in relation to any of the three institutions. This was also the case when the dataset was split by the four points of view on nuclear power. This is not altogether surprising, as although Analysis D shows that item factoring in relation to trust in the UK government most closely resembled Poortinga & Pidgeon's model, and trust in the Nuclear Industry and in the Local Plant Operators most closely resembled Metlay's results, the match to those models was inexact. The present analysis therefore suggests that the dimensional model does not provide a comprehensive and accurate conceptual model of trust. It seems likely, therefore, especially in the context of recent literature describing relative complex statistical models of the concept (e.g. Poortinga & Pidgeon, 2006; Earle & Siegrist, 2006) that the dimensional approach is perhaps an overly simplistic way of representing trust. However, the results of Analyses E&F are strongly suggestive that, at least in some circumstances, an Affective/Cognitive distinction may indeed be made, at least by certain segments of the community and in some circumstances.

Consistent with Study 1, Analysis 3, the present analysis therefore draws attention to the different results that can be produced from the same dataset when alternative forms of statistical modelling are applied to it. In that study, both four and two factors solutions were possible, depending on the analytical technique used. In the present study, the issue of whether the expectations described in Analysis D should be treated as a basis for exploratory analysis, or as firm hypotheses leading to testable statistical models is debateable. However, the analyses show that the former approach leads to the detailed results described previously, whilst the latter leads to the conclusion that there is probably no dimensionality of trust.

5.16 Analyses D-G: Discussion and Conclusions

Using the dimensional approach to the study of trust, this series of analyses has examined, in detail, the nature of trust relationships between local communities and a nearby nuclear power station. A number of key conclusions are drawn. First, when considering the nearby power station and also the broader institution of the nuclear industry (with which respondents were highly familiar), the results suggest that most individuals assess trust on two separate (but highly correlated) dimensions, representing sets of Affective and Cognitive considerations. The exception to this is seen in relation to a minority of individuals who are not motivated to engage with the issues of living near to a nuclear power station. For this segment of the community, general, undifferentiated judgements are more likely to be made. Second, most of the variation between groups representing a range of attitudes towards nuclear power appears to lie on the Affective dimensions of trust and SVS. Third, such judgements of SVS appear to be particularly important in determining trust in the Local Plant Operators and the Nuclear Industry, as opposed to the Government. Fourth, it appears that the closer to the power station one lives, the greater ones' Affective trust and perceptions of value similarity with the Nuclear Industry and Local Operators is likely to be. Finally, the study also serves a useful purpose in largely reconciling the conflicting results reported in the previous studies by Metlay (1999) and Poortinga & Pidgeon (2003). In accordance with the implications of those studies, the present results suggest that increasingly differentiated trust-related judgements appear to be made as the familiarity and specificity of an institution increases. In other words, a distinction between the Affective and

Cognitive dimensions of trust increasingly seems to be made as familiarity, specificity, or personal involvement with the trust target increases.

The results draw particular attention to the importance of affect in the relationships between local communities and a nearby nuclear power station. Some segments of the community appear to have positive affective relationships with the nearby facility, which, in terms of trust, seem to be manifest in considerations of shared moral values with the Nuclear Industry and the Operators of the nearby power station. For these individuals, the nuclear industry and local plant operators are considered to be honest and fair, and to care about local people. For segments of the community that oppose nuclear power, however, the opposite appears to be the case. Consistent with Walls et al. (2004), these results therefore suggest that the power station is largely affectively perceived, as opposed to being objectively viewed in terms of factors such as potential risks, and through rational assessments of the probability of an accident. This Affective/Cognitive distinction in relation to trust also strongly reflects the dual-system model of risk perception (Slovic et al., 2002a,b) described in Analysis A. In relation to this theory, it may be that Cognitive evaluations of trust reflect the relatively slow, logical and conscious deliberations associated with the 'Analytic System', whilst Affective judgements illustrate the operation of the fast, intuitive, and largely automatic 'Experiential System' of risk perception.

However, whilst the results of Analyses D-F present evidence supporting the existence of an Affective-Cognitive distinction, Analysis G did not confirm these results. This could mean that the two factor solution is invalid, or it could be that the Affective-Cognitive distinction is just one aspect of a far more complex set of relationships. This latter possibility implies that the dimensional approach may just be too simplistic to accurately represent social trust. Indeed, the specific items used to measure trust in this thesis were selected in order to resolve the conflicting results reported in two previous studies of trust in relation to nuclear power. With hindsight it is clear that the items used to represent different dimensions of trust in this thesis were very similar, and the fact that they were not *exactly* replicated from the previous studies by Poortinga & Pidgeon (2003) and Metlay (1999) may have led to additional inconsistencies between the present results and those reported in previous studies. In addition, it is important to note that the he Dimensional approach to the study of trust is now over 20 years old (e.g. Renn and Levine 1991). Although it still provides a number of important insights, it has since been superseded by more complex approaches to the study of trust, such as the integrated model (Poortinga & Pidgeon, 2006) and the Trust, Confidence and Cooperation Model (Earle & Siegrist, 2007). As such, it does not necessarily fully reflect more recent developments in the conceptualisation of risk perception and trust, especially those based on more interpretive approaches (e.g. Horlick-Jones et al., 2003; Walls et al, 2004). It may therefore be that the Dimensional approach adopted for the survey aspect of this thesis was not sufficiently sensitive to detect the broad range of contextual nuances associated with trust in relation to both the nuclear hazard and the existing social contexts at the sites studied here.

5.17 Study 2, Analyses H-J: Sense of Place, Nuclear Power, and Attitudes towards New Nuclear Build in the Nearby Area

5.17.1 Rationale

This thesis has thus far identified and described some of the predominant points of view on nuclear power amongst two local communities. It has also investigated the relationships between these points of view and trust in the regulation of nuclear power, and proximity to the power station. The final empirical section of this thesis concentrates broadly on the role of sense of place (SoP) in relation to risk perceptions, proximity, and attitudes towards new nuclear build. In particular, two implications from previous literature are investigated[58].

First, some previous qualitative studies (reviewed in section 2.7.6 of this thesis) note that individuals who identify strongly with an area or place sometimes appear to avoid acknowledging the risks that may be associated with a valued location, or pollution that may be associated with it (e.g. Bonauito et al., 1996; Kaltenbourn, 1998; Bickerstaff, 2004; Bush et al., 2001; Bickerstaff & Walker, 2001; Walker et al., 1998; Wakefield et al., 2001). Some qualitative research has therefore suggested that SoP may play a role in mediating local people's perceptions of the risks associated with established hazardous sites

[58] Sense of Place, Place Attachment and Place Identity are discussed in detail in Sections 2.3.4-8 of this thesis. Some previous researchers have used the terms 'place attachment' and 'place identity' interchangeably and a continued lack of clarity regarding the nature of and the relations between the two concepts persists (Hernandez et al., 2007). Those authors argue that although it is theoretically possible for a person to be attached to a place but not identify with it (and vice versa), the concepts can be expected to overlap in most studies. It is therefore unlikely that differentiating between the concepts in this study would lead to additional insights, and it is not the aim of this thesis to further clarify the debate. Following some previous studies (e.g. Shamia, 1991; Simmons & Walker, 2004), the term 'Sense of Place' (SoP) is used in this thesis as an general term that is assumed to encompass both place identity and place attachment.

(Simmons & Walker, 2004; Bonaiuto et al., 1996). Few previous quantitative studies have examined this issue, however, and, to the author's knowledge, none in respect of an established nuclear power station. In a rare example, Lima & Marques (2005) find that place attachment moderates the proximity effect in relation to the siting of a new incinerator (the closer an individual lived to the new incinerator, the higher the perceived risk, and the relationship was stronger for those with high SoP). The present study examines this issue in relation to an established nuclear power station.

Second, where communities have lived with the presence of a nuclear power station for a prolonged period of time, evidence suggests that community views of the facility may be shaped by a range of local influences such as personal relationships; knowledge of local incidents; media reporting; and the perceived contribution of the power station to the social life of the community (see e.g. Fitchen et al., 1987; Baxter & Eyles, 1999; Irwin et al., 1999; Williams et al., 1999). These studies suggest that, rather than specific psychological concepts such as perceived risks and benefits, it is the presence of the facility in the context of the local geography, both social and physical, on which local people's attitudes appear to be primarily based. This phenomenon has been demonstrated in some previous qualitative studies, which suggest, for example, that facilities such as the Sellafield nuclear complex in Cumbria, or the Allied Colloids chemical plant in West Yorkshire, are, to some segments of the community, positive aspects of local identity. To others, however, they are alien objects that do not 'belong' in the wider rural landscape (Macgill, 1987; Wynne et al., 1993 [2007]; Simmons & Walker, 2004).

The following analyses, H, I & J, represent the final set of studies in this thesis. First, Analysis H examines the relationships between Sense of Place and the four points of view on nuclear power. Second, Analysis I investigates whether proximity to the nuclear power station is associated with decreased levels of perceived risk, and explores whether SoP can be demonstrated to statistically mediate this relationship. Finally, Analysis J investigates the factors that are associated with support or opposition in relation to new nuclear build in the nearby area, and considers the role of the power station as part of the local place and identity in that context.

5.18 Study 2 Analysis H: Sense of Place and Attitudes to the nearby nuclear power station

5.18.1 Hypotheses

A set of descriptive analyses was conducted to examine the relationship between the two Sense of Place scales developed in the previous section of this thesis, and the four points of view on nuclear power (Figure 7). Two ANOVAs were conducted to examine the extent to which these factors varied between groups. With reference to the results of Study 1, it was expected that:

1. The B&S, RA, and TNPW attitude groups would be associated with relatively high scores on both the SoP and PSSoP scales, compared to the Threat group.
2. The Threat group would be associated with relatively strong SoP and relatively weak PSSoP, compared to the other points of view.

5.18.2 Results

Figure 8: Sense of Place scores by Point of View on Nuclear Power

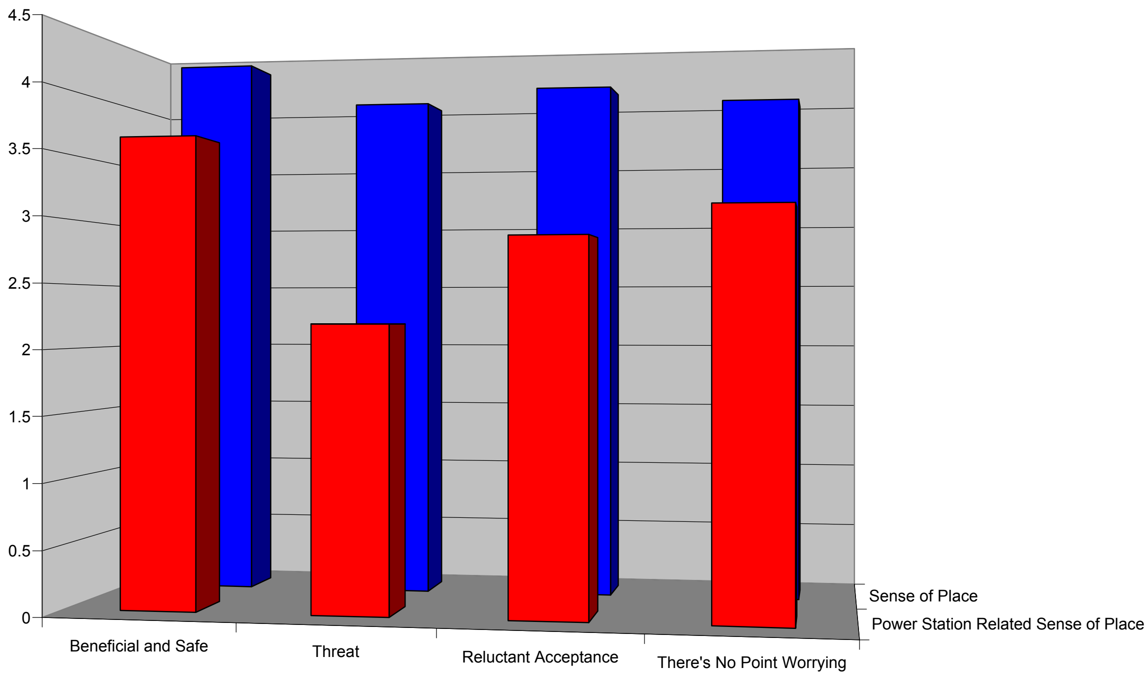
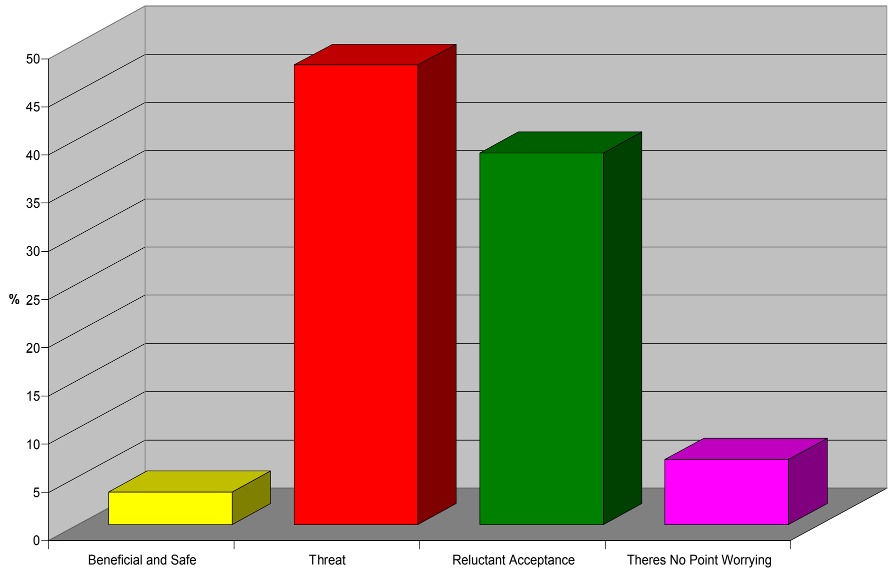


Figure 8 shows the mean scores for SoP and PSSoP for each of the four points of view. The graph shows that SoP (background) was consistently high across the four groups. Analysis of Variance showed a main effect of attitude group on this variable (F=16.57; df=3; p<.001), but post-hoc tests (Tukey HSD) showed that only the differences between the B&S attitude group and the 3 other groups were significant (p<.001 in all cases).

There was more observed variability between groups on the PSSoP construct (Figure 8, foreground; ANOVA main effect: F=222.54; df=3; p<.001). Post hoc analysis (Tukey HSD tests) revealed that there were significant differences (p<.01 or better) between all four groups on this scale. Figure 8 also shows that it is possible for an individual to have high levels of SoP whilst simultaneously having relatively low levels of PSSoP. As expected, the pattern is observed most clearly in relation to the Threat attitude group, and is illustrated further in Figure 9, which shows the proportion of the sample located simultaneously in the upper quartile on the SoP scale and in the lower quartile on the PSSoP scale. Individuals fulfilling this criterion tended to be associated with the Threat and RA points of view (48% of respondents associated with the Threat point of view and 39% of those associated with the RA point of view). In contrast, a significantly smaller proportion of those associated with the B&S (3%) and TNPW points of view (7%) showed similar characteristics (χ^2=83.3; p<.001). This shows that individuals associated with high scores on the SoP scale and low scores on the PSSoP scale tend to be either (a) strongly opposed to nuclear power or (b) only prepared to express a conditional, or 'reluctant' acceptance of nuclear power.

Figure 9: Proportion of the sample simultaneously located in the upper quartile on the SoP scale and the lower quartile on the PSSoP scale, by attitude group



5.18.3 Discussion

This short study verifies the independence of the two SoP scales (as initially suggested in Table 22). Essentially, the SoP concept relates to the strength of the emotional bonds one has to the location, and the PSSoP concept describes the extent to which the nuclear power station is considered to be an authentic aspect of that place. The results show that whilst SoP is fairly high across the four attitude groups, PSSoP is lowest amongst respondents who object strongly to nuclear power (i.e. the Threat point of view), and highest amongst strong supporters (i.e the B&S point of view). These results have a number of practical and theoretical implications. At a general level, the conceptual distinction between SoP and PSSoP shows that considerations of the power station in relation to the local place, community and geography exist independently of SoP. One can feel a strong SoP with regard to the local area (i.e. score high on the SoP scale), whilst simultaneously rejecting the nearby power station as part of that place (i.e. score low on the PSSoP scale). One would expect an individual fitting this description to generally be opposed to nuclear power. Figure 9 confirms this effect, through showing that the individuals in the sample who conformed to this pattern were most likely to be associated with the Threat (and also the RA) point of view. This helps to explain why local people with negative attitudes to the nearby power station may choose to continue living close to the facility, rather than move away. Such individuals may identify with or feel strongly bonded to the local place, yet regard the power station as a foreign object, imposed on the local area, which detracts from an otherwise unspoiled landscape (Simmons & Walker, 2004; MacGill, 1988; Wynne et al., 1993 [2007]). This finding is also consistent with previous literature suggesting that individuals may choose not to move away from a ‘spoiled’ area if their SoP (or appreciation of the community and local social networks) is sufficiently strong (Luginaah et al., 2002; Wynne et al., (1993 [2007]); Mah 2009). Indeed, even under conditions of extreme risk, a strong feeling of SoP has been shown to prevent people from moving away from the area (Billig, 2006). Next, Analysis I investigates the associations between SoP, PSSoP, perceptions of risk and proximity to the power station.

5.19 Study 2 Analysis I: Sense of Place and the Proximity effect

5.19.1 Introduction and Rationale

This study investigates the relationship between the SoP and PSSoP scales (as described in Analysis H) and proximity to the power station. It also examines the data for evidence of a risk-related 'proximity effect', and investigates the role of the SoP and PSSoP scales in relation to this phenomenon. To the author's knowledge, this is a novel investigation. However, a similar study (Lima & Marques, 2005) found that place identity, referred to as 'local identity', acted as a statistical *moderator* in the relationship between proximity and local people's perceptions of risk in relation to the siting of a new incinerator. Not only therefore did those living closer to the incinerator tend to perceive a higher the perceived risk, but the relationship was stronger for those with a strong sense of local identity. The main aim of the present analysis was to investigate the same relationships (i.e. between proximity, SoP/PSSoP, and perceived risk), in the communities under study in this thesis, which are situated close to two long standing nuclear power stations. However, in contrast to the study by Lima & Marques, as these are established facilities (as opposed to new developments) a *negative* relationship between perceived risk and proximity was expected, such that *decreased* levels of perceived risk were anticipated in the communities situated closest to the power stations. In addition, it was expected, in accordance with previous literature, that SoP/PSSoP would either mediate or moderate the relationship between proximity and perceived risk.

5.19.2 Aims and Hypotheses

1. The first aim of this study is to investigate how the two scales relate to perceptions of risk associated with the nearby nuclear power station, and proximity to the facility. In accordance with previous literature, it is hypothesised that SoP/PSSoP will significantly increase with proximity to the power station.
2. The second aim of the study is to examine the data for evidence of a proximity effect. It is hypothesised that a negative relationship between levels of perceived risk and proximity to the power station will be found.
3. Third, it is hypothesised that the two scales will act to either statistically mediate or moderate the proximity effect.

5.19.3 Results

5.19.3a Associations between SoP/PSSoP, attitudes to nuclear power, and perceived risks and benefits

Correlations were conducted between the two place-related scales and: perceptions of risks and benefits relating to the nearby power station; acceptability (i.e. an assessment of whether the perceived benefits of the local station outweighed the risks); attitude to the local station; and attitudes towards new nuclear build at the existing local site. These results are shown in Table 47. As expected, both scales correlated positively with acceptability, attitude to the power station, attitude to local new build and perceived benefits of the nearby power station. In addition, both scales correlated negatively with perceived risks relating to the nearby facility. The correlations between PSSoP and all variables were considerably stronger than those observed in relation to the SoP construct, which were fairly weak. However, all correlations were significant to the *p*<.001 level or better.

Table 47: Zero-order correlations between place identity and attachment and length of residence, attitude to the power station, and assessments of risks and benefits from the nearby power station (n=1327)*

Construct	Perceived risks	Perceived benefits	Attitude to local station	Acceptability (benefits outweigh risks)
SoP	-.19	.24	.25	.19
PSSoP	-.54	.49	.74	.62

** all correlations significant at p<.001*

5.19.3b Relationship with proximity

Proximity was operationalised as described in Section 5.5.4. As in Analysis F, mean scores on each scale were contrasted at the point of overlap on the proximity scale in order to ensure than any observed effects were not simply due to the characteristics of the different study areas (Table 48).

Table 48: Mean levels of SoP and Perceived Risk at the point of overlap (Proximity point 2; see Table 23)

Construct	Oldbury Sample (mean)	Hinkley Point Sample (mean)	*t*	*p*
SoP	12.55	12.56	-.03	ns
PSSoP	17.61	18.87	2.91	***p*<.01**
Perceived Risks	3.10	3.06	.42	ns

Table 48 shows that at an equidistant point from the power station, levels of SoP and perceived risk were similar at Oldbury and Hinkley Point. This is reassuring, as it suggests that any observed relationships between these concepts and proximity can be more confidently attributed to proximity to the power station, rather than to differences between samples. Mean levels of PSSoP did, however, differ significantly between study locations.

The relationship between proximity to the power station and SoP and PSSoP was then investigated through examining the correlations between mean scores on the individual items comprising each scale with proximity. Partial correlations were conducted, in order that in addition to Affiliation, the effects of various potential covariates identified from the literature as relevant to SoP could be taken into account (length of residence in local area; age; and the population size of the settlement). Analysis showed that there was a small but significant correlation between SoP and proximity (R=.26; p<.001). Population size was also significantly associated with proximity (R=-.62; p<.001), such that the mean population size at each settlement was observed to decrease as proximity to the power station increased[59]. The inclusion of population size as a controlling variable caused the correlation coefficient between SoP and proximity to fall from .26 to .16 (Table 49). This suggests that a trend for villages to decrease in size partially explains why SoP increases with proximity to the power station, although the latter relationship remained significant even when settlement size was controlled for. There was, however, no significant relationship between proximity and PSSoP. On this scale, only one of the individual items showed a significant proximity effect ('The power station has featured strongly in our area'). The relationship between proximity and PSSoP was therefore not investigated further.

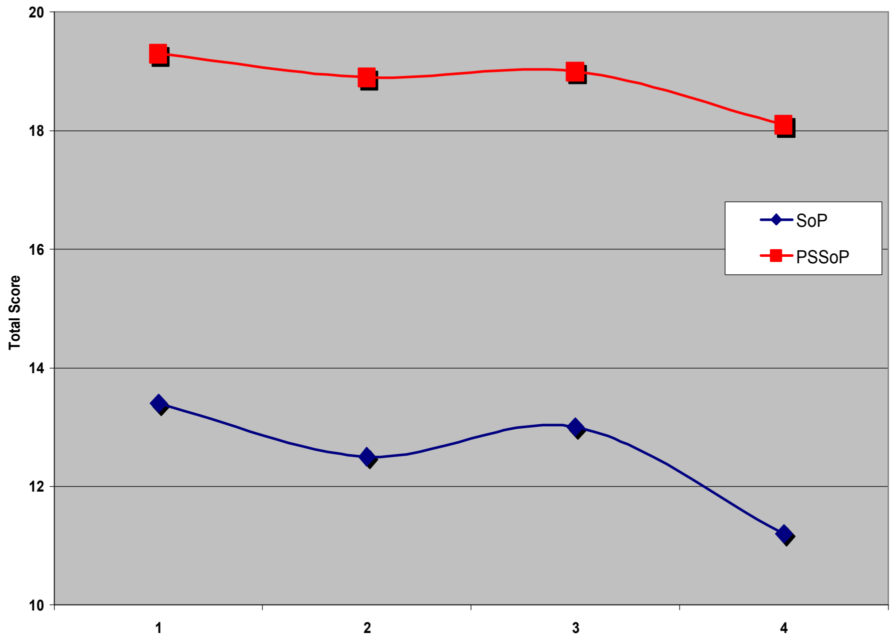
[59] Settlements situated further from the power stations tended to be larger (i.e. Thornbury and Bridgwater). When considering the datasets in aggregate this is less of a problem, as, for example, the substantial town of Thornbury (population 12,500) is only 3.5 miles from the power station at Oldbury, whilst the small villages of Nether Stowey, Cannington, and Spaxton & Four Forks all represent sampling points that are considerably smaller than Thornbury, but are further away from the power station.

Table 49: Partial correlations* between Proximity and the two SOP scales

Variable	*R*	*p*
Sense of Place		
I feel like I belong…	.11	<.001
For me, this is the ideal place to live	.14	<.001
I strongly value the place where I live	.16	<.001
Total Sense of Place (SOP) score	**.16**	**<.001**
Power Station Related Sense of Place**		
The power station is part of our community here	.10	ns
If I was to move, I would want to live somewhere like this, except without a nuclear power station nearby***	.01	ns
I am proud to have the nuclear power station in our area	.08	ns
Having the power station here helps me to live my life the way I want to	-.03	ns
For better or for worse, the power station has featured strongly in my life	-.06	ns
The power station has featured strongly in our area	-.10	<.01
Total Power Station related Sense Of Place (PSSOP) score	**.01**	**ns**

**controlling for settlement size, LoR, Age, and Affiliation (personal and friends/family)*
*** Reported p-values are Bonferroni corrected. This procedure controls for chance associations (Type I errors), and is appropriate when significant results on individual scale items are reported in the context of a non-significant result on scale totals (Bland, 2000).*
**** Reverse-scored; see Footnote 41.*

Figure 10: Relationships between SoP, PSSoP, and Proximity to the power station



Nearest to Power Station **Furthest from Power Station**

Figure 10 shows the relationships between the SoP and PSSoP constructs and proximity to the power station. As indicated by the correlation analyses presented in Table 49, the relationship between SoP and proximity is only slight (although statistically it is highly significant) and the relationship between PSSoP and proximity is non-significant. A 1 by 4 ANOVA was conducted to assess where, on the proximity scale, the main differences in SoP occurred. As expected, this analysis showed a main effect of proximity (F=37.48; p<.001). The 'stepped' differences in mean SoP scores are shown in Table 49.

Table 50: Post-hoc comparisons of SoP between proximity points* (Tukey HSD tests)

Comparison across proximity points 1-4	Mean Difference	Sig.
3 and 4	1.76	***p*<.001**
2 and 3	-.46	ns
1 and 2	.84	***p*<.001**

**Point 1 represents settlements that are closest to the power station. Point 4 represents those that are furthest.*

Table 50 shows that SoP scores increased significantly between proximity points 3 and 4, and again between points 1 and 2. There was a slight fall in mean SoP scores between points 2 and 3, but this was not significant (p=.06).

5.19.3c Mediation analysis and the proximity effect

Table 51 shows that the expected negative association between proximity and perceived risks was found (Row 1). The role of SoP was therefore considered as a potential mediator of the relationship[60, 61]. As proximity was significantly associated with SoP (Table 51, Row 2), and with perceived risk (Row 3), and

[60] As there was no significant relationship between proximity and PSSoP (Table 55), the PSSoP construct could not be considered as a potential mediator (Baron & Kenny 1986)

[61] A moderation analysis was also conducted, according to the procedure described by Aguinis (2004). The effect, however, was non-significant and is not presented.

SoP was also significantly associated with perceived risk (Row 1), the requirements for a mediation analysis were therefore satisfied (Baron & Kenny, 1986). The mediation analysis was conducted to assess the impact of the introduction of SoP on the Beta weight of the relationship between proximity and perceived risk (Row 3; Beta= -.10). It was found that the inclusion of SoP in the regression model rendered this association non-significant (Row 4). A Sobel test[62] showed that this mediation effect, although small in size, was highly significant (*S*=.5.37; *Effect*= .07; *p*<.001). The size of the mediation is calculated by dividing the indirect effect by the total effect (Jose, 2008): in this case it is .07/.10=70%. This suggests that the effect of proximity on perceived risk is largely an indirect effect of SoP, as 70% of the relationship goes through this latter variable.

Table 51: Sense of Place as a mediator of the Proximity – Perceived Risk relationship

Independent variable(s)	Dependent Variable	B	SE	Sig
1. Sense of Place	Perceived Risk	-.11	.02	<.001
2. Proximity	Sense of Place	.57	.07	<.001
3. Proximity	Perceived Risk	-.10	.04	<.05
4. Proximity	Perceived Risk*	-.03	.04	ns

**Controlling for Sense of place through its inclusion in the model*

5.19.4 Discussion

This analysis shows that whilst SoP increases with proximity to the nuclear power station, PSSoP does not. This latter result suggests a broader significance of the power station to less proximate settlements. In general, individuals living up to 8 miles further afield (the limit of the proximity scale) were as likely as those living less than 2 miles away to consider the power

[62] Conducted online at http://www.danielsoper.com/statcalc/calc31.aspx

station to be part of the community, to be proud to have the power station in the area, and to consider the power station to be a salient and facilitating aspect of the local environment (or not). Communities in more distant areas therefore generally appeared to consider that the power station had a similar level of impact on their lives and on the local area as those who lived in very close proximity to it.

In a previous study, Lima & Marques (2005) found that in relation to a new incinerator development, SoP moderated a positive relationship between proximity and perceived risk, such that the closer an individual lived to the new development, the greater the perceived risk, and the effect was stronger for those with high levels of SoP. The results of the present study provide an interesting contrast: in relation to an *established* nuclear facility, individuals living very close to the power station associate *lower* levels of risk with the power station than those living further away. This relationship is statistically *mediated* (but not moderated; see Footnote 56) by SoP, such that the lower levels of perceived risk associated with proximity to the power station are largely accounted for via the indirect influence of stronger SoP. To the author's knowledge, this result has only been reported in qualitative literature to date.

Similar to the 'neighbourhood halo effect' described by Bickerstaff & Walker (2001), the results of the present study are therefore consistent with previous literature suggesting that individuals with a strong SoP may avoid attributing negative aspects of the community to a nearby facility (e.g. Mah, 2009). In addition, a strong SoP may lead people to accept pollution as a part of their community; reinterpret 'spoiled' identities as being positive and distinct (Bush et al., (2001); and develop a tangible sense of community and pride (Burningham & Thrush, 2004). This effect may be connected to perceived stigmatisation - Baxter & Lee (2004) argue that 'the effect of stigmatisation is to reinforce the resident's sense of outward pride and positive community identity' (p.721). Therefore, in circumstances where a potentially hazardous or stigmatised industry challenges place and personal identities, marks a neighbourhood as 'spoiled', or transgresses the values associated with 'home' (Simmons & Walker, 2004), it appears that local peoples' SoP may intensify as a cognitive response to the perceived threat. Such connections may form with respect to physical aspects of the environment, or may take the form of close, mutually reinforcing community bonds (Burningham & Thrush, 2004).

One way of interpreting this phenomenon is as a form of coping strategy (Lazarus & Folkman, 1984), developed to foster and sustain low concern (see e.g. Luginaah et al., 2002; Baxter & Lee, 2004; Billig, 2006). Considerations that the area is unspoiled, or that risks are low, may also be bolstered by factors such as maintaining a belief that outsiders overemphasize hazards and underemphasize benefits (Baxter & Lee, 2004; Simmons & Walker, 2004). The relatively high levels of SoP observed in this study in communities close to the power station can also be related to social-psychological research on group cohesiveness and identity (e.g. Brewer & Brown, 1998; Levine & Moreland, 1998; Wright et al., 1990). Here, individuals are seen as reacting to threats to their identity as members of a group by increasing their cohesiveness and identity with that group, especially if membership of that group is seen as inescapable (e.g. Taylor et al., 1987; Wright et al., 1990). Similarly, and consistent with the results of previous analyses described in this thesis, the results suggest that social networks may play an important role in determining perceptions of risk, possibly through acting to mutually reassure local residents that a facility is safe (Freudenberg & Davidson, 2007; Parkhill et al., 2010; Edelstein, 1988; Taylor et al., 1991; Burningham & Thrush, 2004).

The mechanism through which SoP might act to reduce perceptions of risk is unclear, however. One possibility is that it provides a psychological or social framework through which potential risks can be reconstructed as being less threatening (Pred, 1983; Simmons & Walker, 2004). A further possibility is that SoP interacts with social capital. Social capital refers to aspects of social organisation, for example, social networks, trust, and norms that operate together in way that is mutually beneficial for a community (Putnam, 1995; Wakefield et al., 2001). This may take the form of local clubs and leagues, which help produce self-reinforcing networks and shared behavioural norms, which in turn, facilitate collective action for mutual benefit (Putnam, 1993; Levi, 1996). This may help to explain why SoP was observed in the present study to be fairly high across all four attitude groups, and why previous research has noted that place attachment, for local people, is sometimes high in areas considered undesirable by outsiders (Greenberg & Schneider, 1996). In the communities studied in this project, such links were often apparent in positive references made by participants to the researcher during fieldwork, to social entities such as the local church, and the organisation of regular social events such as the ‘Oldbury Fun Run’. Social capital is thought to overlap with sense of place (Wakefield et al., 2001), as the development of social networks is thought to be a significant part of the formation of place attachment (Qiaoming et al., 1998). However, social capital is generally associated with formal, or organised networks, rather than informal relationships, and does not take physical aspects of place into account (McHugh & Mings, 1996). The two can therefore be considered as separate, but related concepts, although they are likely to be mutually reinforcing, and both may contribute to community health and well being. Nash (2008) suggests that the potentially beneficial effects of SoP may only be realised in the context of sufficient social capital. Therefore, although social capital was not specifically measured in the present study, it is possible that the relationship between SoP, perceived risks, and proximity to the power station may have resulted from the combined effect of these two related concepts[63].

5.19.5 Limitations and future research

This study is subject to a number of limitations. First, the proximity effect itself (i.e. the relationship between proximity and perceived risk), together with the statistical association observed in this analysis between proximity and SoP, is weak (although highly significant due to the power of the analysis). The size of the effect suggests that the relationships between proximity, SoP, and perceived risk are subtle. However, there may be segments of the population with stronger associations, which appear relatively weak when averaged out over the whole sample. In addition, proximity itself can be considered in psychological or physical terms. In essence, this refers to how close

[63] The effects of close community bonds and social networks should not automatically be assumed to be positive. Some previous research suggests that such networks may operate to 'silence' of dissenting voices that might otherwise express concern. Thus, it may be that some local people avoid expressing negative opinions which would contradict the prevalent views of the community (Baxter & Lee, 2004), thus creating the illusion that lower levels of risk are perceived.

individuals feel that they live, as opposed to how close they actually live to a source of potential risk. For example, Maderthaner et al., (1978) note that actual distance from a nuclear reactor (situated near to Vienna, USA), was associated with increased levels of risk perception. However, Howe (1988) finds that *perceived* distance from a toxic waste disposal site in the US explained 22 times more variance in concern than actual distance (which was not significant). Moreover, recent literature suggests that the critical factor in proximity may be how often one is reminded of the existence of the nearby hazard, regardless of proximity or perceived proximity *per se*. Rather, perceived risks may depend on the extent to which the hazard is psychologically ‘present’ or ‘absent’, and how this varies between individuals or groups of local people (Bickerstaff & Simmons, 2009; Parkhill et al., 2010).

The small effect sizes in this study may also reflect ineffectual measures of SoP. Indeed, the lack of consensus over how SoP should be conceptualised inevitably leads to disagreement over how it should be investigated (Dixon & Durrheim, 2004), and whilst some researchers have either argued that SoP is amenable to quantification and psychometric measurement, or successfully conducted quantitative studies of the concept (e.g. Lalli, 1992; Pretty et al., 2003; Stedman, 2002; Knez, 2005; Bonaiuto et al., 2002; Billig, 2006), other prominent theorists such as Tuan (1991) argue that SoP may not be quantifiable or suited to positivist approaches. The appropriate and effective use of ratings scales to quantify SoP is therefore an area requiring further investigation. In addition, the study did not specifically attempt to measure home attachment, a correlate of place attachment found to be important by some studies in explaining why some people choose to remain living in high-risk environments (e.g. Billig, 2006). Nor was social capital measured, which, as discussed previously, may play an important role in local perceptions of risk, and may interact with SoP. Also, although mediation analyses imply causality (Baron & Kenny, 1986), the direction of the relationships between SoP, perceived risk and proximity cannot be stated with certainty. It is possible, for example, that proximity to the power station leads to greater familiarity, which in turn leads to decreased levels of perceived risk, which ultimately facilitate a stronger SoP. Such dilemmas are, however, inherent in any analysis of this nature, and further research involving longitudinal studies designed to monitor communities over time would be required to investigate the implication that SoP may actually increase in very proximate communities as a psychological reaction to the imposition of a hazardous or stigmatised facility (see Lima, 2004; Lima & Marques, 2005).

5.20 Study 2 Analysis J: New nuclear build in the local area: Levels of Support and Predictors of Attitudes

5.20.1 Introduction and Rationale

This final study aims to investigate levels of support for the building of new nuclear power stations in existing 'host' communities, and also the factors that are important in predicting local people's attitudes towards new build at the existing local site. The issue of new build is of high contemporary political relevance in the UK and elsewhere, and since the present project began, all three sites studied in this thesis were nominated as likely to be required to host a new nuclear power station (BBC News, 23rd January 2009; http://www.world-nuclear.org/info/inf84.html). As described in Chapter 1, there is an apparent assumption that existing nuclear communities will be either more supportive or less resistant (or both) towards new nuclear build, yet there appears to be little in the way of objective research on this issue. What is clear, however, is that public support will be important if plans for new nuclear build are to go ahead without significant disruption. The literature notes that public objections to new developments can impact negatively on both the affected communities and the proposed developments. It can adversely affect the cost and timescale of the siting process, and the social conflict and uncertainty generated in relation to it can have significant effects on the psychosocial health of affected communities (e.g. Elliott et al., 1997). It is therefore important that the factors underlying public support and objection and support in relation to new energy developments are identified and understood.

The present analysis is designed to investigate both these issues. First, levels of support and objection to possible new build are contrasted between the present dataset and the most recently available nationally representative figures. Second, a regression analysis is conducted with the aim of identifying the factors that are important in predicting attitudes amongst local communities towards new nuclear build in the nearby area.

5.20.2 Hypotheses

1. It is hypothesised that levels of support for new build amongst communities situated close to an established nuclear power station will be greater than those reported in the most recently available national figures from independent researchers (Poortinga et al., 2006; Spence et al., 2010).
2. It is also anticipated that a range of factors, including trust, perceived risks and benefits, acceptability, gender, affiliation, SoP, and PSSoP, and concern about radioactive waste are likely to be associated with attitudes towards local new nuclear build. There are no specific expectations in relation to the relative strengths of each of these potential associations, however.

5.20.3 Method

Two quantitative analyses were conducted. First, frequency data from the current survey were compared to the most recently available figures (nationally representative and site-specific) using the same or similar measures (Tables 52 & 53). Next, a regression analysis was conducted with attitude towards the building of a new nuclear power station at the existing nuclear site as the dependent variable (Table 54). The predictors, which were entered stepwise into the model were: PSSoP, SoP, perceived risks, perceived benefits, acceptability; affiliation, concern (about nuclear power, and about radioactive waste); trust (in government, nuclear industry, and local plant operators[64]); gender & age.

In addition, a qualitative analysis was undertaken. This involved searching the existing NVIVO database (developed and coded by Dr. Karen Parkhill as part of the first phase of the LWSTR/SCARR project; see Footnote 9). A number of sub-codes, specifically relating to (a) the concept of place and (b) to references to the aesthetics of the power station were examined. These were: 'aesthetically negative'; 'aesthetically positive'; 'benign presence'; and 'malignant presence'. The results of these searches were subsequently augmented with additional, targeted text searches using key words identified in the quotes identified from the initial thematic searches. Quotations were then selected for inclusion in the present analysis (Box 8) with the aim of exemplifying a range of attitudes towards the nuclear power station, with particular regard to the visual salience and symbolic representation of the power station amongst research participants.

5.20.4 Results

Table 52 shows that in the present survey, approximately 58% of respondents supported the building of new nuclear power stations in the UK. This can be compared to 44% in the most recent nationally representative UK survey (by independent researchers) using exactly the same question (Poortinga et al.,

[64] The separate variables measuring trust in the government, nuclear industry and local plant operators raised collinearity problems when attitude to new nuclear build was used as the dependent variable in the regression equation. For this analysis, these three variables were therefore summed to produce a single 'trust' construct.

2006) and 42% in a more contemporary independent survey using a similar measure (Spence et al., 2010)[65]. These results suggest that in existing host communities, attitudes towards a national new build programme are more positive than in the UK in general[66]. Table 53 shows that in relation to new build at the existing local site, support in the host communities sampled stood at 55% (support or strongly support), with 25% opposed or strongly opposed. This can be compared to a telephone poll (*n*=1002) conducted subsequent to this thesis (EDF, 2010). On a similar measure, that survey found 63% support for the building of a new nuclear power station at the existing site at Hinkley Point, with just 18% opposed.

Table 52: Support and Opposition towards the building of new nuclear power stations 'in the UK' (%)

	Strongly Oppose	Tend to Oppose	Neither Support nor Oppose	Tend to Support	Strongly Support
2005 National GB (Poortinga et al.)	22	20	21	23	11
2008 Oldbury/Hinkley Point (present study)	9	12	21	34	24

Question: *Please indicate the extent to which you would support or oppose the following: The building of new nuclear power stations in the UK*

Table 54 shows the results of a regression analysis examining predictors of support for new build at the existing local site. The final model explained a large proportion (70%) of the variance. The strongest predictor of attitude to new nuclear build locally was PSSoP, whilst SoP did not contribute significantly to the model and was excluded, along with perceived risks and

[65] The question was: "If you were to vote today, how do you think you would be likely to vote in relation to the following: Whether to build new nuclear power stations in Britain"
[66] The difference between surveys in terms of time of data collection (Poortinga et al., 2006) and the measure used (Spence et al., 2010), together with the strictly non-representative nature of the local sample in the present study prevent a definitive comparison being made.

benefits, age, and concern about radioactive waste. Significant positive associations were also found with Acceptability (a consideration that the benefits of the existing plant outweighs its risks), and Trust.

Table 53: Support and Opposition towards the building of a new nuclear power station at Oldbury/Hinkley Point

	Strongly Oppose	Tend to Oppose	Neither Support nor Oppose	Tend to Support	Strongly Support
To what extent would you support or oppose the building of a new nuclear power station at Oldbury/'Hinkley Point? (as appropriate to study location; present study)	14	13	18	33	22
	Strongly Opposed	**Slightly Opposed**	**Neither in Favour nor Opposed**	**Slightly in Favour**	**Strongly in Favour**
Overall, thinking about the potential development of Hinkley Point C would you say that you would be? (EDF, 2010)	11	7	18	30	33

Table 54: Factors predicting attitude to new nuclear build at the existing local site – whole sample

Variable	Beta (std)	S.E. of Beta	Sig
PSSoP	.36	.01	<.001
Acceptability	.28	.02	<.001
Concern about nuclear power	-.21	.03	<.001
Trust (in government, nuclear industry and local operators)	.16	.00	<.001
Affiliation (personal)	-.07	.07	<.001
(female) Gender	-.07	.05	<.001

Model: R^2=.70; Adj R^2=.70; *df*=1073; *f*=220.38; *p*<.001.

Box 8: Illustrative quotations from qualitative data

Perspective	Qualitative example
Positive aesthetics and integration with place	*(A)Miss Price:* "I like looking at it, it's like a blue and white castle…I find it quite a nice thing, part of the countryside" Interviewer: "And…how do you feel about the prospect of there being another power station there?" *Miss Price*: "Fine, I would miss the power station if it went so I don't mind a new power station" *B)Mr Burke:* "With the very flat land of the Severn flood basin and the mountains behind it's actually artistically quite nice, the right sort of general place, looks good, if it wasn't there you'd have to put something else there"
Unremarkable and unnoticed aspect of place	*Interviewer:* "…can you see the plant from where you live?" *(C)Mrs Heitman:* "Well I don't think in the end you do see it do you? It's there, it's just part of the [landscape]" Mr Hietman: "you can always see it [the power station], there's no getting away from it" Mrs Heitman: "But you don't notice it do you in the end?" Mr Heitman: "Well you don't 'cause it's been there so much"
Negative aesthetics and disintegration with place	*(D)Ms Ryan:* "I think it's a blight on the countryside…in a lovely part of the world it is very ugly…it is a pretty place to be apart from the power station" *Interviewer:* "How about if they decided to use the power station site to put another nuclear power station there…? *Ms Ryan*: I would be dead against it."
Visual salience cues concern and anxiety	*(E) Mr Bundock:* "[a new power station would be acceptable] as long as it wasn't any closer to me than it [the existing station] is and they're not allowed to build any closer…it wouldn't concern me" *Interviewer:* "…why not any closer?" *Mr Bundock*: "Because it would physically affect me. I could see it. I don't want to see it" *(F) Mr King*: "Well, if they wanna build more power stations I wouldn't be against them building another power station there, cos I can't see it..." *(G) Mr Heseltine*: "…it's a presence, it's an eyesore…in the psyche, deep in the subconscious [are] the thoughts of what it represents, what it is, some of the dangers that potentially surround that kind of power supply…some of the issues around cancer"

Box 8 shows a number of illustrative quotations identified from the qualitative interviews conducted at Oldbury (Pidgeon et al., 2008; Parkhill et al., 2010). These excerpts were identified from the qualitative dataset described in Section 5.20.3, and are included to exemplify how the implications of the quantitative analyses may be manifest in the discourse of individual participants.

5.20.5 Discussion

In the UK, most or all of the next generation of nuclear power stations are likely to be sited adjacent to existing nuclear power stations - that is, the same sites that were used for the first generation of nuclear power stations in the 1950s and '60s (DBERR, 2008; British Energy, 2008; DECC, 2010). This study finds that just over half of local people (55%) at Oldbury and Hinkley Point are prepared to support the building of a new nuclear power station in the nearby area, which can be compared to 44% of a nationally representative sample stating, in 2005, that they would accept the building of new nuclear power stations in the UK , and 42% who indicated, in an independent, nationally representative survey, that they would probably or definitely vote in favour of building new nuclear power stations in the UK in 2010 (Table 52). In addition, the present results suggest that around 25% of community members at Oldbury and Hinkley would be opposed to the building of a new nuclear power station in the nearby area (18% in the EDF-sponsored poll conducted subsequently at Hinkley Point [September 2010]). This can be compared to 42% who indicated that they would be opposed to any new build in the UK in 2005, and 46% who stated that they would probably or definitely vote against the building of new nuclear power stations in the UK in 2010 (Tables 52 & 53; Poortinga et al., 2006; Spence et al., 2010). Although a definitive comparison cannot be made, this pattern of results strongly suggests that in general, levels of public support for new build are significantly higher, and objection significantly lower, in the existing 'host' communities at Oldbury and Hinkley Point than elsewhere[67].

[67] Note that Study 2, Analysis C (Figure 3) suggests that *within* these communities, opposition to nuclear power remains constant regardless of proximity to the power station, whilst strong

Table 54 shows, as expected, that attitudes to new build in the local area are associated with a range of considerations and demographic factors. In a study of perceived risks amongst nearby communities in relation to proposed new nuclear waste storage facilities, Sjoberg (2004b) notes that previous research on related topics has rarely achieved more than 25% of explained variance, and argues that when large, representative samples are drawn from populations where the issue is salient, the proportion of variance explained can be expected to be considerably higher. Sjoberg argues that the 65% of variance in perceived risk explained in his 2004 study 'approaches a full explanation' (p.59). In the present study, 70% of the variance in attitudes to new nuclear build was explained.

This analysis again suggests that perceptions of risks and benefits *per se* may be relatively unimportant in determining attitudes towards nuclear power. In comparison to literature suggesting that perceived risks are generally regarded as more important than perceived benefits (Brody & Fleishman, 1993; Desvousage et al., 1993; Dunlap et al., 1993b; Slovic et al., 1993), and may be the most important determinant of attitudes towards new build in the local area (van der Pligt & Eiser, 1986), the present results suggest (consistent with Study 1a) that it is the balance of one over another (i.e. Acceptability) that is most important.

As expected, public trust is seen to be important in relation to attitudes towards new build. Previous literature, mostly related to waste repository siting, has consistently linked low levels of trust with public opposition, increased concern, and greater levels of perceived risk (e.g. Pijawka &

support is observed to increase significantly in the most proximate communities (within 2 miles of the facility).

Muchkatel, 1991/1992; Bord & O'Connor, 1992; Flynn et al., 1992; Freudenberg, 1993; Bassett Jr et al., 1996).

The influence of gender is also observed to be significant in relation to attitudes towards new build in the local area. Support is associated with (male) gender (and therefore opposition with female gender). This is consistent with a long history of research reporting a 'gender gap' in risk research which has been observed across a wide range of hazard domains, and is detectable from an early age (e.g. Davidson & Freudenberg, 1996). Recent studies continue to report that women perceive technologies associated with energy production as more risky than men (e.g. Chauvin et al, 2007). In addition, Kahan et al., (2007) finds that nanotechnologies are considered more risky by women; Wester-Herber & Warg (2002) report that women's estimations of the effects of a hypothetical industrial accident in their community are greater than men's; and Greenberg (2009) finds that support for nuclear power is associated with older and relatively well educated males. The reasons for the gender effect are still unexplained, and competing evolutionary and social theories are forwarded in the literature. The meta-analysis by Byrnes et al., (1999), however, shows that the effect size of the gender gap is decreasing over time, which strongly suggests that it is at least partly explicable by gender role socialisation (see Venables & Pidgeon, 2007 for a review and discussion of the gender effect in risk research).

A further interesting finding is that affiliation with the power station or nuclear industry is observed to be associated with a marginally decreased level of support for new build in the local area. This result is curious, as previous research suggests that familiarity with technology, and experience of technical occupations, appears to be associated with decreased risk perceptions regarding nuclear power (e.g. Deaux, 1976; Greenberg, 2009). It was noted during fieldwork, however, that some older individuals, who had previously worked at nuclear power stations, reported having experienced unsafe working practices which caused them, subsequently, to perceive nuclear power stations as risky. During data collection for Study 1, for example, a retired male who had formerly worked at the (now decommissioned) nuclear power station at Berkeley, related detailed anecdotes to the researcher. These pertained, for example, to careless treatment of radioactive materials at the site, unofficial radioactive discharges, and 'bodged' repairs to the reactor conducted during the 1950s and '60s. It is possible, therefore, that some former (and possibly some current) employees attribute high, rather than low levels of risk to the nearby power stations. Another possibility is that affiliated individuals hold a greater level of awareness that radioactive waste will be stored on-site at new nuclear power stations. It is notable, in the present analysis, that concern about radioactive waste is not significantly associated with attitudes towards new build (Table 54). This result is somewhat curious, as previous literature suggests that waste storage has historically been an extremely contentious issue amongst the public, being associated with negative impacts on local economies and house prices, as well as significant negative social impacts (van der Pligt & de Boer, 1991; Gregory et al., 2001; Hastings and Dean, 2000; Burningham & Thrush, 2004; Easterling, 2001; Slovic et al., 2001; Jenkins-Smith, 2001; Bickerstaff, 2004). The absence of concern about radioactive waste in relation to potential new build in the local area in the present analysis therefore suggests that it may not yet be widely understood amongst the public that high-level radioactive material will be stored on site at any newly built facilities in the UK.

This result also suggests that perceived risks are not the only determinants of attitudes to nearby new nuclear build. For example, affiliated individuals may simply have a greater understanding of the potential disruption that the construction of a new nuclear power station might cause in the local area. This suggests that wider factors such as the value of peace and quiet, or the aesthetics of the local landscape are also important in determining attitudes towards new nuclear build (*see e.g.* Baxter & Eyles, 1999; Luginaah et al., 2002 Ansolabehere & Konisky, 2009). Indeed, the poll conducted by EDF at Hinkley Point (2010) reports that (a) damage to the local environment and (b) safety concerns (threat of nuclear waste leak/explosion at power plant) are the primary concerns of both supporters *and* objectors to the proposed Hinkley C development. These results are consistent with the most salient result of the present analysis, which is that the strongest predictor of support for new build is PSSoP, whilst in contrast, SoP is excluded from the regression model. This suggests that whilst attachment to, or identification with place can be demonstrated to explain much of the observed decrease in perceived risk associated with proximity to the power station (Study I), it is PSSoP that appears to be most important in determining attitudes towards new build.

PSSoP, in this thesis, was conceived as an exploratory concept intended to measure the extent to which the existing power station is perceived to contribute to place identity. Table 22 therefore shows that items referring to perceptions of the self in the context of place identity and attachement (i.e. 'I';

items a-c) are independent of those referring to perceptions of the power station in the same context (i.e. items a-c factor separately to items d-i). This is consistent with previous research suggesting that new industrial developments, especially those associated with stigmatisation, might have significant impacts on the lives of affected individuals through their effects on perceptions of place (e.g. Wester-Herber, 2004). First, the presence of such industry may have negative impacts on place-related self esteem. Second, episodes of contamination, whether real or perceived, would likely have major impacts on those who work the land for a living or pastime. This may therefore impact on self-efficacy. Third, the presence of a stigmatised industry may enforce distinctiveness, but for negative, rather than positive reasons. Fourth, although an individual may have the option of relocating, to do so might break a place-referent or place-congruent continuity, especially if one had lived in the area for a long period of time, or if one's forebears had also lived in the locality. One might expect, therefore, that the introduction of a new, potentially hazardous or stigmatised facility to an area would be generally be opposed by people who were strongly attached to that place.

However, a different set of considerations are raised in respect of potential new build in communities (such as those studied in this thesis), which already host a stigmatised or potentially hazardous facility, and may have done so for some 40 years. For some individuals, therefore, the power station might be perceived to make the area distinctive in a positive way. Some individuals may feel proud to have the power station nearby, perhaps due to the contribution it makes to the country's electricity supply and to the local economy (self-esteem). Further, it may offer a sense of place-related continuity to those who have long-standing connections to the area or to other nuclear facilities, and for some, it may be perceived to provide economic and/or social opportunities (self-efficacy).

This finding, which to the author's knowledge is novel, can be illustrated with reference to a selection of quotations from the interviews conducted at Oldbury by Parkhill et al (2010; also Pidgeon et al., 2008) immediately prior to the questionnaire study (Box 8). Excerpt (A) shows an example of an interviewee who had grown up with the power station and regarded it as a benevolent feature of the local place which had always been part of her life. In excerpt (B), Mr Burke appears to be articulating an opinion that the power station makes the local landscape aesthetically complete. For these individuals, therefore, the power station can be regarded as integrated into the local place and contributing positively to it, rather than imposing a stigmatised place identity on nearby communities.

For others, the power station appeared to have faded into the background and become a familiar and ordinary aspect of the surroundings; an unremarkable and non-threatening aspect of everyday life (Excerpt C). Consistent with previous studies reporting that visual and other olfactory pollutants appear to lose salience over long periods of time (e.g. Wakefield et al., 2001; Burningham & Thrush 2004; Bush et al., 2001), these individuals appear to accept the presence of the power station as part of the local landscape. For such individuals, therefore, the power station may not be seen as contributing positively to the local place, but it nevertheless does not appear to detract from it either. This may reflect a form of habituation (Thompson & Spencer, 1966), whereby the visual stimulus of the power station has gradually lost salience over time. For these two segments of the local population, the prospect of a new power station being built at the existing local site may represent a potentially unremarkable and unthreatening addition to the landscape, as suggested in excerpt (A). This was clearly not the case for all local people though. Excerpt (D) shows how for some, the power station has not faded into the background as an unnoticed aspect of the local landscape. For these individuals, the visual presence of the power station contrasts sharply with an otherwise rural and largely unspoiled environment.

These qualitative data therefore suggest that the PSSoP concept is at least partially reflected in the visual salience of the power station to local people. Some authors (e.g. Wakefield et al., 2001) note that the ability to see, smell, touch and taste pollution is of particular significance in determining experiences of it and, by ‘marking’ a place, in generating perceptions of it as ‘spoiled’. As nuclear power is distinct from some other industries in that it does not release observable pollutants, it may be that visual and other forms of reminder take on particular significance in the absence of other cues. Zonabend (1993) notes, for example, that some local residents in the communities situated close to the nuclear facilities at Cap la Hague, France, actively tried not to see the nearby nuclear power station: “You can’t see the plant from my place… So we’re all right” (p.29). Interestingly, this is also seen with regard to the possibility of new build at Oldbury (excerpts E & F). Thus, for some, the power station may act as a visual reminder of potential risks. These are described by Parkhill et al, (2010; also Pidgeon et al., 2008) as ‘extraordinary moments’, cued by incidents such as the observation of off-site radiation sampling and monitoring, or witnessing an anti-terrorism drill involving armed police. The authors describe such events as appearing to cause moments of genuine anxiety in those living nearby.

In addition to visual salience, the PSSoP concept may also be partially reflected in what the power *represents* to local people, as explicitly stated in excerpt G. This finding can be related to Social Representations Theory (SRT) (Moscovici, 2000), which argues that representations are formed through the processes of *anchoring* (where new ideas are connected to established knowledge) and *objectification* (the process by which abstract ideas are made concrete); both being motivated by the desire to make unfamiliar concepts familiar (Devine-Wright & Howes, *in press*). SRT takes the view that knowledge is socially constructed, and is formed through interactions both between individuals, and between individuals and institutions. The theory has not, to the author's knowledge, yet been widely applied to place-related literature. However, Devine-Wright & Howes suggest that changes to place, in the context of SRT, can be seen as involving a combination of social and psychological processes in which community attitudes towards industrial developments are formed on the basis of the arguments forwarded by the institutions involved, and public trust in those institutions. Consistent with this, the present results suggest that both trust (Table 54) and social representations of the power station (Excerpt G) may be important in determining community attitudes to new build in the nearby area.

Further research is clearly required to develop the PSSoP concept and to clarify exactly what it measures. Overall, however, the observed pattern of results suggests that attitudes towards potential new build in the local area may be primarily dependent on people's views of the existing power station within the physical and social geographies of the local place. For some, the power station is an integral and reassuring aspect of the landscape. For others, it is not generally noticed, but it may cue anxiety, possibly because of what it represents or symbolises, when one is reminded of its presence. Finally, for some segments of the community it is visually salient as an ugly eyesore which has been imposed upon the local area. Previous research has noted that anticipated disruption and damage to the landscape is an important determinant of local attitudes towards nearby new build (e.g. Eiser et al., 1988). This study, however, suggests that it may be the juxtaposition of the existing power station with place-related perceptions of the local area that primarily determine local people's attitudes towards the building of a new nuclear power station. For opponents of nuclear power, there may be a contrast between their perceptions of the character of the local area and the power station. For those segments of the community, the power station may represent a visually or symbolically inauthentic feature of the area, or an industrial, 'placeless' aspect of the local area that contrasts with the wider landscape (Relph, 1976; MacGill, 1987; Wynne et al., (1993 [2007]); Simmons & Walker, 2004). For its supporters, however, the power station may symbolise positive factors such as economic prosperity, employment or technological achievement (e.g. Walker et al., 1998). This finding is broadly consistent with a recent study examining community responses to a proposed offshore wind farm development (Devine-Wright & Howes, *in press*). Those authors report that opposition to the proposal was connected to perceptions of a symbolic contradiction between nature and industry in an area regarded by segments of the community as a 'restorative' seascape. The present study suggests that a similar phenomenon may exist in respect of the nuclear power stations at Oldbury and Hinkley Point.

5.20.6 Limitations and Future Research

This study is subject to many of the limitations that apply to Study I. These relate to factors such as the measurement of sense of place and disagreements over how it should be conceptualised. It is also important to reiterate the conclusions of Simmons and Walker (2004), who argue that in general, SoP should not be reified as an explicator of the relationship between communities and risk, as factors such as media reporting and other cultural influences are also likely to play a role in amplifying or attenuating the experience of potential socio-technological threats (*c.f.* Pidgeon et al., 2003). The wide range of influences that are associated with attitudes towards new build locally (Table 54) further reinforces this conclusion in showing that a complex range of factors, many of which may be correlated and/or mutually reinforcing are at play.

Chapter 6: General Discussion

Numerous studies exist of situations where communities have mobilised against a local source of perceived technological risk. However, far less attention has been afforded to the numerous sites that could perhaps be regarded as more ‘typical’. These are locations where, in contrast to sites such as Sellafield, UK, or Yucca Mountain in the US, communities have lived in proximity to an established hazardous industrial site for many years without significant controversy or protest (Simmons 2004)[68]. In addition to helping to fill this gap in the literature, the present project also represents the first major study on public views of nuclear power in the UK for around 15 years, and, at the time of writing, provides the only contemporary in-depth insight into how local people currently ‘live with nuclear power’ in the UK[69].

The thesis aimed to investigate the relationships between three communities and the nuclear power stations situated close to them. The sites studied were Bradwell-on-Sea, Oldbury-on-Severn and Hinkley Point. The specific aims of the thesis were detailed in Chapter 2. In summary, these were: (a) to use a contextually sensitive research methodology to identify and describe a range of local community opinions on nuclear power, going beyond simplistic ‘pro-‘ and ‘anti-nuclear’ categorisations; (b) to investigate whether these points of view were consistent across two communities hosting different nuclear power stations; (c) to investigate the distributions and characteristics of the points of view, and the differences between them, in a larger and more representative

[68] The demonstrations at Hinkley Point in the mid to late 1980s were directed at a proposed new reactor, (plans for which were eventually abandoned) rather than at the existing facility.
[69] Consequently, its results (in the form of the broader LWSTR project) have been widely reported in the media (see Appendix 4).

community sample; (d) to examine the nature of trust relationships, including perceptions of Salient Value Simiarity, between communities and the nearby nuclear power station; (e) to investigate the associations between risk perceptions, trust, sense of place, and residential proximity to the nearby nuclear power station; and (f) to investigate the factors associated with support for the building of a new nuclear power station in the local area. These aims were addressed through a mixed-methods research design. Points of view on living with nuclear power were identified and described via a Q-Method study (n=84), the design of which was based on pre-existing set of qualitative interviews. Aims of the thesis c-f were subsequently addressed through a large-scale household survey (n=1327).

6.1 Summary of results

Study 1 of this thesis investigated the main points of view on living with nuclear power at communities situated close to the reactors at Bradwell-on-Sea and at Oldbury-on-Severn. Four shared community perspectives were identified: *Beneficial and Safe*, a point of view in which the local and national benefits of nuclear power were emphasised, and in which trust was placed in the local plant operators to assure public safety; *Threat and Distrust*, a perspective in which respondents regarded nuclear power to be unacceptably risky, and in which there was a distinct lack of trust, particularly in relation to the nuclear industry; *Reluctant Acceptance*, a belief that one has little choice but to accept nuclear power in the face of concerns about national energy security and climate change; and *There's No Point Worrying*, a point of view in which respondents were not motivated to consider the potential risks or benefits of living close to a nuclear power station, and were barely aware of the presence of the nearby facility. These points of view were found to be fairly consistent across study locations, although some specific local concerns were voiced at different sites. One perspective, Reluctant Acceptance, was subjected to further analysis, which emphasised the apparent ambivalence and potential fragilility of the point of view. Collectively, the four perspectives drew particular attention to the importance of community trust relationships with the nearby power station and nuclear industry, and to perceptions of risk and place in relation to community attitudes towards a nearby nuclear power station.

The points of view, and the themes identified as central to them, were investigated further via a quantitative survey (Study 2). Analysis A suggested that the Reluctance Acceptance point of view was the most commonly held perspective on nuclear power amongst the communities studied. Analysis B showed that the four points of view could most effectively be differentiated on the basis of expressed trust, perceptions of risks and benefits, and Power-Station related Sense of Place, a concept developed to assess the extent to which the power station was perceived to contribute to place identity. Analysis C found that strong support for nuclear power rose significantly in the communities situated closest to the power station, whilst conditional support (representation of the Reluctant Acceptance group) decreased significantly in the those communities.

Analyses D-G investigated the dimensionality of trust between communities and the nearby nuclear power station. It was found that trust was formed of separate Affective and Cognitive components. The main trust-based differences between positions of strong support for and opposition to nuclear power were all Affective in nature, and the strength of the Affective dimensions of trust were also observed to increase in strength with proximity to the power station. However, the proposed Affective-Cogntitive model was not successfully validated against the data through confirmatory factor analysis, and it was also found that perceptions of Salient Value Similarity with the nuclear industry and local plant operators explained almost as much of the variance in attitudes towards the nearby nuclear power station as all of the other dimensions of trust combined.

Analyses H-J concentrated on investigating the importance of community perceptions of place. Two scales were developed from previous literature: the first, Sense of Place, assessed attachment to and identification with the local place. The second, labelled Power Station-Related Sense of Place, assessed the extent to which the nuclear power station was perceived to contribute to place identity. Analysis H found that the former concept, Sense of Place, was consistently strong across the four points of view, whilst there was far more variation in Power Station-Related Sense of Place. Analysis I explored the relationships between proximity to the power station, perceptions of risk, and the two place-related scales. It was found that proximity to the power station was associated with lower perceptions of risk, and, that this relationship was significantly mediated by Sense of Place (but not Power Station-Related Sense of Place). Finally, Analysis J investigated the factors associated with support for the building of a new nuclear power station in the local area. The results showed that although trust and perceptions of risks and benefits were significant predictors of attitudes in this context, the most powerful explanatory concept was Power Station-Related Sense of Place.

6.2 Contributions to the literature

6.2a Implications of the points of view on nuclear power

To the author's knowledge, this is the first time that Q-Method has been used to investigate how communities perceive a nearby nuclear power station[70]. In interpretating the points of view on living with nuclear power, this thesis draws on the tradition of contextual risk perception research, an approach which seeks to capture the complexity of understandings as they are shaped in specific hazard locations, and by a range of local influences and factors (see e.g. Fitchen et al., 1987; Baxter & Eyles, 1999; Irwin et al., 1999; Williams et al., 1999). The approach contends that geographical and social context is as important as the hazard itself in shaping local attitudes towards an issue, and in amplifying or attenuating perceptions of risk. The nuanced descriptions of local responses to nuclear power presented in this thesis therefore avoid simplistic bipolar dichotomies such as 'for' or 'against', and suggest that local publics and their understandings of nuclear power should not be viewed in such simplistic terms. Accordingly, it was observed that the factors representing strong support for and opposition to nuclear power (as presented in Study 1; Analysis 1) were not mirrored opposites (see also Eiser et al., 1995), and at least two other nuanced points of view were found: one, albeit ambivalent and potentially fragile, reflecting sympathy and agreement with a

[70] The only similar study identified by the author (Hill, 1992) was concerned with evaluating the processes by which local communities evaluated and made policy choices, not nuclear power itself.

strengthening policy discourse on nuclear power and the environment, and the other suggesting that hazardous facilities can be discursively positioned as unremarkable aspects of a place and of people's daily lives. It is concluded, therefore, that the 'landscape of beliefs' about nuclear power in such communities is subtle and complex. However, through identifying and describing these points of view, this thesis assists in the process of articulating and communicating the full spectrum of local community views, beliefs and concerns about living with nuclear power.

6.2b Implications for theories of trust

Through the use of a comprehensive and systematically designed set of items, this thesis provides clarification in relation to the dimensional approach to the study of trust. With regard to relatively familiar institutions (the nuclear industry and the local plant operators), its results are consistent with previous research suggesting that trust is comprised of two separate constructs (the Affective and Cognitive dimensions; Metlay, 1999). It also clarifies how trust appears to be structured in relation to less familiar institutions, through suggesting that the General Trust/Scepticism model proposed by Poortinga & Pidegon (2003) may constitute a partial representation of two general evaluative components, broadly representing Trust and Distrust. The results of those two influential (but conflicting) studies are largely reconciled through the results of this thesis, which suggests that increased familiarity with a trust target may lead to increased levels of discrimination between trust dimensions.

The observation that positions of strong support for and opposition towards the nearby facility could be differentiated most strongly on the basis of the Affective dimensions of trust points to the importance of emotion in relation to community trust relationships with the nuclear industry and power station staff. Consistent with Parkhill et al., (2010), Pidgeon et al., (2008) and Venables et al., (2009), the results implied that positive emotional responses to the nearby nuclear power station may, in part, be borne of: familiarity with it; the presence of mutually reinforcing social networks in the most proximate communities; and perceptions that the power station staff and broader nuclear industry share salient values with members of nearby communities. Interestingly, such perceptions (of Salient Value Similarity) were observed to explain almost as much of the variance in attitudes towards nuclear power as all of the other dimensions of trust combined. Furthermore, Confirmatory Factor Analysis failed to validate the Affective-Cognitive model suggested by the initial Exploratory Factor Analysis. Therefore, despite the interesting results reported above, the results of this thesis also suggest that the dimensional approach to the study of trust is relatively cumbersome, potentially inaccurate, and may not represent the most productive avenue of further enquiry in this field.

The powerful and relatively parsimonious SVS conception of trust is itself, however, limited by the fact that it gives no indication of the nature of the values considered salient in a given context. The literature suggests that these may vary across different sources of risk. For example, in relation to public concern about cancer clusters, Siegrist et al. (2001) suggest that public health and information policies may be salient, and Poortinga & Pidgeon

(2006) suggest that in some situations, the dimensions of trust might themselves be considered to be salient values. An alternative to the SVS hypothesis was recently proposed by Sjoberg (2008) and Sjoberg & Wester-Herber (2008). Those researchers suggest, in relation to a proposed nuclear waste storage facility, that Epistemic trust (i.e. in science and technology) and perceived Antagonism (a perception that the target institution holds opposed interests and goals to the truster) are better explicators of perceived risk than social trust. Therefore, although this thesis provides some clarification in relation to the dimensional model, the concept of trust remains elusive. As some recent research has also questioned the value of constructing detailed statistical models of the concept (Poortinga & Pidgeon, 2006), it may be that future qualitative research is required to gain a better understanding of trust. Such studies might usefully focus on the identification of the values and other qualitative components of trust that individuals consider important when evaluating the safety and acceptability of a nearby nuclear power station.

6.2c Implications for theories of perceived risks and benefits

A consistent finding of this thesis is that perceived risks were strongly associated with local peoples' relationships with the nearby nuclear power station, whilst perceived benefits appeared to be of lower significance. The observed importance of perceived risks is consistent with a long tradition of previous research suggesting that such perceptions are important aspects of attitudes towards nuclear power, especially amongst its opponents (Otway & Fishbein, 1976; 1977; Otway, Maurer & Thomas, 1978; Eiser & van der Plight, 1979; Woo & Castore, 1980; Vlek & Stallen 1981; van der Pligt et al., 1982;

van der Pligt, 1992; Eiser et al., 1995). This contrasts, however, with other research suggesting that perceived benefits are the most important of the two (Brody & Fleishman, 1993; Desvousage et al., 1993; Dunlap et al., 1993; Slovic et al., 1993; Greenberg, 2009; Freudenberg & Davidson, 2007; Krannich et al., 1993). One reason for this discrepancy might be the nature of the communities studied. In this thesis, the communities sampled appeared to be fairly affluent and economically diverse, compared to the apparently relatively deprived communities that previous studies have tended to focus on (e.g. Sellafield; MacGill, 1987; Wynne et al., 1993 [2007]). Some previously studied communities may therefore have stood to gain more from the continued presence of an existing nuclear power station or from the building of a new one, relative to those studied in this thesis. The present results therefore suggest that the relationship between expressed concern and perceived economic benefits (Baxter & Lee, 2004) may depend partly on the economic circumstances of the target community. Further research, taking socio-economic indicators into account, is needed to systematically test this hypothesis.

6.2d Implications for theories of place

Previous qualititative research suggests that the significance of a location as a physical setting for economic and social activities, and as a focus for the expression of individual and shared meanings and values (Satterfield, 2001), may be a powerful mediating factor in determining how people make sense of living close to sources of risk (see Boholm & Löfstedt, 2004; Simmons & Walker, 2004). Strong identification with a region or place may therefore lead communities to distance themselves from the risks associated with nearby hazards - possibly either in an attempt to avoid acknowledging the despoilment of a valued location (Bickerstaff, 2004), or the potential for social stigmatisation (cf. Edelstein, 1987; Gregory et al., 1995). This thesis is, to the author's knowledge, the first quantitative study to statistically evaluate these suggestions in relation to an established socio-technical hazard[71].

Consistent with some previous research, the results showed first, that perceptions of the risks associated with the nuclear power station decreased significantly with residential proximity to the facility. However, a subsequent novel finding was that this 'proximity effect' was significantly mediated by a correspondingly heightened sense of place. The results therefore suggest that strong emotional or affective bonds to the local place, observed particularly amongst the most proximate communities, may act to offset concerns about the safety of the nearby plant.

This thesis is also, to the author's knowledge, the first quantitative study to investigate the implications of community perceptions of an existing nuclear power station in the context of place identity. This concept, labelled Power Station-Related Sense of Place (PSSoP), was developed in this thesis as an attempt to investigate the contribution of the nearby nuclear power station to the four processes of place identity (Distinctiveness; Continuity; Self-esteem; and Self-efficacy [Knez, 2005; Breakwell 1986, 1992, 1993]). In accordance with the implications of some previous qualitative research (e.g. Macgill, 1987; Wynne et al., 1993 [2007]; Simmons & Walker, 2004), the concept was found to be central in predicting community attitudes towards new nuclear build.

[71] The study by Lima & Marques (2005) investigated similar issues, but in relation to a new incinerator development

Selected qualitative data (as described in Study I) suggested that the PSSoP concept may, however, also reflect the visual salience of the facility, or community perceptions of congruity between the meanings and values attributed to the nearby power station and those assigned to the local area and landscape. This is an area in which further research is clearly required. The finding is, however, broadly consistent with previous research suggesting that locally grounded values, particularly those related to place and to perceived impacts on the local area, are of key importance in determining experiences of nearby, potentially hazardous industry. For example, Costa-Font et al., (2008) report that attitudes to nuclear power are largely ideological or 'value-laden' (p.1284), and Eiser et al., (1988) suggest that even amongst those who are not opposed to nuclear power in principle, anticipated damage to the landscape and the visual environment is associated with objection to nearby new nuclear build. Likewise, Ansolabehere & Konisky (2009) suggest that perceptions of environmental harm may be the most important determinant of public attitudes towards new power plants. Finally, Baxter et al., (1999) observe that new industrial developments, even if low risk, may still represent a hazard to the things that local communities value. Accordingly, this thesis concludes that in addition to evaluations of specific psychological concepts such as risks, benefits and trust, contextual factors such as place identity and attachment, land use concerns, aesthetics, and the presence of social networks appear to be key in determining the both the experience and acceptance of nuclear power in the local landscape.

This conclusion is consistent with the broad findings of other related studies examining the relationships between a range of different (non-nuclear) major accident or environmental hazards and nearby communities such as chemical plants (e.g. Irwin et al., 1999; Simmons & Walker, 2004), incinerators (Lima 2004; Lima & Marques 2005) or air pollution (Bickerstaff and Walker 2001; Bickerstaff 2004). First, it illustrates that community perceptions of risk are tied to the ways in which a risk object is framed and socially constructed, both within local context, and the everyday lives of those living close to it (e.g. Pidgeon et al., 2006; Henwood et al., 2008). As a result, contextually sensitive research methods, such as those adopted in Study 1 of this thesis, are therefore required to detect and describe the processes of risk sense-making at specific localities (Irwin et al., 1999; Simmons & Walker, 1999).

Second, this thesis notes that objections to the presence of potential hazards may become 'silenced' for a variety of reasons, including feelings of powerlessness (e.g. Wakefield et al., 2001), or through the apparent adoption of coping strategies – which may be based on action, inaction, emotion or an apparent refusal to acknowledge risks (e.g. Zonabend, 1993; Wakefield et al., 2000; Bickerstaff & Walker, 2001). The broad conclusions of this thesis also concur with studies suggesting that those living close to a potential risk may, over time, come to view it as a characteristic of life at that locality – one which for some, becomes assimilated into notions of place (e.g. Bush et al., 2001; Lima, 2004; Lima & Marques, 2005). In such circumstances, continued exposure may lead to: the cognitive reappraisal of a hazard; increased community cohesion and pride; and a continued desire to live in the locality, despite the presence of the facility (Elliot et al.,1999; Wakefield et al., 2000; Luginaah et al, 2002).

The conclusions of this thesis also have an interesting wider relevance to an emerging body of literature investigating public responses to the siting of new, low-carbon or 'renewable' energy facilities. Despite being regarded as generically 'good' (e.g. Butler et al., 2011) such developments have nevertheless led to intense public contestation, particularly at a local level, and especially in relation to on-shore wind farms (Bell et al., 2005; Butler et al., 2011). The literature suggests that, despite not generally being associated with risks, acceptance of and opposition towards such developments is linked closely to perceptions of place, and in particular, to social contexts in which pre-existing place attachments and identities are perceived to have been disrupted (e.g. Vorkinn & Riese, 2001; Kempton et al., 2005; van der Horst, 2007; Brittan, 2001; Devine-Wright, 2009). Clearly then, the importance of place in affecting public reactions to locally situated technological developments is not limited either to 'risky' facilities, or to nuclear power.

6.3 Applied Implications

6.3a Implications for studies of support for and opposition to nuclear power

Study 1 of this thesis identified a point of view expressing a *conditional* acceptance of nuclear power, in which support for the technology is apparently contingent on perceptions that it can contribute significantly to climate change mitigation strategies and to improving national energy security. This position of ‘Reluctant Acceptance’ has been noted in previous qualitative research (Bickerstaff et al., 2008a). To the author’s knowledge, Study 2 of this thesis is the first quantitative survey to directly examine public agreement with the discourse. The results, which indicated a high level of public endorsement of the point of view, at least amongst the communities studied in this thesis, have potentially important implications for the nature of public support for nuclear power and the building of new nuclear power stations in the UK, and constitute one of the most important applied results of this thesis.

The prevalence of the Reluctant Acceptance position is important because the ability of nuclear power to contribute to climate change mitigation and national energy security is highly disputed by some commentators, and is dismissed by some as ‘propaganda’ which serves to inflate public favourability (Blowers, 2009, p34). Accordingly, the online group ‘World Information Service on Energy’ (WISE) argues, from a technical perspective, that the ability of nuclear power to produce a reliable ‘baseload’ supply of electricity in the context of an irregular contribution from renewable sources is questionable. According to WISE, the combined output from a wide range of renewable sources, including wind, hydroelectric and solar power, could comfortably provide the required baseload when considered collectively (WISE, 2008a,b). The potential carbon savings of nuclear power are similarly disputed. Sovacool (2008) argues that whilst nuclear energy may produce lower levels of CO_2 over its lifetime than coal, oil, or natural gas fuelled power stations, it nevertheless produces an estimated 5-7 times more CO_2 over its lifetime than renewable alternatives. Nuclear power may therefore represent an improvement over fossil fuels, but the fact that its own emissions are close to zero at the point of production is only one aspect of a bigger picture (WISE, 2008a).

The basis on which the support of 'The Reluctant 38%'[72] is premised may, therefore, be fundamentally flawed. Therefore, although this thesis (and also the report associated with this project [Pidgeon et al., 2008]) suggests that the UK Government and nuclear industry's 'reframing' of nuclear power has been persuasive for some people, it also suggests that the most common form of support for nuclear power, at least in the three communities studied in this thesis, is also the most fragile. These results suggest, therefore, that if, in the future, nuclear power was perceived by the public to have failed to deliver on these promises, overall support for the technology could quickly turn into overall opposition.

6.3b Implications for Risk Communicators

This thesis also has important implications for risk communicators, particularly in relation to the longstanding and historical public mistrust of nuclear power. Around twenty years ago, Bayea & Harms (1991) argued that 'the major goal of any second generation nuclear research program would have to be the restoration of public confidence' (p.2). The question of how public trust can be restored is clearly a difficult one. However, the literature generally suggests that silence about risks triggers distrust (Breakwell, 2007). This is illustrated at Sellafield, where the impression of complete certainty and control

[72] See www.nuclearspin.org

conveyed by the nuclear industry is reported to have actually undermined public confidence (Wynne et al., 1993 [2007]).

It may therefore be that increased openness is the best policy for the Nuclear Industry (Bier, 1991). However, such actions need to go beyond simply providing more information, which previous research has shown, in isolation, to be ineffective. Some studies, for example, have connected increased knowledge about nuclear power with *less* favourable attitudes (Costa-Font et al., 2008), as new information is likely to be interpreted cynically when mistrust is already evident (Bier, 1991; Jungermann et al.,1988; Eiser et al., 2002). Similarly, Showers and Shrigley (1995) report that education about nuclear physics had no effect on attitudes toward nuclear power, and Page & Hood (1981) report that participation in an educational workshop on energy issues tended either to have very little effect on attitudes, or to intensify participants' existing attitudes. Reviewing the evidence, Yim & Vaganov (2003) conclude that effective educational campaigns in relation to nuclear power should target public values, provide balanced and accurate information, appreciate the difference between lay and expert rationalities, and frame information with issue-relevance and the credibility of the presenter. Attitude change may therefore be possible in an atmosphere of trust, where there is mutual respect between involved parties together with a consideration that each group has both something to contribute, and the competence to take effective action (Slovic et al., 1980; La Porte and Metlay, 1996). This suggests that in addition to greater transparency, the nuclear industry also needs to ensure that the public feel that they are involved in decision-making processes, and that their concerns are being taken seriously (Bier, 1991; Ibitayo & Pijawka, 1999).

The results of this thesis, in noting an apparent distinction between Affective and Cognitive dimensions of trust, further suggest that risk communications need to go beyond demonstrations of technical excellence and reliability, and might be more effective if accompanied by expressions of genuine openness, honesty, fairness and care in relation to affected communities. However, it is also relevant to note that some of the most recent UK survey data suggests that public acceptance of nuclear power appears to be increasing, *despite* persistently low levels of overall public trust (Spence et al., 2010). Consistent with Siegrist & Buhlman (1999), who show that gene technology is considered more beneficial and acceptable when it is framed as having a medical application, public opinion in relation to nuclear power appears to be more favourable when it is presented in the context of contemporary concerns about climate change and energy security.

6.3c Implications for UK policy on the siting of new nuclear power stations

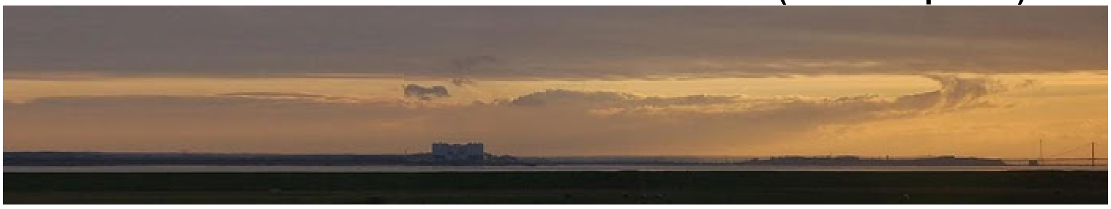
In addition to providing an important contemporary investigation into how people living in close proximity to existing nuclear power facilities conceptualise and construe their risks, this thesis is timely when considered in relation to the emerging policy debate in many countries on the renewal of nuclear energy. In direct relevance to the UK recent proposals that new nuclear power stations will be sited mostly or exclusively adjacent to existing nuclear sites (DBERR, 2008; DECC, 2010), this thesis generally supports the apparent assumption that acceptance of new build is likely to be greater at existing 'host' communities (within 8 miles of the existing facility), at least when compared to the most recently reported national figures based on the same or similar questionnaire items. However, the results of this thesis also show that even amongst such communities, up to 25% of the population are likely to oppose new build, as whilst support for nuclear power appears to increase with proximity to the existing facility, strong objection does *not* appear to correspondingly decrease. Furthermore, these figures do not take into account additional potential hostility from neighbouring communities (Blowers, 2009). Therefore, it would seem that wherever new nuclear power stations are sited, the potential for significant social unrest remains high.

One of the potentially important findings of this thesis is that this 'proximity effect' appears to be at least partially explained by the mediating effect of SoP in communities situated closest to the existing facility. This, however, carries an important moral implication in relation to current siting policy. The literature suggests that one reason why Sense of Place may become heightened in such locations is as a psycho-social response to the perception that one's community is subject to stigmatisation by outsiders (Baxter & Lee, 2004). If the increased acceptance of nuclear power amongst communities situated close to an existing facility stems from a defensive psychological reaction to the negative perceptions of others, it seems hardly correct to use this as a reason to impose *additional* stigmatised or hazardous industry on the same areas.

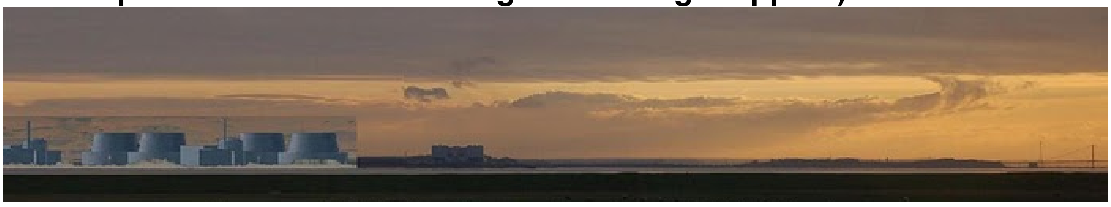
In relation to siting policy, this thesis also highlights the importance of perceptions of an existing facility in the context of perceptions of local place identity and landscape (Power Station-Related Sense of Place). This is of particular relevance in relation to current proposals for the building of a new reactor at Oldbury, where the cooling water directly available from the River Severn is apparently insufficient for the proposed new reactor. As a result, 3 to 4 cooling towers, which will be either 70 or 200m in height, will be required for the new facility to operate, and these will create a far greater aesthetic impact on the local landscape than that of the existing facility. Consistent with the results of this thesis, the issues of visual salience, and the potential industrialisation of an otherwise largely rural area, have become the main foci of the Oldbury anti-nuclear pressure group 'Sheppardine Against Nuclear Energy' (SANE) (see Figure 11). In theory, at least, the aesthetic impact of new reactors could potentially be minimised either through the use of visually unobtrusive reactor designs, or through placing such facilities at locations that are less visually prominent in the landscape. However, the extent to which such steps might impact on public attitudes is a question for further research. In addition, if, as suggested in this thesis, opposition to new nuclear build is largely borne of a perceived symbolic contradiction between the rural landscape and the industrial 'placelessness' of a nuclear power station (*c.f.* Devine-Wright & Howes, 2010), it may be that new nuclear power stations might be considered less risky and more acceptable if they were sited within already industrialised areas. Again, further research would be required to test this possibility.

Figures 11a-c: Potential Impact on the landscape of the proposed new nuclear power station at Oldbury

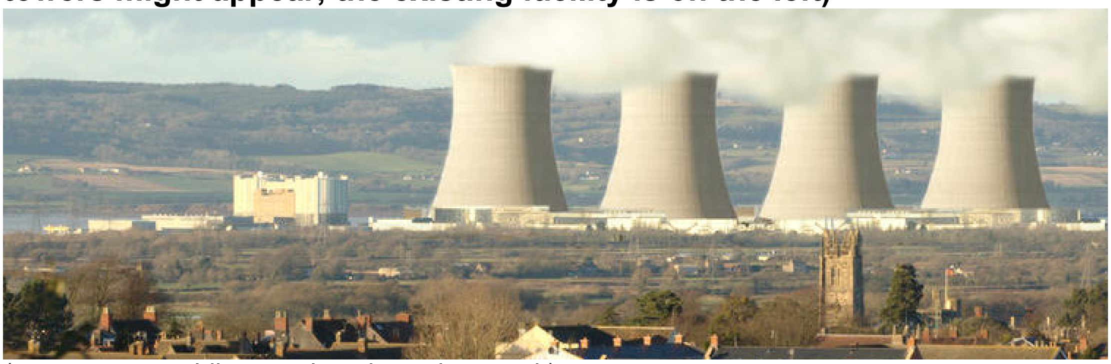
11a. Present View from across the Bristol Channel (near Chepstow)



11b. Potential View from across the Bristol Channel (near Chepstow; mock-up of how four 70m cooling towers might appear)



11c. Potential View from Thornbury (mock-up of how four 200m cooling towers might appear; the existing facility is on the left)



(source: www.oldburynuclearviewpoint.org.uk)

6.4 Reflections on the research design

This thesis combined research methodologies with the aim of producing a comprehensive, high quality set of results which incorporated the strengths of multiple methods. First, a Q-Study, was conducted, which itself was based on a set of qualitative interviews. Second, a large-scale household survey was undertaken. In addition, illustrative quotations, identified from the preceding interview study, were incorporated into the results of both empirical phases in order to facilitate the interpretation of the results, and illustrate how some of the main quantitative conclusions might be manifest in participant discourse. This thesis is the first, to the author's knowledge, to combine these particular methods.

Bryman (2006) suggests that mixed-methods research designs can enhance the results of research studies, and that one way of achieving this is through selecting appropriate research methods to address the specific aims or research questions of a project. Through attending to the strengths and weaknesses of the methods chosen, this thesis attempted to combine different research methodologies within a single project through emphasising the pragmatic, rather than philosophical issues raised in doing so. It therefore combines research methods in what Hammersley (1996) refers to as a *complementary* manner. The initial aim, to identify a range of detailed and nuanced points of view on a nearby nuclear power station, required a contextually sensitive research tool containing at least some qualitative elements. Accordingly, Study 1 began with a comprehensive thematic analysis of the qualitative interview data collected in an earlier phase of the project. The emergent themes were condensed into a set of statements, which were subsequently incorporated into a Q-Sort procedure (Study 1). This enabled a number of detailed points of view on living near to a nuclear power station to be identified and described. As anticipated, these results reflected local context, as evidenced through the site-specific concerns detected in Study 1, Analysis 2. However, the results of Study 1 were based on a small, theoretically structured sample, which provided no indication of how the emergent points of view might be represented in a broader community sample, or may stand up to additional statistical scrutiny. Study 2 therefore further investigated both the points of view, and with the themes identified as critical to them (perceived risks and benefits, social trust, and sense of place) in a larger and more representative community sample. This thesis therefore uses quantitative and qualitative methods appropriately, in order to address specific research questions. It demonstrates how methods might be successfully combined within a single project to provide a clearer and more comprehensive view of how communities live with nuclear power than either qualitative or quantitative methods could achieve in isolation.

Nevertheless, the results from both empirical phases should still be interpreted with caution. The points of view identified in Study 1 represented shared elements of opinion across a number of individuals, each holding their own, unique point of view. Assumptions that such groups are internally homogenous, or that they correspond to empirical social groups should therefore be avoided. In addition, some of the limitations of Q-Methdology were also revealed in Study 1. Analysis 3 demonstrated how differing factor analysis and factor rotation approaches can significantly affect the general results of a Q study, and also how such choices can lead to the same individuals being significantly associated with different points of view in separate analyses. These results therefore suggest that the finer details (as opposed to the broad implications) of factor meanings in Q-Studies should be approached cautiously. In the context of investigating shared community views on a given issue, Q might therefore best be utilised (as it is here) as a method for facilitating future investigation, whether qualitative or quantitative, rather than as a standalone technique.

In relation to Study 2, it should be noted that the effect sizes reported in this thesis were often weak (e.g. the strength of correlations, the size of differences between means, and the beta values reported in relation to regression equations, etc). This may reflect the use of ineffectual or omitted measures, or simply that the reported effects and trends were subtle. It is important, therefore, to note that although the relationships observed in Study 2 were often highly significant due to the statistical power of the analysis, they were, nevertheless, broad statistical trends that would not generally be meaningful to, or even observable in the lives of individual participants.

6.5 Limitations

Many of the limitations of this thesis are specific to individual analyses, and these have been discussed previously in relevant sections. However, the thesis is also subject to a number of more general limitations. One of the most important is that it is not possible to generalise from these results to other communities situated close to nuclear facilities. The similarities between communities observed in relation to the points of view on nuclear power suggest that some of these perspectives may be present at multiple sites – at least those that are superficially similar to those included in the present study. However, other UK nuclear sites such as Sellafield are subject to different circumstances and are likely to be associated with different sets of priorities and salient issues.

In addition, fieldwork for this thesis was conducted during 2007, just prior to the announcement of the new build programme, at a time when all three communities studied were faced either with the current or future decommissioning of their stations and no realistic prospect of renewal. This situation has now changed at all three locations, and the research does not take into account the potential shifts in public opinion that may have occurred since new nuclear build in these areas became a real possibility. In addition to such proposals, it is now clear that high-level radioactive waste (in the form of spent fuel) will be stored on-site at all new British nuclear power stations. The extent to which local communities are currently aware of this is not known, and it is unclear to what extent, if any, this knowledge will affect public attitudes towards new build when it is widely understood. Previous research suggests that the public is significantly more negative towards nuclear waste storage than it is to the generation of electricity via nuclear power itself (Slovic, 1992; see also Eiser et al., 1995)[73]. Therefore, although the formation of relatively new, organised local anti-nuclear pressure groups such as 'Sheppardine Against Nuclear Energy' (SANE) (at Oldbury) and 'Blackwater Against New Nuclear Group' (BANNG) (at Bradwell) shows that affected publics are responding to progressions in UK nuclear energy policy, it is not possible to say how such developments may have impacted on the results of this thesis. However, it seems likely that fewer individuals would now remain neutral on, or disengaged from the issue of new nuclear build in the nearby area. Consequently, it is possible the nature and number of points of view on nuclear power, as revealed by Study 1, may already have changed.

[73] As with the issue of visual salience, promotion of the fact that spent fuel will be stored on-site at any new nuclear power stations is another key aspect of the SANE campaign.

6.6 Further research

The various studies described in this thesis collectively provide an account of some of the main ways in which three communities live with nuclear power. However, it was not an aim of this thesis to systematically compare and contrast the three sites. One possibility for future research is therefore to investigate the similarities and differences in the ways in which local people construct and represent nuclear power, both between locations that are superficially similar, and also between those that are not. In particular, drawing a specific contrast between sites similar to those studied in this thesis and others such as those close to the reprocessing facilities at Sellafield would be interesting, and would enable a contemporary re-evaluation of the conclusions of MacGill (1987) and Wynne et al., (1993 [2007]). Those studies describe a culture of dependency – a situation where the presence of the power station as the only local economic multiplier created a situation where local people had no choice but to accept and place trust in the facility. This thesis suggests, however, that a nuclear power station may function harmoniously with large sections of the nearby population in the absence of social coercion or economic pressure. This raises the possibility that reports of significant underlying anxiety amongst local communities at Sellafield may have been overemphasised and might, at least in part, reflect the prevalent politics and social agendas of the late 1980s and early '90s.

A second important focus for future research relates to the nature and prevalence of the Reluctant Acceptance point of view. As noted in Study 2, the extent to which the discourse was novel to survey respondents may have affected both the levels of agreement reported, and the longevity of any persuasive effect of the novel frame. A follow-up study addressing both of these issues may lead to a better understanding of the extent to which the discourse is represented amongst the general public. Moreover, a future study that presented the Reluctant Acceptance point of view in discrete parts dispersed throughout a longer questionnaire would allow agreement with the overall attitude position to be estimated whilst avoiding the imposition of a coherent persuasive frame onto research participants. In addition, it is notable that a ‘counter-frame’ to the Reluctant Acceptance discourse was not provided to survey respondents in the present study, and nor was it presented to respondents in the original research by Bickerstaff et al., (2008a). The extent to which agreement with the discourse is resilient to counter-arguments (such as those presented in Section 6.3a of this thesis) has therefore not yet been investigated.

Further research is also required to investigate the relationships between values and attitudes towards difference sources of energy production (e.g. Whitfield et al., 2009; Ansolabehere & Konisky, 2009). This thesis used the four Q-factors as the basis for sub-analyses of the survey data and did not specifically measure values. However, future research may achieve more accurate segmentation of survey respondents through splitting large datasets on the basis of established and validated values scales (e.g. Schwartz, 1992). This may, in turn, lead to more clearly interpretable differences between such subgroups on relevant concepts.

Further longitudinal and comparative research is also required to understand the impacts of the energy policy developments described in the previous section (6.5), and in that respect, this thesis provides a unique baseline which can be used as a point of reference for follow up research. One possible future research project could therefore be to investigate the associations between landscape, place attachment and identity, and perceptions of risk through conducting a mapping exercise designed to simultaneously incorporate both the 'risk perception shadow' (Stoffle, 1991), and place attachment mapping (Brown & Raymond, 2007). Such an approach, particularly if combined with follow-up qualitative interviews intended to investigate local values, affect, and the symbolism of the power station might provide further useful insights into the factors that underlie the local experiences of nuclear power, as well as helping to identify the sites at which the imposition of new nuclear power stations might have the least social impact.

However, future studies investigating the impacts of new nuclear build on local communities should also aim to look beyond community opinions. Such studies should also monitor how local levels of anxiety and public health respond to disruptions and risks, and also to the benefits that may accompany such developments. They should also aim to identify the factors that can help mitigate such impacts, in order that the potentially detrimental impacts of new nuclear build close to populated areas can be minimised.

6.7 Conclusions

The results of this thesis suggest that within nearby communities, nuclear power stations are perceived in a range of different ways that go significantly beyond 'pro-' and 'anti-nuclear' labels. Such perceptions are based on a complex array of interacting factors, within which perceptions of risks and benefits, trust relationships, familiarity, and perceptions of place all play important roles. However, this thesis also shows that responses to current political discourses and agendas, or simply feelings of disinterest and powerlessness can also form the basis of opinions in relation to a nearby nuclear power station. The results also suggest that the apparent assumption that existing host communities will be more accepting of new nuclear power stations, may have some grounds in reality. However, that is not to say that such sites are necessarily the best places to locate new nuclear build. Rather, it appears that such sites may simply be the most convenient (Blowers, 2009). Consistent with observations elsewhere in Europe (Luoama-Aho & Vos, 2009), the UK government's approach to siting new nuclear power stations appears to represent a return to the 'decide-announce-defend' approach specifically warned against in previous research (Pidgeon et al., 2008a; Blowers, 2009). Pidgeon et al., (2008a) argue that a consequence of specific new nuclear build proposals in the UK, even on existing sites, would be a hardening of both opposition and support, leading to a polarisation of local opinions, and as a result, the potential for conflict and mobilisation, both for and against new build plans. There is a window of opportunity, however, within which the social sciences have the opportunity to help facilitate informed policy decisions, better considered risk communications, and effective public engagement processes. These will not however, be achieved just through gaining a better understanding of the factors that affect community attitudes to locally situated nuclear power. The insights generated by such research will also need to be afforded full and proper consideration in future siting decisions if their potential benefits are to be realised.

References

Accenture & Utility Week Research Survey on Attitudes Towards Nuclear Power in the United Kingdom (April 2008)

Aguinis, H., (2004). Regression Analysis for Categorical Moderators. London: Guilford Press

Altman, I., & and Low, S., (1992). Place Attachment. New York: Plenum.

Andserson, J., (2004). The ties that bind? Self- and place-identity in environmental direct action. Ethics, Place & Environment, 7, 1-2, 45-57.

Ansolabehere, (2007). *Public Attitudes Toward America's Energy Options: Report of the 2007 MIT Energy Survey*. Center for Energy and Environmental Policy Research.

Ansolabehere, S., & Konisky, D., (2009). Public Attitudes toward Construction of New Power Plants. Public Opinion Quarterly 73, 3, 566-577.

Arnold, L., (1995), Windscale 1957: Anatomy of a Nuclear Accident, Second Edition. MacMillan: London

Augé, M. (1995). *Non-Places*. London: Verso.

Bachelard, G., (1994). The Poetics of Space. Beacon Press, Boston.

Barber, B, (1983). The Logic and Limits of Trust. New Brunswick: Rutgers University Press.

Barbour, R.S., (1999), The case for combining qualitative and quantitative approaches in health services research. Journal of Health Services Research Policy, 4, 1, 39-43.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173-1182.

Bassett Jr, G.W., Jenkins-Smith, H.C., & Silva, C., (1996). On-site storage of high level nuclear waste: attitudes and perceptions of local residents. Risk Analysis, 16, 309-319

Baxter, J., & Lee, D., (2004). Understanding expressed low concern and latent concern near a hazardous waste treatment facility. Journal of Risk Research, 7, 705-729

Baxter., J., & Eyles, J., (1999). The utility of in-depth interviews for studying the meaning of environmental risk. Professional Geographer, 51, 2, 307-320.

Baxter., J., Eyles, J., & Elloit, S., (1999). 'Something Happened': The relevance of the Risk Society for describing the siting process for a municipal landfill. Geografiska Annaler, 81B(2): 91-109.

BBC News, (September 1999). Scotland Nuclear company ordered to improve safety http://news.bbc.co.uk/1/hi/scotland/458877.stm

BBC News (2006), 'Russia blamed for 'gas sabotage' http://news.bbc.co.uk/1/hi/world/europe/4637034.stm

BBC News (2009), 'Russia shuts off gas to Ukraine' http://news.bbc.co.uk/1/hi/world/europe/7806870.stm

BBC News (2009). 'Nuclear owners guilty over leaks'. February, 2009. http://news.bbc.co.uk/1/hi/england/7875870.stm

BBC News (2009). 'Potential Nuclear Sites are Named'. January 2009. http://news.bbc.co.uk/1/hi/7847032.stm

BBC News (2010), 'Climate scepticism 'on the rise', BBC poll shows' http://news.bbc.co.uk/1/hi/sci/tech/8500443.stm

Bender, B (ed) (1993). Landscape: Politics and Perspectives. Oxford: Berg.

Benford, R., Moore, H., & Allen-Williams Jr, J., (1993). In whose backyard?: concern about siting a nuclear waste facility. Sociological Inquiry, 63, 1, 30–48.

Bell, D., Gray, T., & Haggett, C., (2005). The 'social gap' in wind farm policy decisions: explanations and policy responses. Environmental Politics, 14, 4, 460-477.

Bentler, P.M., & Chou, C.P., (1987). Practical Issues in Structural Modelling. *Sociological Methods & Research*, 16, 78-117.

Betz, N.E., (1996). Test Construction. In F.T.L. Leong & J.T. Austin (eds), The Psychology Research Handbook (p239-250). Thousand Oaks, CA: Sage.

Beyea, J & Harms, V., (1991). Overview: Nuclear energy. Environment, 33, 3, p2.

Bhattacharya, R., Devinney, T.M., & Pillutla, M.M., (1998). A formal model of trust based on outcomes. Academy of Management Review, 23, 3, 459-472

Bickerstaff, K & Walker, G., (2001). Public understandings of air pollution: the localisation of environmental risk. Global Environmental Change, 11, 133-145.

Bickerstaff, K. (2004). Risk perception research: socio-cultural perspectives on the public experience of air pollution. *Environment International*, 30, 827-840.

Bickerstaff, K. and Simmons, P., (2009). Absencing/presencing risk: Rethinking proximity and the experience of living with major technological hazards. *Geoforum*, 40: 864–872

Bickerstaff, K., Lorenzoni, I., Pidgeon, N.F., Poortinga, W., & Simmons, P., (2008a). Reframing nuclear power in the UK energy debate: nuclear power, climate change mitigation, and radioactive waste. Public Understanding of Science, 17, 145-169.

Bickerstaff, K., Simmons, P., & Pidgeon, N.F. (2008b). Constructing responsibilities for risk: negotiating citizen - state relationships. *Environment and Planning A*, 40, 1312-1330.

Bier, V.M., (1991). On the state of the art: risk communication to the public. Reliability Engineering and System Safety, 71, 139-150.

Billig, M., (2006). Is my home my castle? Place attachment, risk perception and religious faith. Environment & Behaviour, 38, 248-265.

Bisconti Research, Inc. (2001), US Public Opinion on Nuclear Energy January 2001. Washington, D.C.

Bisconti Research Inc (2004); cited in Nuclear Energy Insight (June 2005), 'Americans Voice Record-High Support for Nuclear Energy'.

Bisconti Research, Inc (2005). Nuclear power plant neighbors accept potential for new nuclear reactor near them by margin of 3 to 1. http://www.nei.org/newsandevents/plantneighbors

Bisconti Research, Inc, (2007a). Nuclear power plant neighbors accept potential for new nuclear reactor near them by margin of 3 to 1. http://www.nei.org/newsandevents/newsreleases/nuclearpowerplantneighborsacceptpotentialfornewreactornearby

Bisconti Research, Inc. (2007b) http://www.nei.org/newsandevents/newsreleases/surveyfindsoverwhelminglocalsupportforsecondreactoratwattsbarnuclearplant/

Black D., (1984). Report of the Independent Advisory Group. Investigation of the possible increased incidence of cancer in West Cumbria. London: HMSO.

Bland, J.M., & Altman, D.G., (1996) Statistics Notes: Transforming data. British Medical Journal, 312:770

Bland, M., (2000)., An Introduction to Medical Statistics (3rd edition). Oxford University Press: Oxford.

Blowers, A., & Leroy, P. (1994). Power, politics and environmental inequality: a theoretical and empirical analysis of the process of peripheralisation. *Environmental Politics*, 3, 197-228.

Blowers, A., (2009). Why dump on us? Town & Country Planning, January 2009, p33-37

Blowers, A., (2010). Sheppardine Against Nuclear Energy (SANE) interview with Andy Blowers, 27th November 2010. *Available at*: http://www.youtube.com/watch?v=uTtZA49DgUo&feature=related

Boaler, J., (1997), Setting, social class, and the survival of the quickest. British Education Research Journal, 23, 5, 575-595.

Boholm, A. & Lofsted, R., (eds) (2004). Facility Siting: Risk, Power and Identity in Land Use Planning. Earthscan: London

Boholm, A., (1996). The cultural theory of risk: an anthropological critique. Ethnos, 61, 64-84.

Bolsen, T., & Cook, F.L., (2008), The Polls – Trends: Public Opinion on Energy Policy 1974-2006. Public Opinion Quarterly, 72, 2, 364-388

Bonaiuoto, M., Carrus, G., Martorella, H., & Bonnes, M., (2002). Local identity processes and environmental attitudes in land use changes: the case of natural protected area. Journal of Economic Psychology, 23, 631-653.

Bonaiuto, M., Breakwell, G., & Cano, I., (1996). Identity processes and environmental threat: the effects of nationalism and local identity upon perception of beach pollution. Journal of Community and Applied Social Psychology, 6, 157-175.

Bord, R.J., & O'Connor, R.E., (1990). Risk communication, knowledge and attitudes: explaining reactions to a technology perceived as risky. Risk Analysis, 10, 499-506

Bord, R.J., & O'Connor, R.E., (1992). Determinants of risk perceptions of a hazardous waste site. Risk Analysis, 12, 411-416.

Botella, T., Coadou, J., & Bolhm-Hieber, U., (2006), European Citizen's Attitudes Towards Radioactive Waste: An updated review. European Commission: Directorate General for Energy and Transport: Unit Nuclear Energy and Radioactive Waste. Presented at Local Competence Building and Public Information in Nuclear Territories, Cernavoda, Romania, 5th-6th April. 2006

Brittan, G., (2001). Wind, energy, landscape: reconciling nature and technology. Philosophy and Geography, 4, 2, 171-178.

Breakwell, G., (1986). Coping with Threatened Identities. London: Methuen.

Breakwell, G., (2007). The Psychology of Risk. Cambridge University Press: Cambridge

Breakwell, G.M., (1992). Processes of self evaluation: efficacy and estrangement. In G.M. Breakwell, (ed), Social Psychology and the Self-Concept. Surrey: Surrey University Press.

Breakwell, G.M., (1993). Integrating paradigms: methodological implications. In: Prohansky,1978; G.M. Breakwell & D.V. Canter (eds), Empirical Approaches to Social Representations. Oxford: Clarendon Press.

Brewer, J., & Hunter, A., (1989), Multimethod Research: A Synthesis of Styles. Thousand Oaks, CA: Sage.

Brewer, M. B., & Brown, R.J., (1998). Intergroup relations. In D. T. Gilbert, S. T. Fiske, & G. Lindsey (eds), The handbook of social psychology, New York, McGraw Hill, pages 554-594.

Brody, J., & Fleishman, J., (1993). Sources of public concern about nuclear waste disposal in Texas agricultural communities. In: R. Dunlap, M.Craft & & E. Rosa, Public Reactions to Nuclear Waste: Citizens' Views of Repository Siting. P115-135. Durham, NC: Duke University Press.

Brown, B., & Werner, C., (1985). Social cohesiveness, territoriality, and holiday decorations: the influence of cul-de-sacs. Environment & Behaviour, 17, 539-565

Brown, G., & Raymond, C., (2007). The relationship between place attachment and landscape values: toward mapping place attachment. Applied Geography, 27, 89-111.

Brown, P., (1992). Popular epidemiology and and toxic waste contamination: lay and professional ways of knowing. Journal of Health and Social Behaviour, 33, 267-281.

Brown, S.R. (1980). *Political Subjectivity: Applications of Q-methodology in Political Science*. New Haven, CT: Yale University Press

Bryant L., Green, J., & Hewison, J. (2006). Understandings of Down's syndrome: a Q-methodological investigation. Social Science & Medicine, 63, 188-1200.

Bryman, A (1988). Quality and Quantity in Social Research. Unwin Hyman: London.

Bryman A. (2006). Integrating quantitative and qualitative research: how is it done?, Qualitative Research, 6, 97-113.

Burningham, K & Thrush, D., (2001). ‘Rainforests are a long way from here’: the environmental concerns of disadvantaged groups. Guildford: University of Surrey.

Burningham, K., & Thrush, D., (2004). Pollution concerns in context: a comparison of local perceptions of the risks associated with living close to a road and a chemical factory. Journal of Risk Research, 7, 2, 213-232.

Burns, R & Burns, R., (2008). Business Research Methods and Statistics Using SPSS. London: Sage.

Burns, C., Mearns, K., & McGeorge, P., (2006). Explicit and implicit trust within safety culture. Risk Analysis, 26, 5, 1139-1150.

Burt, C., (1972). The Reciprocity Principle. In S.R. Brown & D. J. Brenner (eds), Science, Psychology and Communication. New York: Teachers College Press, p. 39-56.

Bush, J., Moffatt, S., & Dunn, C. (2001). ‘Even the birds round here cough’: stigma, air pollution and health in Teeside. *Health and Place*, 7, 47-56

Butler, C., Parkhill, K., & Pidgeon, N., (2010). From the material to the imagined: public engagement with low-carbon technologies in a nuclear community. In: Devine-Wright, P. (ed). ‘Renewable Energy and the Public: from NIMBY to participation’. Earthscan: London.

Byrnes, J.P., Miller, D.C., & Schafer, W D., (1999), Gender differences in risk taking: a meta-analysis. Psychological Bulletin, 125, 3, 367-383.

Campbell, A., (2004). Words words words. British Journal of Developmental Psychology, 22, 509-513.

Chalmers, A.F., (1999). What is this thing called Science? 3rd Edition. Open University Press: Buckingham

Chang, E., Thompson, P., Dillon, T, & Farookh, H., (2005). The fuzzy and dynamic nature of trust. In: S. Katsikas, J., Lopez & G. Pernul (eds): TrustBus 2005, LNCS 3592, p161-175.

Chong, D., & Druckman, J., (2007). Framing Theory. Annual Review of Political Science, 10, 1, 103-126.

Chow, K & Healey, M., (2008). Place attachment and place identity: first year undergraduates making the transition from home to university. Journal of Environmental Psychology, 28, 362-372

Christensen, T., & Laegreid, P., (2003). Trust in government: the significance of attitudes towards democracy, the public sector, and public sector reforms. Working Paper 7-2003, Stein Rokkan Centre for Socail Studies, Bergen University Research Foundation.

Cogent-SSC (2010). Nuclear report calls for major skills development to support new build. *available at*: http://www.cogent-ssc.com/general/news/31_03_10_renaissance2.php

Coolican, H. (1999) Research Methods and Statistics in Psychology, Second Edition. London: Hodder & Stoughton

Corner, A., Venables, D., Spence, A., Poortinga, W., Demski,. C & Pidgeon, N., (*under review*). Nuclear power, climate change and energy security: Exploring British public attitudes.

Costa-Font, J., Rudisill, C., & Mossialos, E., (2008). Attitudes as an expression of knowledge and 'political anchoring': the case of nuclear power in the United Kingdom. Risk Analysis, 28, 5, 1273-1287.

Costello, A.B.,& Osborne, J.W., (2005). Best practices in exploratory factor analysis: four recommendations for getting the most from your analysis. Practical Assessment, Research & Evaluation, 10 (7), 1-10

Coxon, T., (2005), Integrating Qualitative and Quantitative data: What does the user need? Forum: Qualitative Social Research, 6, 2, URL: http://www.qualitative-research.net/fqs/fqs-eng.htm

Cresswell, T., (2004). Place: a short introduction. Oxford: Blackwell.

Cutter, S., (1993). Living with Risk. Edward Arnold: New York.

Cvetkovich, G., (1999). The Attribution of Social Trust. In: G.T. Cvetkovich & R.T. Lofsted (eds), Social Trust and the Management of Risk. London: Earthscan

Cvetkovich, G. and Löfstedt, R (1999). (eds). *Social Trust and the Management of Risk*. London: Earthscan

Dalquist, S., (2004), Timeline: A Chronology of Public Opinion on Nuclear Power in the United States and the United Kingdom. MIT.

Davidson, D., and Freudenberg, W., (1996), Gender and environmental risk concerns: a review and analysis of available research. Environment and Behaviour, 28, 302-339.

Dawkins, R., (2003). A Devil's Chaplin: Selected Essays. Phoenix: London.

DECC, (2009). People Power: The Civil Nuclear Workforce. Cogent-SSC

DECC, (2010). Next Generation: Skills for New Build Nuclear. Cogent-SSC de Groot, J.I.M., & Steg, L., (2010). Morality and Nuclear Energy: Perceptions of Risks and Benefits, Personal Norms, and Willingness to Take Action Related to Nuclear Energy. Risk Analysis, 30, 9, 1363-1373

DEFRA (2007). Draft Climate Change Bill. HM Government: UK.

DEFRA (2008). Climate Change Act. Department for Environment, Food and Rural Affairs. London: The Stationery Office.

de Graaf, G., (2003). Discourse theory and business ethics. The case of bankers' conceptulaisations of customers. Journal of Business Ethics, 31, 299-319.

de Groot, J.I.M., & Steg, L., (2007). Value orientations and environmental beliefs in five countries: validity of an instrument to measure egoistic, altruistic and biospheric value orientations. Journal of Cross-Cultural Psychology, 38, 318-332

Dietz, T, Fitzgerald, A & Shwom, R., (2005). Environmental Values. *Annual Review of Environment and Natural Resources*. 30: 335-372.

Department for Business Enterprise and Regulatory Reform (DBERR), (2008). Meeting the Energy Challenge: A White Paper on Nuclear Power. January 2008. Cm 7296, HMSO.

Department of Energy and Climate Change (2010). https://www.energynpsconsultation.decc.gov.uk/nuclear/ssa/ accessed 26.03.10

Desvousage, W., Kunreuther, H., Slovic, P & Rosa, E., (1993). Perceived Risks and Attitudes to nuclear waste. In: R. Dunlap, M.Craft & & E. Rosa, Public Reactions to Nuclear Waste: Citizens' Views of Repository Siting. P175-208. Durham, NC: Duke University Press.

DETR, (2000). Climate Change, the nuclear programme. Department of Transport, the Environment and the Regions, London.

Devine-Wright, P., (2009). Rethinking Nimbyism: the role of place attachment and place identity in explaining place-protective action. Journal of Community and Applies Socail Psychology, 19, 6, 426-441

Devine-Wright, P., & Howes, Y., (2010). Disruption to place attachment and the protection of restorative environments: a wind energy case study. Journal of Environmental Psychology, 30, 271-280.

Dietz, T., (2001). Thinking about environmental conflict. In: L. Kadous (ed.), Celebrating Scholarship, p31-54. Fairfax, VA: George Mason University.

Dixon, J., & Durrheim, K., (2004). Displacing place identity: a a discursive approach to locating self and other. British Journal of Social Psychology, 39, 27-44

Douglas, M., & Wildavsky, A. B., (1982), Risk and culture: an essay on the selection of technical and environmental dangers. Berkeley: University of California Press.

Draper, C., Stiller, C., Cartwright, R., Craft, A., & Vincent, T.J., (1993). Cancer in Cumbria and in the vicinity of the Sellafield nuclear installation, 1963-90. British Medical Journal, 306, p89-94.

Druckman, J., (2001). The implications of framing effects for citizen competence. Political Behaviour, 23, 225-256.

DTI, (2006). The Energy Challenge. Energy Review Report, 2006. Department of Trade and Industry, London.

DTI, (2007). The Future of Nuclear Power. The Role of Nuclear Power in a Low Carbon Economy. Department of Trade and Industry, London.

Dunlap, R., Rosa, E., Baxter, R., & Mitchell, R., (1993). Attitudes towards siting a high level nuclear waste repository at Hanford, Washington. In: R. Dunlap, M.Craft & & E. Rosa, Public Reactions to Nuclear Waste: Citizens' Views of Repository Siting. P.136-172. Durham, NC: Duke University Press.

Earle, T.C., (2004). Thinking aloud about trust: a protocol analysis of trust in risk management. *Risk Analysis*, 24, 169-183.

Earle, T. & Cvetkovich, G. (1995). Social trust: Toward a cosmopolitan society. Westport, CT: Praeger.

Earle, T.C., & Siegrist, M., (2006). Morality information, performance information, and the distinction between trust and confidence.. Journal of Applied Social Psychology, 36, 2, 383-416

Earle, T.C., & Siegrist, M., (2008). On the relation between trust and fairness in environmental risk management. Risk Analysis, 28, 1395-1414

Earle, T.C., Siegrist, M., & Gutscher, H., (2007). Trust, Risk Perception and the TCC Model of Cooperation. In In Siegrist, M., Earle, T.C., & Gutscher, H., (eds) *Trust in Cooperative Risk Management: Uncertainty and Scepticism in the Public Mind.* London: Earthscan.

Edelstein, M.R., (1988). Contaminated Communities: the social and psychological impacts of residential toxic exposure. Boulder: Westview

Eden, S., Donaldson, A., & Walker, G. (2005). Structuring Subjectivities? Using Q-method in human geography. Area, 37, 4, 413-422.

EDF (1961). Minutes of meeting of EDF Comite de l'Energie Nucleaire, 4 May 1961; personal papers of C.Bienvenu. *Cited in:* Hecht, G. (1998). *The Radiance of France: Nuclear Power and National Identity after World War II*. p.179. Cambridge, Mass: MIT Press.

EDF (2010). Public Attitudes towards Hinkley Power Station. Poll conducted by ICM Research for EDF, 24th-28th September, 2010.

Eiser, D. & van der Pligt, J., (1979). Beliefs and values in the nuclear debate. Journal of Applied Social Psychology, 9, 524-536

Eiser, J.R., Spears, R., & Webley, P., (1988). Predicting attitudes to oil and to nuclear energy. Journal of Environmental Psychology, 8, 141-147.

Eiser, J.R, van der Pligt, J., & Spears, R. (1995). *Nuclear Neighbourhoods: Community Responses to Reactor Siting*. Exeter: University of Exeter Press.

Eiser, J.R., & van der Pligt, J (1979). Beliefs and values in the nuclear debate. Journal of Applied Social Psychology, 9, 524-536

Eiser, J.R., Aluchna, K., & Jones, C.R., (2010). Local wind or Russian oil? Identity dilemmas in Polish attitudes to wind energy developments. Presentation at the European Society for Risk Analysis, London, June 2010.

Eiser, J.R., Miles, S & Frewer, L.J., (2002). Trust, perceived risk, and attitudes towards food technologies. Journal of Applied Social Psychology, 32, 2423-2433

Elliott, S., Martin Taylor, S., Hampson, C., Dunn, J., Eyles, J., Walter, S., & Streiner, D., (1997). "It's not because you like it any better…" Residents' reappraisal of a landfill site. Journal of Environmental Psychology, 17, 229-241

Erdem, F., Ozen, O., (2003). Cognitive and affective dimensions of trust in developing team performance. Team Performance Management, 9, 5/6, 131-135

European Commission, Directorate General for Energy and Transport (2007), Attitudes on Issues Related to EU Energy Policy. Flash Eurobarometer 206a.

Ewings, P.D., Bowie, C., Phillips, M.J., & Johnson, S.A., (1989). Incidence of leukaemia in young people in the vicinity of Hinkley Point nuclear power station, 1959-86. British Medical Journal, 299, 289-293.

Fairweather, J., & Swaffield, S., (2001). Visitor experiences of Kaikoura New Zealand: an interpretive study using photographs of landscapes and Q-Method. Tourism Management, 22, 219-228.

Farber, D., & Weeks, J., (2001). A graceful exit? Decommissioning nuclear power. Environment, 43, 6, 7-21

Festinger, L., (1957). A Theory of Cognitive Dissonance. Stanford: Stanford University Press.

Field, A., (2000). Discovering Statistics Using SPSS for Windows. Sage: London

Finucane, M.L; Slovic, P; Mertz, C.K; Flynn, J & Satterfield, T.A. (2000), Gender, race and perceived risk: the 'White Male' effect. Health Risk & Society, 2, 159-172.

Fischer, G.W., Morgan, M.G., Fischhoff, B., Nair, I., & Lave, L.B., (1991), What risks are people concerned about? Risk Analysis 11, 303-314.

Fischhoff, (1989). Risk: a guide to controversy. Appendix C in: Improving Risk Communication. Washington, DC: National Academy Press

Fitchen, J.M., Heath, J.S., & Fessenden-Raden, J. (1987). Risk perception in community context: a case study. In B.B. Johnson & V. Covello, (Eds.) *The Social and Cultural Construction of Risk*. Dordrecht: Reidel.

Flynn, J., Burns, W, Mertz, C.K., & Slovic, P., (1992). Trust as a determinant of opposition to a high level radioactive waste repository: analysis of a structural model. Risk Analysis, 12, 417-429.

Flynn, J., Slovic, P., & Mertz, C.K., (1993). Decidedly different: expert and public views of risks from a radioactive waste repository. Risk Analysis, 13, 643-648.

Flynn, J; Slovic, P & Kunreuther, H (2001) (eds). Risk, Media and Stigma: Understanding Public Challenges to Modern Science and Technology. Earthscan: London

Foss, C., & Ellefson, B (2002), The value of combining qualitative and quantitative approaches in nursing research by means of method triangulation. Journal of Advanced Nursing, 40, 2, 242-248.

Freudenberg, W., & Davidson, D., (2007). Nuclear families and nuclear risk: the effects of gender, geography and progeny on attitudes towards a nuclear waste facility. Rural Sociology, 72, 2, 215-243

Freudenberg, W.R., & Baxter, R.K., (1984). Host community attitudes towards nuclear power plants: a reassessment. Social Science Quarterly, 65, 4.

Freudenberg, W.R., (1993). Risk and recreancy: Weber, the division of labour, the rationality of risk perceptions. Social Forces, 71, 909-932

Frewer, L.J., (1999). Risk perception, social trust, and public participation into strategic decision making: implications for emerging technologies. Ambio, 28, 569-574.

Frewer, L.J., Howard, C., Hedderley, D., & Sheppherd, R., (1996). What determines trust in information about food-related risks? Underlying psychological constructs. Risk Analysis, 16, 4, 473-485.

Gallup, (2007). Expanding the Use of Nuclear Energy. The Gallup Organisation, Princeton, New Jersey.

Gardner, G.T., & Gould, L.C., (1989). Public perceptions of the risks and benefits of technology. Risk Analysis, 9, 225-242

Garson, G.D., (2008). Statnotes: Topics in Multivariate Analysis - Discriminant Function Analysis. North Carolina State Univiersity Public Administration Programme. Available at: http://faculty.chass.ncsu.edu/garson/PA765/discrim.htm

Glaser, B.G., & Strauss, A.L. (1967). *The Discovery of Grounded Theory*. New York: Aldine de Gruyter.

Gowing, M., (1974). Britain and Atomic Energy 1939-45. London: MacMillan

Greenberg, M. (2009). Energy sources, public policy, and public preferences: Analysis of US national and site-specific data. Energy Policy, 37, 3242-3249

Greenberg, M. and Schneider, D. (1996) Environmentally devastated neighborhoods: perceptions, policies, and realities. Rutgers University Press, New Brunswick, NJ

Greenberg, M.R., & Williams, B., (1999). Geographical dimensions and correlates of trust. Risk Analysis, 19, 2, 159-169.

Greenaway, J., Smith, S & Street, J., (1992). Deciding Factors in British Politics: A Case Studies Approach. London: Routledge.

Gregory, R., & Satterfield, T., (2002). Beyond perception: the experience of risk and stigma in community contexts. Risk Analysis, 22, 347-358

Gregory, R., Flynn, J & Slovic, P., (1995). Technological Stigma. American Scientist, 83, 220-223

Gregory, R., Flynn, J., & Slovic, P (2001). Technological Stigma. In: Flynn, J; Slovic, P & Kunreuther, H (eds). Risk, Media and Stigma: Understanding Public Challenges to Modern Science and Technology. Earthscan: London

Groothius, P.A., & Miller, G., (1997). The role of social distrust in risk-benefit analysis: a study of the siting of a hazardous waste disposal facility. Journal of Risk and Uncertainty, 15, 241-257

Grove-White, R., Kearnes, M., Macnaughten, P., & Wynne, B., (2006), Nuclear Futures: Assessing public attitudes to new nuclear power. The Political Quarterly, 77, 2, 238-246

Guba, E.G. (ed), (1990). The Paradigm Dialog. Newbury Park: Sage

Hall, T., (1986). Nuclear Politics: The History of Nuclear Power in Britain. Harmondsworth: Engand: Penguin

Hammersley, M. & Atkinson, P., (2000). Ethnography: Principles in Practice (2nd Edition). Tavistock Publications: London.

Hammersley, M., (1996). The Relationship Between Qualitative and Quantitative Research: paradigm loyalty versus methodological eclecticism. In T.E. Richardson (ed), *Handbook of Qualitative Research Methods*. BPS Books: Leicester.

Hardeman, W., Johnston, M., Johnston, D. W., Bonetti, D., Wareham, N. J., Kinmouth, A. L. (2002). Application of the Theory of Planned Behaviour in behaviour change interventions: A systematic review. *Psychology and Health*. 17, 123-158.

Hay, R., (1998). Sense of place in developmental context. Journal of Environmental Psychology, 18, 5-29.

Hecht, G. (1998). *The Radiance of France: Nuclear Power and National Identity after World War II*. Cambridge, Mass: MIT Press.

Henrion, M., & Fischhoff, B., (1986). Assessing uncertainty in physical constants. American Journal of Physics, 54, 791-798

Henwood, K. & Pidgeon, N., (1992), Qualitative Research and Psychological Theorising. *British Journal of Psychology*, 83, 97-111.

Henwood, K., & Nicolson, P., (1995). Qualitative Research. *The Psychologist*, March 1995, p109-110.

Henwood, K., & Pidgeon, N., (2001). Talk about woods and trees: Threat of urbanisation stability and biodiversity. Journal of Environmental Psychology, 21, 125-147.

Henwood, K., Pidgeon, N., & Simmons, P., (2008). Risk, framing and everyday life: epistemological and methodological reflections from three socio-cultural projects. Health, Risk & Society, 10, 5, p.421–438.

Henwood, K., Pidgeon, N., Parkhill, K & Simmons, P., (2010). Researching risk: narrative, biography, subjectivity. Forum: Qualitative Social Research, 11, 1, Art.20.

Hernandez, B., Carmen Hidalgo, M., Esther Salazar-Laplace, M., 7 Hess, S., (2007). Place attachment and place identity in natives and non-natives. Journal of Environmental Psychology, 27, 310-319.

Hidalgo, M.C., & Hernandez, B., (2001). Place attachment: conceptual and empirical questions. Journal of Environmental Psychology, 21, 273-281

Hill, S. (1992). *Democratic Values and Technological Choices*. Stanford, California: Stanford University Press

Hirsch, E & O'Hanlon, M., (eds) (1995). The Anthropology of Landscape: Perspectives on Space and Place. Oxford: Oxford University Press.

Hitchcock, J. L., (2001), Gender differences in risk perception: broadening the contexts. Risk: Health, Safety and Environment, 12, 179-204.

HMSO, (1978). The Windscale Enquiry (The Parker Report). London: HMSO.

Hogg, M. A., (2007). Social identity and the group context of trust: managing risk and building trust through belonging. In Siegrist, M., Earle, T.C., & Gutscher, H., (Eds.) *Trust in Cooperative Risk Management: Uncertainty and Scepticism in the Public Mind.* London: Earthscan.

Hogg, M.A., & Vaughan, G.,M., (2002). Social Psychology 3rd Edition. London: Prentice Hall

Holdstock, D & Barnaby, F., (eds) (2003). The British nuclear weapons programme, 1952-2002. Routledge: London

Horlick-Jones, T., & Sime, J., (2004). Living on the border: knowledge, risk, and transdisciplinarity. Futures, 36, 441-456.

Howe, H., (1988). A comparison of actual and perceived residential proximity to toxic waste sites. Archives of Environmental Health, 43, 6, 415-419.

Howell, D., (2009). Treatment of missing data. Available at: http://www.uvm.edu/~dhowell/StatPages/StatHomePage.html

Howitt, D & Kramer, D., (2003). An Introduction to Statistics in Psychology, Revised 2nd Edition. Prentice Hall: London.

Hyman, I. Jr (1992). Multiple approaches to remembering. The Psychologist, 5, 10, October.

Hynes, M., & Vanmarcke, E., (1976). Reliability of embankment performance prediction. In: Proceedings of the ASCE Engineering Mechanics Division Speciality Conference, Waterloo, Ontario: University of Waterloo Press.

Ibitayo, O.O., & Pijawka, K.D., (1999). Reversing NIMBY: an assessment of state strategies for siting hazardous waste facilities. Environment and Planning, C: Government and Policy, 17, 379-389

Inhaber, H., (1982). Energy Risk Assessment. Gordon and Breach Science Publishers, New York.

Ipsos-MORI, (2006). Attitudes to the Nuclear Industry November 2005. Presentation by Robert Knight, January, 2006.
Available at: http://www.allparty-nuclear.org.uk/meetings/MORI%20presentation.pdf

Irwin, A., (1995). Citizen Science: A Study of People, Expertise, and Sustainable Development. Routledge: London:

Irwin, A., Simmons, P., & Walker, G. (1999). Faulty environments and risk reasoning: the local understanding of industrial hazards. *Environment and Planning A*, 31, 1311-1326.

Jackson, I & Jackson, S., (2006). Siting New Nuclear Power Stations: Availability and Options for Government. Discussion Paper for DTI Expert Group. Jackson Consulting (UK) ltd.

Jasanoff, S., (1993). Bridging the two cultures of risk analysis. Risk Analysis, 13, 2, 123-129.

Johnson, B.B. (1999). Exploring dimensionality in the origins of hazard related trust. *Journal of Risk Research*, 2, 325-354.

Johnson, B., & Slovic, P., (1995). Presenting uncertainty in health risk assessment: Initial studies of its effects on risk perception and trust. Risk Analysis, 15, 485-494

Johnson, B.B., & Chess, C. (2006). From the inside out: Environmental Agency views about communications with the public. *Risk Analysis*, 26, 1395-1407

Johnson, B.B. (2007). Getting Out of the Swamp: Toward Understanding Sources of Local Official's Trust in Wetlands Management. In Siegrist, M., Earle, T.C., & Gutscher, H., (eds) Trust in Cooperative Risk Management: Uncertainty and Scepticism in the Public Mind. London: Earthscan.

Jones, G.R., & George, J.M., (1998). The experience and evolution of trust: implications for cooperation and teamwork. Academy of Management Review, 23, 531-546

Jose, P.E., (2008). Moderation/Mediation Helpcentre. School of Psychology, Victoria University of Wellington.
http://www.victoria.ac.nz/psyc/paul-jose-files/helpcentre/help1_intro.php

Jungermann, H., Pfister, H.R & Fischer, K., (1996). Credibility, information preferences,and information interests. Risk Analysis, 16, 251-261

Kaatsch, P., Spix, C., Schulze-Rath, R., Schmiedel, S., & Blettner, M., (2007). Leukemia in young children living in the vicinity of Geman nuclear power plants. International Journal of Cancer, 1220, 721-726.

Kahan, D. M., Slovic, P., Braman, D., Gastil, J. and Cohen, G. L. (2007). Affect, Values, and Nanotechnology Risk Perceptions: An Experimental Investigation. Cultural Cognition Project Working Paper No. 22. available at: http://research.yale.edu/culturalcognition/content/view/117 on 25/05/2007.

Kaltenbourn, B.J., (1998). Effects of sense of place on responses to environmental impacts: a study among residents in Svalbard in the Norwegian high Arctic. Applied Geography, 18, 169-189

Kasperson, J.X, Kasperson, R.K., Pidgeon, N.F., & Slovic, P. (2003) The social amplification of risk: assessing fifteen years of theory and research. In N.F. Pidgeon, R.K. Kasperson & P. Slovic (eds.) *The Social Amplification of Risk*. Cambridge: Cambridge University Press, pp 13-46.

Kasperson, R.E., Golding, D., & Tuler, S., (1992). Siting hazardous facilities and communicating risks under conditions of high social distrust. Journal of Social Issues, 48, 161-187.

Kasperson, R.E., Kasperson, J.X., & Renn, O., (1992), The social amplification of risk progress in developing an integrative framework. In: In S. Krimsky & D. Golding (eds), Social Theories of Risk. New York: Praeger

Kasperson, R.E., Renn, O., Slovic, P., Brown, H.S., Emel, J., Goble, R., Kasperson, J.X., & Ratick, S., (1988). The Social Amplification of Risk. A Conceptual Framework. Risk Analysis, 8, 2, 177-187

Kay, J., (2001). Meetings of Closed Minds. The Financial Times, 28th November

Kempton, W., Firestone, J., Lilley, J., Rouleau, T. & Whitaker, P., (2005). The offshore wind power debate: views from Cape Cod. Coastal Management, 33, 2, 119-149

Kline, P. (1994). *An Easy Guide to Factor Analysis*. London: Routledge

Knez, I., (2005). Attachment and identity as related to a place and its perceived climate. Journal of Environmental Psychology, 25, 207-218

Knight, R., (2005), What the Polls Tell Us. Nuclear Engineering International, April 2005, 24-25

Kopytoff, I., (1986). The Cultural Geography of Things: Commoditisation as a Process. In A. Appadurai (ed), The Social Life of Things: Commodities in Cultural Perspective. Cambridge: Cambridge University Press.

Korpela, K.M., Hartig, T., Kaiser, F.G., & Fuhrer, U., (2001). Environment & Behaviour, 33, 572-589

Korpela, K.M., (1989). Place identity as a product of environmental self-regulation. Journal of Environmental Psychology, 9, 241-256

Korpela, K.M., (1992). Adolescents' favourite places and environmental self-regulation. Journal of Environmental Psychology, 12, 249-258.

Kraft, M.E., & Clearey, B.B., (1993). Public testimony in nuclear waste respository hearings: a content analysis. In: R. Dunlap, M.Craft & & E. Rosa, Public Reactions to Nuclear Waste: Citizens' Views of Repository Siting. P89-114. Durham, NC: Duke University Press.

Krannich, R., Little, R., & Cramer, L., (1993). Rural community residents 's views of nuclear waste repository siting in Nevada. In: R. Dunlap, M.Craft & & E. Rosa, Public Reactions to Nuclear Waste: Citizens' Views of Repository Siting. P263-290. Durham, NC: Duke University Press.

Kuklinski, J.H., Metlay, D.S., Kay, W.D. (1982), "Citizen knowledge and choices on the complex issue of nuclear energy", *American Journal of Political Science*, Vol. 26 No.4, 615-42.

Lalli, M., (1992). Urban related identity: Theory, measurement and empirical findings. Journal of Environmental Psychology, 12, 285-303

Langford, I.H., (2002). An existential approach to risk perception. Risk Analysis, 22, 1, 101-120.

La Porte, T. R. and Metlay, D.S., (1996). Hazards and Institutional Trustworthiness: Facing a Deficit of Trust. Public Administration Review, 56, 4, 341-347.

Layton, D., Jenkins, E., Macgill, S., & Davey, A., (1993). Inarticulate Science – Perspectives in the Public Understanding of Science and Some Implications for Science Education. Studies in Education, Driffield).

Lazarus, R.S., & Folkman, S., (1984). Stress, Appraisal and Coping. New York: Springer.
Lee, C., (1989), Perception of immunity to disease in adult smokers, Journal of Behavioural Medicine, 12, 3, 267-277

Leake, J., (2005) The Nuclear Charm Offensive. New Statesman, 23rd May, 2005. *Available at*: http://www.newstatesman.com/200505230004).

Lee, T.R., (1995). Social and psychological consequences of the Chernobyl Accident: an overview of the first decade. Paper presented at the International Conference of the Chernobyl and other Radiological Accidents, Geneva.

Leiserowitz, A., Maibach, E., & Roser-Renouf, C., (2010). Climate Change in the American Mind: Americans' Global Warming Beliefs and Attitiudes in January 2010. Yale University and George Mason University. New Have: CT. Yale Project on Climate Change. http://environment.yale.edu/uploads/AmericansGlobalWarmingBeliefs2010.pdf

Levi, M., (1996). Social and unsocial capital: a review essay of Robert Putman's Making Democracy Work. Politics and Society, 24, 45-55.

Levin, I. P., Schneider, S. L. and Gaeth, G. J. (1998). All frames are not created equal: A typology and critical analysis of framing effects. Organizational behaviour and human decision processes.76, 149-188.

Levine J. M., & Moreland, R. L., (1998). Small groups. In D. Gilbert, S. Fiske, & G. Lindzey (Eds.), *Handbook of social psychology (4th. ed., Vol. 2, pp. 415-469).* Boston: McGraw-Hill.

Levine, M.S., (1977). Canonical Analysis and factor Comparison. Quantitative Applications in the Social Sciences. Sage University Press: London.

Lewicka, M., (2008). Place attachment, place identity and place memory: restoring the forgotten city past. Journal of Environmental Psychology, 28, 209-231.

Lewicki, R., AcAllister, D., & Bies, R., (1998). Trust and distrust: new relationships and realities. Academy of Management Review, 23, 438-458.

Lima, M., (2004). On the influence of risk perception on mental health: living near an incinerator. Journal of Environmental Psychology, 24, 71-84.

Lima, M.L., & Marques, S., (2005). Towards successful social impact assessment follow-up: a case study of psychosocial monitoring of a solid waste incinerator in the North of Portugal. Impact Assessment and Project Appraisal, 23, 3, 227-233

Lippard, L., (1997). The Lure of the Local. Senses of Place in a Multicultural Society. The New Press: New York.

Lofsted, R., (2001). Trust and the nuclear power industry. Environment, 43, 7, 41-43.

Lovell, N (ed) (1998). Locality and Belonging. London: Routledge

Luginaah, I.N., Martin Taylor, S., Elliott, S.J. & Eyles, J.D., (2002). Community responses and coping in the vicinity of a petroleum refinery in Oakville, Ontario. Health and Place, 8, 177-190

Luhmann, N., (1979). Trust and Power: Two works by Nicklas Luhmann. John Wiley & Sons, Chichester.

Luhmann, N., (1980). Trust and Power. New York: Wiley.

Luoma-Aho, V., & Vos, M., (2009). Monitoring the complexities: Nuclear power and public opinion. Public Relations Review, 35, 120-122.

MacGill, S. (1987). *Sellafield's Cancer-link Controversy: The Politics of Anxiety*. London: Pion Press.

Maderthaner, R., Guttman, G., Swaton, E., & Otway, H.J., (1978). Effect of distance on risk perception. Journal of Applied Psychology, 63, 3, 380-382.

Mah, A., (2009). Devastation but also home: place attachment in areas of industrial decline. Home Cultures, 6, 3, 287-310.

Marko, P., Kos, D., & Zeleznik, N., (2009). Nuclear objects risk perception and their siting. *presentation at*: SRA-Europe Conference, 28 June-1 July, 2009, Karlstad, Sweden.

Massey, D., (1993). Space, Place & Gender. Cambridge: Polity Press.

Mattson, D.J., Byrd, K.L., Rutherford, M.B., Brown, S.R., & Clark, T.W.(2006). Finding common ground in large carnivore conservation: Mapping contending perspectives. Environmental Science & Policy, 9, 3, 92-405.

Mayer, R.C., Davis, J.H., & Schoorman, F.D., (1995). An integrative model of organisational trust. Academy of Management Review, 209, 3, 709-734

McAllister, D.J., (1995). Affect- and cognition-based trust as foundations for interpersonal cooperation in organisations. Academy of Management Review, 38, 1, 24-59.

McFarland, S.G., (1981). Effects of question order on survey responses. Public Opinion Quarterly, 45, 208-215

McGowan, A.H., (2001). A future without nuclear? Environment, 43, 6, 1

McGowan, F., & Sauter, R., (2005), Public Opinion on Energy Research: A Desk Study for the Research Councils. SPRU, University of Sussex.

McHugh, K.E., & Mings, R.C., (1996). The circle of migration: attachment to place in aging. Annals of the Association of American Geographers, 86, 3, 530-550

McKeown, B., & Thomas, D. (1988). *Q Methodology: Quantitative Applications in the Social Sciences No. 66*. Thousand Oaks, CA: Sage.

McKnight, D.H, & Chervany, N.L., (1996). The Meanings of Trust (MISRC Working Paper Series 96-04): Management Information Systems Research Center.

Melber, B.D., Nealey, S.M., Hammersla, J., & Rankin, W.L., (1977). Nuclear Power and the Public: Analysis of Collected Survey Research. Batelle Memorial Institute, Human Affairs Research Centers, Seattle, Washington.

Metlay, D., (1999). Institutional Trust and Confidence: a journey into a conceptual quagmire. In: G.T. Cvetkovich & R.T. Lofsted (eds), Social Trust and the Management of Risk. London: Earthscan.

Mishra, A., (1996). Organisational Responses to Crisis: the centrality of trust. In R.M. Kramer & T.R., Tyler, (eds), Trust in Organisations: frontiers of theory and research. London: Sage.

Moran-Ellis, J., Alexander, V., Cronin, A., Dickinson, M., Fielding, J., Sleney, J., & Thomas, H., (2006), Triangulation and Integration: processes, claims and implications. Qualitative Research, 6, 45, 45-59.

Moscovici, S. (2000). Social representations: Explorations in social psychology. London: Polity Press.

Nacci, P., Stapleton, R.E., & Tedeschi, J.T., (1973). An empirical restatement of the reciprocity norms. Journal of Social Psychology, 91, 263-271.

Nash, N., (2008). Future issues in socio-technical change for UK citizenship: the importance of 'place'. *Beyond current horizons: technology, children, schools & families*. 1-14.

Nash, N.,. Lewis, A & Griffin, C., (2009). Not in our front garden: Land use conflict, spatial meaning and the politics of naming place. Journal of Community and Applied Psychology, 19, 1-13.

Nash, R., (2002), Numbers and narrarives: further reflections in the sociology of education. British Journal of Sociology of Education. 23, 3, 397-412.

Nealey, S., Melber, B., & Rankin, W., (1983). Public Opinion and Nuclear Energy. Lexington, MA: Lexington Books.

Niemeyer, S., Petts, J., & Hobson, K. (2005). Rapid climate change and society: assessing responses and thresholds. *Risk Analysis*, 25, 1443-1456.

Nuclear Industry Association (2010). News Release: NIA/Polling 2010, 2nd December 2010.

O'Brien, E.A., (2005). Publics and woodlands in England: well-being, local identity, social learning, conflict and management. Forestry, 78, 4, 321-336.

O'Byrne, P., (2007). The Advantages and Disadvantages of Mixing Methods. An Analysis of Combining Traditional and Autoethnographic Approaches. *Qualitative Health Research*, 17, 1381-1391.

Olsen, J., & Zanna, M., (1994). Attitudes and attitude change. Annual Review of Psychology, 44, 117-154

Otway, H., Maurer, D., & Thomas, K., (1978). Nuclear Power: the question of public acceptance. Futures, 10, 109-118

Otway, H.J., & Fishbein, M., (1976). The determinants of attitude formation in application to nuclear power (RM 76.80). Laxenberg, Austria: International Institute for Applied Systems Analysis.

Otway, H.J., & Fishbein, M., (1977). Public attitudes and decision making (RM 77.54). Laxenburg, Austria: International Institute for Applied Systems Analysis

Otway, H.J., & von Winterfeldt, D., (1982). Beyond Acceptable Risk: On the social acceptability of technologies. Policy Sciences, 14, 247-256

Page, A. L. & Hood, T., (1981). Attitude Change Among Teachers in U.S. Department of Energy Educational Workshops. *Journal of Social Psychology,* 115, 183-188.

Parkhill, K., Henwood, K, Pidgeon, N., Simmons, P. & Venables, D., (2009). From the familiar to the extraordinary: local residents' perceptions of risk when living with nuclear power in the UK. Transactions of the Institute of British Geographers, 35(1), 39 – 58

Parliamentary Office of Science and Technology (2007), Public Opinion on Electricity Options. Postnote, October 2007, no.294.

Patomaki, H., & Wight, C., (2000). After Postpositivism? The Promises of Critical Realism. International Studies Quarterly, 44, 213-237.

Pelletier, L.G., & Sharp, E., (2008). Persuasive communication and proenvironmental behaviours: how message tailoring and message framing can improve the integration of behaviours throughself-determined motivation. Canadian Psychology, 49, 3, 210-217.

Peters, R.G., Covello, V.T., & McCallum, D.B., (1997). The determinants of trust and credibility in environmental risk communication: an empirical study. Risk Analysis, 17, 1, 43-54.

Pew Research Centre for the People and the Press. (2009). *Fewer Americans See Solid Evidence of Global Warming.* Available from http://people-press.org/report/556/global-warming

Pidgeon, N.F., Lorenzoni, I & Poortinga, W., (2008b), Climate change or nuclear power - No thanks! A quantitative study of public perceptions and risk framing in Britain. Global Environmental Change, 18, 69-85

Pidgeon, N; Hood, C; Jones, D; Turner, B; and Gibson, R., (1992), Risk Perception. In Risk Analysis, Perception and Management: Report of a Royal Society Study Group, 1992, London, The Royal Society, pp 89-134.

Pidgeon, N. F., Henwood, K. L., Parkhill, K. A., Venables, D. and Simmons, P., (2008a). Living with Nuclear Power in Britain: a Mixed-methods Approach. Summary Findings Report: 30th September 2008. Available at: http://www.understanding-risk.org/

Horlick-Jones, Sime, J,. & Pidgeon, N., (2003). The Social Dynamics of Environmental Risk Perception: implications for risk communication research and practice. In: Pidgeon, N., Kasperson, R. & Slovic, P., 'The Social Amplification of Risk'. Cambridge Univeristy Press: Cambridge.

Pidgeon, N., Simmons, P & Henwood, K., (2006). Risk, Environment and Technolgy. In: Taylor-Gooby, P & Zinns, J., 'Risk in Social Science'. Oxford University Press: Oxford.

Pijawka, K.D., & Muchkatel, A.H., (1991/1992). Public opposition to the siting of the high level nuclear waste repository: the importance of trust. Policy Studies Review, 10, 180-194

Pomiankowski, A (1984). Cancer incidence at Sellafield. Nature, 311, p100.

Poortinga (2004). Public Perceptions and Trust in the Regulation of Genetically Modified Food. Unpublished PhD Thesis. Cardiff University.

Poortinga, W. & Pidgeon, N., (2003). Exploring the dimensionality of trust in risk regulation. Risk Analysis, 23(5), 961-972.

Poortinga, W., Bickerstaff, K., Langford, I., Niewöhner, J. and Pidgeon, N.F. (2004a) . The British 2001 foot and mouth crisis: A comparative study of public risk perceptions, trust and beliefs about government policy in two communities, *Journal of Risk Research*, 7(1), 73-90.

Poortinga, W., & Pidgeon, N.F., (2004). Trust, the asymmetry principle, and the role of prior beliefs. Risk Analysis, 24, 1475-1486

Poortinga, W., & Pidgeon, N.F., (2005). Trust in risk regulation: cause or consequence of the acceptability of GM food? Risk Analysis, 25, 197-207

Poortinga, W., & Pidgeon, N.F., (2006). Prior attitudes, salient value similarity, and dimensionality: towards an integrative model of trust in risk regulation. Journal of Applied Social Psychology, 36, 7, 1674-1700

Poortinga, W., Pidgeon, N., & Lorenzoni, I., (2006). Public Perceptions of Nuclear Power, Climate Change and Energy Options in Britain: Summary Findings of a Survey Conducted in October and November 2005. Understanding Risk Working Paper 06/02, School of Environmantal Science, University of East Anglia.

Poortinga, W., Cox, P., & Pidgeon, N.F., (2008). The perceived health risks of indoor radon gas and overhead power lines: a comparative multilevel approach. Risk Analysis, 28, 1, p.235-248

Pred, A., (1983). Structuration and place: on the becoming of sense of place and structure of feeling. Journal for the Theory of Social Behaviour, 13, 45-68.

Pretty, G.H., Shipuer, H.M., & Bramston, P., (2003). Sense of place amongst adolescents and adults in two rural Australian towns: the discriminating features of place attachment, sense of community and place dependence in relation to place identity. Journal of Environmental Psychology, 23, 273-287.

Prohansky, H.M., Fabian, A,K., & Farminoff, R., (1983). Place identity: physical world socialisation of the self. Journal of Environmental Psychology, 3, 57-84.

Punch, K., (2005), Introduction to Social Research Qualitative and Quantitative Methods (2nd edition). London: Sage.

Putnam, R., (1993). Making Democracy Work: Civic Traditions in Modern Italy. Princeton University Press, Princeton: NJ.

Putnam, R., (1995). Bowling alone: America's declining social capital. Journal of Democracy, 6, 1, 65-78

Qiaoming, A.L., Ryan, V., Aurbach, H., & Besser, T., (1998). The influence of local church participation on rural community attachment. Rural Sociology, 63, 3, 432-450

Ravetz, J., (2008). Nuclear Uncertainty. In: P. Dorfman (ed), Nuclear Consultation: Public Trust in Government. Nuclear Consultation Working Group. Joseph Rowntree Charitable Trust. p 24-25.

Reason, J., (1987). The Chernobyl errors. Bulletin of the British Psychological Society, 40, 201-206.

Relph, R., (1976). Place and Placelessness. London: Pion

Renn, O., & Levine, D., (1991). Credibility and Trust in Risk Communication. In R.E. Kasperson & P.J.M. Stallen (eds), Communicating Risks to the Public. Kluwer, Dordrecht, The Netherlands, 175-218.

Renn, O., (1992). The Social Arena Concept of Risk Debates. In: S Krimsky & D. Goulding (eds), Social Theories of Risk. New York: Praeger.

Robbins, P., & Kreuger, R., (1999), Beyond Bias? The promise and limits of Q Method in human geography. Professional Geographer, 52, 636-648

Rosa, E.A., & Clark Jr, D.L., (1999), Historical Routes to Technological Gridlock: Nuclear Technology as Prototype Vehicle. Research in Social Problems and Public Policy, 7, 21-57.

Rosa, E.A., (2007) The Public Climate for Nuclear Power: The Changing of Seasons. The Role of Nuclear Power in Global and Domestic Energy Policy: Recent Developments and Future Expectations. Howard H. Baker Jn. Center for Public Policy.

Rosa, E.A., (2004). The Future Acceptability of Nuclear Power in the United States. Institute Francais des Relations Internationales, Paris

Rosa, E.A., (2005), Déjà vu all over again for nuclear power? (Letter), Science, 310, 5748, 619.

Rose, G., (1993). Feminism and Geography: The Limits of Geographical Knowledge. Polity; Cambridge.

Rose, G., (1995). Place and Identity: A Sense of Place. In: D. Massey & P Jess (eds), A Place in the World? Oxford: Oxford University Press.

Rowles, G.D., (1983). Place and personal identity in old age: Observations from Appalachia. Journal of Environmental Psychology, 3, 299-313.

Rummel, R., (1970). Applied Factor Analysis. Evanston, Northwestern University Press

Sale, J.E.M., Lohfeld, L.H., & Brazil, K., (2002), Revisiting the quantitative-qualitative debate: implications for mixed methods research. Quality and Quantity, 36, 1, 43-53

Satterfield, T., (1996). Pawns, Victims, or Heroes: The Negotiation of Stigma and the Plight of Oregon's Loggers. Journal of Social Issues, Volume 52, 1, p71–83.

Satterfield, T., (2001). In search of value literacy: suggestions for the elicitation of environmental values. Environmental Values, 10, 33-359

Schluter, A, Phillmore, P & MoffattS., (2004). Enough is enough: Emerging ‘self help’ environmentalism in a petrochemical town. Environmental Politics, 13, 4, 715-733.

Schuman, H., Presser, S & Ludvig, J., (1981). Context effects on survey responses to questions about abortion. Public Opinion Quarterly, 45, 216-233.

Schwartz, S., (1992). Universals in the content and structure of values: theoretical advances and empirical tests in 20 countries. Advances in Experimental Social Psychology, 25, 1-65.

Sustainable Development Committee, (2006). The Role of Nuclear Power in a Low Carbon Economy. Sustainable Development Commission, London.

Shamia, S., (1991). Sense of place: an empirical measurement. Geoforum, 24, 3, 347-358.

Shapiro, S.P., (1987). The social control of impersonal trust. American Journal of Sociology 93(3), 623-658.

Sheppard, B.H., & Sherman, D.M., (1998). The grammars of trust: a model and general implications. Academy of Management Review, 23, 3, 422-437.

Sherif, M. & Hovland, C.I., (1961). Social Judgement: Assimilation and contrast effects in communication and attitude change. New Haven, CT: Yale University Press.

Showers, D & Shrigley, R., (1995). Effects of knowledge and persuasion on high-school students' attitudes toward nuclear power plant. Journal of Research in Science Teaching, 32, 1, 29-43.

Sider, D., (1994). A cross sectional survey of community health effects in the vicinity of Petro Canada Oakville Refinery. Unpublished Master of Science Dissertation, McMaster University.

Siegrist, M., & Bulhman, R., (1999). Perception of different applications of gene technology: results of an MDS analysis. Zeitschrift fur Sozialpsychologie, 30, 32-39.

Siegrist, M., Earle, T.C., & Gutscher, H., (2003). Test of a trust and confidence model in the applied context of electromagnetic field (EMF) risks. Risk Analysis, 23, 705-716.

Siegrist, M., Cvetkovich, G., & Roth, C., (2000). Salient value similarity, social trust, and risk/benefit perception. Risk Analysis, 20, 353-362

Siegrist, M., Cvetkovich, G.T., & Gutscher, H., (2001). Shared values, social trust, and the perception of geographic cancer clusters. Risk Analysis, 21, 1047-1053.

Siegrist, M., Gutscher, H., & Earle, T.C., (2005). Perception of risk: the influence of general trust and general confidence. Journal of Risk Research, 8, 2, 145-156.

Simmons, P. (2004). Performing safety in faulty environments. In: Szerszynski, B., Waterton, C., & Heim, M. (Eds.), *Performing Nature*. London: Sociological Review Monographs.

Simmons, P., & Walker, G., (1999). Tolerating Risk: policy principles and public perceptions. Risk Decision and Policy, 4, 3, 179-190

Simmons, P., & Walker, G., (2004). Living with Technological Risk: Industrial Encroachment on Sense of Place. In: Asa Boholm & Ragnar Lofsted (eds), Facility Siting: Risk, Power and Identity in Land Use Planning. Earthscan: London

Simmons, P., & Wheldon, S., (2000). The GM controversy in Britain: actors, arenas and institutional change. Politeia, 16, 6, 53-67

Simon, S (2002). Log Transformation. *available at*: http://www.childrensmercy.org/stats/model/log.asp

Sjoberg, L & Drottz-Sjoberg, B., (1994). Risk perception of nuclear waste: experts and the public. RHIZIKON: Risk Research Report, 16, Centre for Risk Research, Stokholm, School of Economics.

Sjoberg, L., & Wester-Herber, M., (2008). Too much trust in (social) trust? The importance of epistemic concerns and perceived antagonism. International Journal of Global Environmental Issues, 8, 1/2, 30-44.

Sjoberg, L., (2000). Factors in risk perception. Risk Analysis, 20, 1, 1-11.

Sjoberg, L., (2004a). Local Acceptance of a high-level nuclear waste repository. Risk Analysis, 24, 3, 737-749.

Sjoberg, L., (2004b). Explaining individual risk perception: the case of nuclear waste. Risk Management: An International Journal, 6, 1, 51-64.

Sjoberg, L., (2008). Antagonism, trust, and perceived risk. Risk Management: an International Journal, 10, 32-55.

Slovic, P., B. Fischhoff, and S. Lichtenstein, (1980). Facts and Fears. In R. C. Schwing and W.A. Albers (eds), Societal Risk Assessment. Plenum Press, New York, NY.

Slovic, P., (1987). Perception of risk. Science, Wash. 236, 280-285

Slovic, P., (1992), Perceptions of Risk: Reflections on the psychometric paradigm. In D. Golding and S. Krimsky (Eds.), Theories of Risk (pp117-152), New York: Praeger.

Slovic, P., (1993). Perceived risk, trust and democracy. Risk Analysis, 13, 675-682

Slovic, P., (1996). Perception of risk from radiation. Radiation Protection Dosimetry, 68, 165-180.

Slovic, P. (1999), Trust, Emotion, Sex, Politics and Science: Surveying the Risk Assessment Battlefield. Risk Analysis, 19, 4, 689-701.

Slovic, P., Finucane, M., Peters, E., & McGregor, D.G., (2002a). In: T. Gilvovich, D. Griffin, & D.Kahneman (eds). Heuristics and Biases: The Psychology of Intuitive Judgement (p397-420). New York: Cambridge University Press.

Slovic, P., Finucane, M., Peters, E., & McGregor, D.G., (2002b). Risk as analysis and risk as feelings: some thoughts about affect, reason, risk, and rationality. Paper presented at the Annual Meeting of the Society for Risk Analysis, New Orleans, Louisiana, December 10, 2002.

Slovic, P., Fischhoff, B., & Lichenstein, S., (1980). Facts and Fears: Understanding Perceived Risk. In R.C. Schwing & W.A. Albers (eds), Societal Risk Assessment: How safe is safe enough? New York: Plenum Press.

Slovic, P., Layman, M & Flynn, J., (1993). Perceived Risk, Trust, and Nuclear Waste: Lessons from Yucca Mountain. In: R. Dunlap, M.Craft & & E. Rosa, Public Reactions to Nuclear Waste: Citizens' Views of Repository Siting. p.64-89. Durham, NC: Duke University Press

Slovic, P., Flynn, J.H., Mertz, C.K., Poumadere, M & Mays, C., (2000). Nuclear Power and the Public: a comparative study of risk perceptions in France and the United States. In O. Renn & B. Rohrmann (eds), Cross-Cultural Risk Perception: A survey of Empirical Studies (p55-102), Dordrecht: Kluwer.

Slovic, P., Layman, M., Kraus, N., Flynn, J., Chalmers, J & Gesell, G (2001). Perceived risk, Stigma and potential economic impacts of a high-level nuclear waste repository in Nevada. In: Flynn, J; Slovic, P & Kunreuther, H (eds). Risk, Media and Stigma: Understanding Public Challenges to Modern Science and Technology. Earthscan: London

Sovacool, B.K., (2009). Valuing the greenhouse gas emissions from nuclear power: a critical survey. Energy Policy 36, 8, 2940-2953.

Spence, A., Venables, D., Pidgeon, N., Poortinga, W. and Demski, C., (2010). Public Perceptions of Climate Change and Energy Futures in Britain: Summary Findings of a Survey Conducted in January-March 2010. Technical Report (Understanding Risk Working Paper 10-01). Cardiff: School of Psychology.

Spies, S., Murdoch, S.H, White, S., Krannich, R, Wulfhorst, J.D., Wrigley, K., Leistritz, F.L., Sell, R., & Thompson, J., (1998). Support for waste facility siting: differences between community leaders and residents. Rural Sociology, 63: 65-93.

Stainton-Rogers, R. (1995). Q-methodology. In J.A. Smith, R. Harré & L. van Langenhofe, (Eds.) *Rethinking Methods in Psychology*, London: Sage.

Stainton Rogers, R., & Stainton Rogers, W., (1990). What the Brits got out of the Q: And why their work may not line up with the American way of getting into it! The Electronic Journal of Communication, 1, 1.
Available at: http://www.cios.org/EJCPUBLIC/001/1/00113.html

Stedman, R.C. (2002). Towards a social psychology of place: predicting behavior from place-based cognitions, attitude, and identity. Environment and Behavior 34:561-581.

Steelman, T., & McGuire, L., (1999). Understanding participant perspectives: Q-methodology in national forest management. *Journal of Policy Analysis and Management*, 18, 361-388.

Stenner, P and Stainton-Rogers, R (2004). Q methodology and qualiquantology: the example of discriminating between emotions. In: Todd, Z and Nerlich, B and McKeown, S and Clarke, DD, (eds.) Mixing methods in psychology: the integration of qualitative and quantitative methods in theory and practice. Psychology Press: New York.

Stoffle, R., Traugott, M., Stone, J., McIntyre, P., & Jensen, F., (1991). Risk Perception Mapping: Using Ethnography to define the locall affected population for a low-level radioactive waste storage facility in Michegan. American Anthropologist, 93, 3, 611-635.

Suhr, D., (2005). Principle Component Analysis vs. Exploratory Factor Analysis. Proceedings from the SAS Users Group International (SUGI) 30, April 10-13, 2005, Philadelphia, Pennsylvania. SAS Global Forum, SAS Institute. *Available at:* www.psych.wisc.edu/henriques/pca.html*).*

Tabachnick, B.G., & Fidell, L, S., (1996). Using Multivariate Statistics, 3rd Edition. Harper Collins: NewYork

Tabachnick, B.G., & Fidell, L, S., (2001). Using Multivariate Statistics, 4th Edition. Harper Collins: NewYork

Taylor, D.M., Moghaddam, F.M., Gamble, I., & Zellerer, E., (1987). Disadvantaged group responses to perceived inequality: from passive acceptance to collective action. Journal of Social Psychology, 127, 259-272.

Taylor, S.M., Elliott, S., Eyles, J., Frank, J., Haight, M., Streiner, D., Walter, S., Norman, W., & Willms, D., (1991). Psychosocial impacts in populations exposed to solid waste facilities. Social Science and Medicine 33, 4, 441-447.

The Daily Telegraph (2008). Nuclear plant concerns for local residents. http://www.telegraph.co.uk/science/science-news/3352579/Nuclear-plant-concerns-for-local-residents.html

The Guardian (2010). 'UK government approves eight sites for new nuclear power stations' 18 October 2010. http://www.guardian.co.uk/environment/2010/oct/18/uk-government-new-nuclear-power

The Independent (1999). "BNFL hit by claims that it faked tests on atom fuel for Japan power station" 30th September, 1999. *available at*: http://www.independent.co.uk/news/bnfl-hit-by-claims-that-it-faked-tests-on-atom-fuel-for-japan-power-station-1123129.html

Tuan, Yi-Fi (1977). Space and Place: The Perspective of Experience. University of Minnesota Press, Minneapolis.

Tuan, Yi-Fi, (1991). Language and the making of place: a narrative-descriptive approach. Annals of the Associations of American Geographers, 81, 684-696.

Tuler, S., Webler, T., & Finson, R. (2005). Competing perspectives on public involvement: planning for risk characterisation and risk communication about radiological contamination from a national laboratory. *Health, Risk & Society*, 7, 247-266.

Tulloch J., & Lupton, D., (2003). Risk and everyday Life. Sage Publications: London.

Tversky, A., & Kahneman, D., (1973). Availability: a heuristic for judging frequency and probability. Cognitive Psychology, 4, 207-232

Tversky, A., & Kahneman, D., (1974). Judgement under uncertainty: heuristics and biases. Science, 185, 1124-1131.

Tweena, M., (2006), Nuclear Energy: Rise, Fall and Ressurection. CICERO Working Paper 2006: 01.

Twigger-Ross, C.,& Uzzell, D.L., (1996). Place and identity processes. Journal of Environmental Psychology, 16, 205-220

Twigger-Ross, C.L., Bonaiuto, M, & Breakwell, G., (2003). Identity theories and environmental psychology. In: M. Bonnes, T. Lee & M. Bonaiuto (eds), Psychological Theories for Environmental Issues (p203-233). Aldershot: Ashgate Publishing Limited.

Tyler, T.R., & Degoey, P., (1996). Trust in Organisational Authorities. In: R.M. Tyler & T.R. Kramer (eds), Trust in Organisations. Frontiers of Theory and Research. London: Sage.

United States Nuclear Regulatory Commission (2009). Three Mile Island Accident Factsheet. Available at: www.nrc.gov/reading-rm/doc-collections/fact-sheets/3mile-isle.html van der Horst, D., (2007). NIMBY or not? Exploring the relevance of location and the politics of voiced opinions in renewable energy siting controversies. Energy Policy, 35, 2705-2714

van der Pligt, J., (1992), Nuclear Energy and the Public. Blackwell, Oxford.

van der Pligt, J., van der Linden, J., & Ester, P., (1982). Attitudes to nuclear energy: Beliefs, values, and false consensus. Journal of Applied Social Psychology, 2, 221-231

van der Pligt, J., Eiser, J.R. & Spears, R (1986). Construction of a nuclear power station in ones locality: attitudes and salience. *Basic and Applied Social Psychology* 7, 1-15.

Van Exel, J., de Graaf, G., & Brouwer, W. (2008). Give me a break! Informal caregiver attitudes towards respite care. Health Policy 88, 73-87

van Patten, S.R., & Williams, D.R., (2008), Problems in place: using discursive social psychology to investigate the meanings of seasonal homes. Leisure Sciences, 30, 448-464

Venables, D., & Pidgeon, N., (2007). Gender and Risk: Still Seeking Explanation. *Understanding Risk Research Group Working Paper*. School of Psychology, Cardiff University.

Venables, D., Pidgeon, N., Simmons, P., Henwood, K., & Parkhill, K., (2009). Living with Nuclear Power: A Q-Method Study of Local Community Perceptions. Risk Analysis, 29, 8, 1089-1104

Viklund, M., & Sjöberg, L. (2008). An expectancy-value approach to determinants of trust. Journal of Applied Social Psychology, 38, 294-313.

Vignoles, V.L., Chryssochoou, X., & Breakwell, G.M., (2000). The distinctiveness principle: identity, meaning, and the bounds of cultural relativity. Personality and Social Psychology Review, 4, 337-354.

Vlek, C.J.H., & Keren, G., (1991). Behavioural decision theory and environmental risk management: what have we learned and what has been neglected? Paper presented at the 13th research conference on subjective probability, utility and decision making. Fribourg, Switzerland, August.

Vlek, C.J.H., & Stallen, P.J.M, (1981). Judging risks and benefits in the small and in the large. Organisational Behaviour and Human Performance, 28, 235-271

Vorkinn, M. & Riese, H., (2001). Environmental concern in a local context: the significance of place attachment. Environment & Behaviour, 33, 2, 249-263

Wai-chung Yeung, H., (1997), Critical realism and realist research in human geography: a method or a philosophy in search of a method. Progress in Human Geography, 21, 1, 51-74.

Wakefield, S., & Elliot, S.J., (2000). Environmental risk perception and well-being: effects of the landfill siting process in two southern Ontario communities. Social Science and Medicine, 50, 1139-1154.

Wakefield, S.E.L., Elliott, S.J., Cole, D.C., & Eyles, J.D., (2001). Environmental risk and (re)action: air quality, health, and civic involvement in an urban industrial environment. Health and Place, 7, 163-177.

Wakeford, R., (2007), The Windscale reactor accident – 50 years on, *Journal of Radiological Protection* **27** (3) (2007), pp. 211–215

Walker, G., Simmons, P., Irwin, A & Wynne, B., (1998). Public Perception of Risks Associated with Major Accident Hazards. Research Report Series 194/98, Sudbury: HSE Books.

Walls, J., Pidgeon, N., Weyman, A., & Horlick-Jones, T., (2004). Critical trust: understanding lay perceptions of health and safety risk regulation. Health, Risk & Society, 6, 2, 133-150.

Wardman, J., (2006). Toward a critical discourse on affect and risk perception. Journal of Risk Research, 9, 2, 109-124.

Watts, S., & Stenner, P., (2005). Doing Q methodology: theory, method and interpretation. *Qualitative Research in Psychology*, 2, 67-91.

Wester-Herber, M., (2004). Underlying concerns in land-use conflicts – the role of place identity in risk perception. Environmental Science and Policy, 7, 109-116

White, M.P., Pahl, S., Buehner, M. & Haye, A., (2003). Trust in risky messages: the role of prior attitudes. *Risk Analysis*, 23, 717-726.

White, M.P., & Eiser, J.R., (2006). Marginal trust in risk managers: building and losing trust following decisions under undertainty. Risk Analysis, 26, 1187-1203.

White, M.P., & Eiser, J.R., (2007). A Social Judgement Analysis of Trust: People as Intuitive Detection Theorists. In Siegrist, M., Earle, T.C., & Gutscher, H., (eds) *Trust in Cooperative Risk Management: Uncertainty and Scepticism in the Public Mind.* London: Earthscan.

Whitfield, S.C., Rosa, E.A., Dan, A., & Dietz, T., (2009). The Future of Nuclear Power: Value Orientations and Risk Perception. Risk Analysis, 29, 3, 425-437

Williams, B. (1988). Formal structures and social reality. In: In D. Gambetta (Ed). *Trust: Making and Breaking Cooperative Relations*. Basil Blackwell, Oxford.

Williams, B.L., Brown, S., & Greenberg, M, (1999). Determinants of trust perceptions among residents surrounding the Savannah River nuclear weapons site. Environment & Behaviour, 31, 354-371.

Williams, D.R., & Vaske, J.J., (2003). The measurement of place attachment: validity and generalisability of a psychometric approach. Forest Science, 49, 6, 830-840.

Williams, R., (1980), The Nuclear Power Decisions: British Policies 1953-78. London: Croom Helm

Wing, S., Richardson, D., Armstrong, D, & Crawford Brown, D (1997), A re-evaluation of cancer incidence near the Three Mile Island nuclear plant: The Collision of Evidence and Assumptions. Environmental Health Perspectives, 105, 1, 52-57.

WISE (2008a). Nuclear energy and renewable power: which is the best climate change mitigation option? Nuclear Monitor, no.699, December 11th, 2009.

WISE (2008b). Nuclear myths. Nuclear Monitor, no.699, December 11th, 2009.

Woo, T.O., & Castore, C.H. (1980). Expectancy-value and selective exposure as determinants of attitudes towards a nuclear power plant. *Journal of Applied Social Psychology*, 10, 224-234.

World-nuclear.org. (2010). Nuclear Power in the United Kingdom. http://www.world-nuclear.org/info/inf84.html

World Nuclear Association (2008), Chernobyl Accident. http://www.world-nuclear.org/info/chernobyl/inf07.html

World Nuclear Association, (2001). Radiation, Health and Safety: Three Mile Island: 1979. http://www.world-nuclear.org/info/inf36.html

Wright, S.C., Taylor, D.M., & Moghaddam, F.M., (1990). Responding to membership in a disadvantaged group: from acceptance to collective protest. Journal of Personality and Social Psychology, 58, 994-1003.

Wynne, B., Waterton, C., & Grove-White, R., (1993; revised 2007). Public Perceptions and the Nuclear Industry in West Cumbria. Centre for the study of Environmental Change, Lancaster University.

Wynne, B., (1992). Risk and Social Learning: reification to engagement. In: S Krimsky & D. Goulding (eds), Social Theories of Risk. New York: Praeger.

Yim, M. & Vaganov, P., (2003). Effects of education on nuclear risk perception and attitude: theory. Progress in Nuclear Energy, 42, 2, 221-235.

Zonabend, F. (1993). *The Nuclear Peninsula*. Cambridge: Editions de la Maison des Science de l'Homme / Cambridge University Press.

Appendices

Appendix 1

Table A1: Q statements, statement categories, and statement ranks within each perspective (for Study1, Analysis 1)

Statement	Perspective 1	Perspective 2	Perspective 3	Perspective 4
Rationalising nuclear threat, habituation to threat/power station				
As long as you block the nuclear power station from your mind, this is a great place to live	-3	1	-3	2
According to the news, everything is going to give you cancer, so I don't let it worry me	2	-2	-2	5
Personally, I try to avoid thinking about or even seeing the power station, so that I'm not reminded of the risks	-3	0	-2	-1
I am reminded of the potential risks of the power station only when I see it, or when someone nearby has got cancer	-3	0	1	-4
I've never given the power station a thought – it's just part of the landscape	1	-2	-1	5
It's almost impossible for an accident like the one at Chernobyl to happen here	2	-3	-1	0
Any little incident is blown out of proportion by the media and treated as a major nuclear catastrophe	2	-2	0	4
If there was a major incident at the power station, it would affect me wherever I lived	2	1	4	-1
There's no reason to worry about radiation from the power station. You get more dosage from an aircraft flight or from lying on a beach	3	-3	-2	3
There's no point worrying about the risks, otherwise you'll spend your whole life worrying	3	0	4	5
Enhanced Locality (Trade offs)				
I'd rather live close to a nuclear power station than a coal fired one, or a factory billowing out toxic fumes	5	-1	3	0
Some of the surrounding areas may have benefited economically from the power station but we haven't benefited at all	-2	0	-1	1
The power station has been a great asset to the community over the years	4	-1	1	0
The area has kept its character because the presence of the power station has prevented too much development	0	-1	0	1
Experiential threat				
There's nothing to stop terrorists crashing a plane into the power station and causing a major disaster	1	3	3	4
There are far less risky ways of generating electricity than nuclear	0	5	0	1
There's just something about nuclear power that makes me feel uneasy	-4	2	1	-3
The Chernobyl accident focused my mind on the fact that I was living with that potential danger	-1	2	-4	-5
I sometimes worry about what gets out of the power station and into the local environment	-2	2	2	-2
I don't like the idea of radioactive waste being stored on the power station site after decommissioning	0	4	4	0
I'm more concerned about radioactivity seeping into the water supply than a big explosion	0	2	0	2
There are lots of cancer risks associated with the power station	-5	2	-1	-5
Spoiled locality				
Because of the power station, this will be a polluted, hazardous place forever	-5	2	-4	-5
The power station is a terrible eyesore	-5	1	1	-1
The presence of the power station is just another example of this area being picked on	-3	0	-5	2
We get a bit fed up with people who don't live here making jokes, like asking if we glow at night or making references to the Simpsons	-1	0	0	-1
Trust/Lack of trust				
The nuclear industry is open and honest	1	-4	-3	-3
The government is more concerned with money and big business than our best interests	1	3	3	1
When I hear spokespeople for bodies like the Environment Agency telling us we have nothing to worry about, I do not find that reassuring	-1	3	1	2
If there was a problem, there is a very good, fail-safe system. The power station would just cut out, like pulling a plug out of the wall. It would just shut down, and that would be that	2	-3	-3	-4
The nuclear industry doesn't really consult – they go through the motions but the important decisions have already been made	0	4	2	0
We can trust the nuclear industry to come forward and tell the truth about any discharges and incidents	1	-5	-3	-4
We can trust the power station staff to make sure it is safe – they are ordinary people just like us	3	-1	1	1

The nuclear industry tries to brainwash people into thinking that nuclear power is safe and acceptable	-4	4	-3	0
When you get a study that shows there's more cancer here than there should be, they just say it's a 'statistical blip'. You get the feeling they are trying to hide something	-2	4	-1	0
The regulatory authorities in this country are probably the best in the world. There's never any question about nuclear safety at all, in any of the plants	2	-3	0	-3
I worry something will go wrong because of people cutting corners or making mistakes	-4	2	-2	-3
When it comes to nuclear power, you can't trust the government	0	3	-1	3
Confident Acceptance				
I'm confident that this nuclear power station is safe	5	-4	2	2
I find the power station quite comforting rather than a threat	1	-4	-5	-1
I would welcome a new nuclear power station being built here	3	-5	-4	1
Nuclear power is one of the best forms of electricity generation. The country needs it and will have to build more nuclear power stations	4	-5	3	-1
Nuclear power is one of the cleanest ways of producing energy	4	-4	4	4
The power station has provided good jobs for the area - without it, this place would have ceased to exist	1	-2	-4	0
People are only worried about nuclear power because they don't understand it	4	-2	2	4
Reluctant Acceptance				
I don't like the idea of nuclear power but I reluctantly have to admit that we may need it if we are to have any chance of combating climate change	0	-2	5	-2
Nuclear power has drawbacks but at the end of the day it will be necessary if we want to have a secure energy supply – we can't rely on imported gas and oil	5	-2	5	-1
I don't really want nuclear power here, but these things have got to go somewhere	-1	-1	5	0
I'm not really in favour of nuclear power but I have to admit that the power station has provided lots of well paid jobs for local people	0	0	0	0
Activism				
If they tried to put a permanent radioactive waste store on the power station site, I for one would do whatever I could to stop them	-1	5	0	-4
People who oppose protests are frightened of acknowledging the dangers of nuclear power	-2	0	-2	-2
We can't let the government think that because we've already got nuclear technology here, this is the best place to put more	-2	3	2	-2
You have to find out your own information – the government rarely volunteers it	0	1	0	1
A lot of people are unhappy about the power station but they don't do anything about it. Only a few of us are willing to stand up and be counted	-4	1	-5	2
Contradictions and Uncertainties				
I don't know who to trust about the risks of nuclear power	-1	1	2	3
I'm not against the nuclear power station, but I wouldn't want my children to work there	-3	-1	-1	-2
I am pleased that the power station is being closed but at the same time I am concerned that its removal will be rushed and won't be done properly	-2	1	1	-3
There's so much contradictory information on the risks, in the end you just don't know who to believe	-1	0	3	2
Others				
In a community like this you have to be careful about expressing your opinions about nuclear power at public meetings	-2	-1	-2	-2
We need to move towards using renewable energy sources as soon as possible	3	5	2	2
The Greens just get in the way of progress by objecting to everything	0	-3	-2	3
Lots of the people who complain about the power station chose to move here when it was already here. They knew it was here yet they criticise it or are terrified of it	2	0	0	3

Appendix 2: Factor loadings

Table A2a: Factor loadings for Study 1 Analysis 1 (cut-off =.45)

Sort	Factor 1	Factor 2	Factor 3	Factor 4
O1	.18	-.03	-.02	**.48**
O2	.60	-.48	-.08	.03
O3	**.75**	-.16	.09	.20
O4	.09	**.45**	.27	.01
O5	**.68**	-.24	.36	.00
O6	**.67**	-.41	.17	.05
O7	.19	-.14	**.54**	.01
O8	**.59**	-.06	.22	.23
O9	-.45	.76	.02	.03
O10	-.55	.48	.16	-.17
O11	-.42	**.77**	.02	-.00
O12	.43	-.06	.03	**.59**
O13	.09	.17	**.64**	.34
O14	.35	-.24	.32	-.28
O15	.21	.26	**.68**	.21
O16	**.52**	.08	.24	-.23
O17	.46	-.03	.45	.02
O18	-.13	**.61**	.34	.13
O19	**.75**	.27	.05	.16
O20	-.30	.45	.24	-.46
O21	**.56**	.01	.21	-.07
O22	.20	.24	**.63**	-.28
O23	.27	**.65**	.14	-.13
O24	**.61**	.03	.13	.12
O25	.41	.14	.41	.40
O26	.66	-.48	.03	.07
O27	**.63**	-.09	.37	.00
O28	-.05	**.46**	-.09	-.19
O29	-.07	.58	.49	-.05
O30	.05	.37	**.46**	.09
O31	**.73**	-.19	.10	-.04
O32	**.63**	-.19	.21	.08
O33	**.46**	.06	.33	.04
O34	-.03	**.69**	.18	-.13
O35	.39	-.12	.08	.05
O36	**.50**	-.19	-.05	.21
O37	**.75**	-.21	.03	.16
O38	.26	**.56**	-.16	.17
O39	**.63**	-.35	.17	.29
O40	.20	**.57**	.01	-.16
O41	**.70**	-.15	.09	.20
O42	**.67**	-.11	-.10	-.15
B43	**.73**	.00	.05	-.09
B44	**.59**	-.34	.16	.19
B45	.42	-.01	.49	.14
B46	-.34	**.61**	.20	-.38
B47	**.70**	-.07	.15	.24
B48	-.18	**.64**	.07	.03
B49	-.28	**.85**	.00	-.06
B50	-.30	**.78**	-.11	-.23
B51	-.05	**.77**	.01	.09
B52	-.40	**.77**	.00	.09
B53	-.19	**.75**	-.14	-.01
B54	-.01	**.47**	.38	.09
B55	-.20	**.75**	-.07	-.09
B56	**.65**	-.17	-.01	-.10
B57	.08	.08	**.62**	-.33
B58	.00	.42	.10	-.17
B59	-.28	**.76**	-.15	.07

B60	.48	-.53	-.16	.26
B61	.22	-08	.31	-.03
B62	-.02	.39	.14	**.45**
B63	-.04	**.62**	-.04	.25
B64	**.69**	-.11	.22	-.01
B65	-.34	**.75**	-.01	.10
B66	**.62**	-.45	.00	.07
B67	.57	-.26	.26	.14
B68	-.03	**.54**	.18	-.04
B69	**.53**	.10	.31	.04
B70	-.43	**.68**	-.20	-.17
B71	**.60**	-.03	.11	.28
B72	.66	-.48	.00	.03
B73	**.75**	-.31	.01	.31
B74	-.32	**.75**	.11	.06
B75	**.73**	-.27	-.13	.06
B76	.02	**.52**	.20	.32
B77	**.64**	-.07	.22	.17
B78	-.26	**.80**	-.20	-.20
B79	**.67**	-.16	.28	-.08
B80	.25	-.10	.27	.40
B81	-.32	**.77**	-.10	.16
B82	.34	-.24	.36	.15
B83	.32	.35	.31	.25
B84	**.77**	-.24	-.04	.09

Table A2b: Factor loadings for Study 1 Analysis 3 (cut-off=.33)

Sort	Factor 1	Factor 2	Sort	Factor 1	Factor 2
O1	.20	.00	**B43**	.49	.34
O2	**.75**	-.01	**B44**	**.68**	.22
O3	**.66**	.31	**B45**	.31	**.55**
O4	-.23	**.43**	**B46**	**-.71**	.29
O5	.64	.49	**B47**	.56	.39
O6	**.75**	.25	**B48**	**-.56**	.27
O7	.25	**.38**	**B49**	**-.80**	.25
O8	.48	.38	**B50**	**-.79**	.12
O9	**-.85**	.16	**B51**	-.57	.35
O10	**-.73**	.08	**B52**	**-.80**	.14
O11	**-.84**	.18	**B53**	**-.67**	.14
O12	**.42**	.12	**B54**	-.30	**.47**
O13	.00	**.56**	**B55**	**-.69**	.23
O14	**.38**	.28	**B56**	**.56**	.18
O15	.00	**.70**	**B57**	-.02	**.50**
O16	.27	**.43**	**B58**	-.31	.30
O17	.35	.50	**B59**	**-.73**	.09
O18	-.49	.47	**B60**	**.72**	-.14
O19	**.73**	.23	**B61**	.21	.27
O20	**-.55**	.21	**B62**	-.21	.25
O21	.37	.42	**B63**	**.44**	.20
O22	-.06	**.70**	**B64**	.54	.43
O23	**-.66**	.29	**B65**	**-.75**	.14
O24	.41	.38	**B66**	**.76**	.04
O25	.25	**.51**	**B67**	.61	.32
O26	**.81**	.09	**B68**	-.39	.35
O27	.49	.53	**B69**	.29	**.50**
O28	**-.39**	.13	**B70**	**-.80**	-.06
O29	-.43	.59	**B71**	**.48**	.31
O30	-.18	**.51**	**B72**	**.80**	.06
O31	.62	.33	**B73**	**.79**	.18
O32	.58	.36	**B74**	**-.74**	.28
O33	.29	**.46**	**B75**	**.70**	.07
O34	-.71	.32	**B76**	-.30	**.38**
O35	**.37**	.16	**B77**	.50	.42
O36	**.48**	.13	**B78**	**-.78**	.10
O37	**.70**	.25	**B79**	.56	.45
O38	-.19	.24	**B80**	.31	.24
O39	**.74**	.24	**B81**	**-.75**	.11
O40	-.27	**.38**	**B82**	.43	.32
O41	**.62**	.29	**B83**	.02	**.49**
O42	**.51**	.17	**B84**	**.70**	.19

Appendix 3: The Questionnaire

Part A: Project Information

- Thank you for participating in this study on **nuclear power.**

Please read this page carefully before you complete the questionnaire.

- This study is part of an independent research programme, conducted by Cardiff University. **We have no connections with the nuclear industry, the government, or any environmental groups.**
- This questionnaire consists of a series of questions that make use of a rating scale. Please tick the box that best describes your opinion for each question.
- **Please work through all the sections of the questionnaire in order.** There are no right or wrong answers. It should only take about **15 minutes** to complete.
- There is no personally identifying information on the questionnaire, and the answers you provide will be stored in an **ANONYMOUS** database.
- If you have any queries or would like more information, please feel free to contact Sara Cartwright at the University on 02920 870 466. Email: CartwrightS@cardiff.ac.uk

We will return to collect this questionnaire on:

If you will not be in, please leave the completed questionnaire on your doorstep, in a plastic bag
Thank you

Part B: General environmental concern

How concerned are you, if at all, about the following issues?

Please tick ONE BOX on EACH LINE	**Not at all concerned**	**Not very concerned**	**Fairly concerned**	**Very concerned**
a) Climate change (sometimes referred to as global warming)	☐	☐	☐	☐
b) Crime in your neighbourhood	☐	☐	☐	☐
c) Deforestation / destruction of tropical forests	☐	☐	☐	☐
d) Genetically modified food	☐	☐	☐	☐
e) Litter in your neighbourhood	☐	☐	☐	☐
f) New development in the countryside	☐	☐	☐	☐
g) Nuclear power	☐	☐	☐	☐
h) Radioactive waste	☐	☐	☐	☐
i) Using up energy resources that are not replaceable	☐	☐	☐	☐
j) Road traffic increase	☐	☐	☐	☐

Please turn over

Part C: Plant Operators at Oldbury Nuclear Power Station

Please indicate the extent to which you agree or disagree with each of the following statements:

Please tick ONE BOX on EACH LINE	Strongly disagree	Tend to disagree	Neither agree nor disagree	Tend to agree	Strongly agree
The plant operators at Oldbury nuclear power station are open and honest	☐	☐	☐	☐	☐
The plant operators at Oldbury nuclear power station do not tell the truth about nuclear incidents and radioactive discharges	☐	☐	☐	☐	☐
We can rely on the plant operators at Oldbury nuclear power station not to cut corners or make mistakes	☐	☐	☐	☐	☐
We cannot rely on the plant operators at Oldbury nuclear power station to ensure that it is safe	☐	☐	☐	☐	☐
The plant operators at Oldbury nuclear power station have the necessary skills to run the power station safely	☐	☐	☐	☐	☐
The plant operators at Oldbury nuclear power station are not competent enough to run the power station safely	☐	☐	☐	☐	☐
The plant operators at Oldbury nuclear power station do the right thing with regards to the safety of nuclear power	☐	☐	☐	☐	☐
The plant operators at Oldbury nuclear power station put the profits of the British nuclear industry before public safety	☐	☐	☐	☐	☐
The plant operators at Oldbury nuclear power station are prepared to take account of studies linking nuclear power stations with elevated rates of cancer in nearby towns and villages	☐	☐	☐	☐	☐
The plant operators at Oldbury nuclear power station distort the facts to make the case for nuclear power	☐	☐	☐	☐	☐

Part C: Plant Operators at Oldbury Nuclear Power Station continued

Please indicate the extent to which you agree or disagree with each of the following statements:

Please tick ONE BOX on EACH LINE	**Strongly disagree**	**Tend to disagree**	**Neither agree nor disagree**	**Tend to agree**	**Strongly agree**
When making decisions, the plant operators at Oldbury nuclear power station consider all sides of the argument	☐	☐	☐	☐	☐
Decisions made by the plant operators at Oldbury nuclear power station are usually unfair and unjust	☐	☐	☐	☐	☐
We can trust the plant operators at Oldbury nuclear power station to act in the public interest	☐	☐	☐	☐	☐
The plant operators at Oldbury nuclear power station are not interested in what ordinary people think about nuclear power	☐	☐	☐	☐	☐
The plant operators at Oldbury nuclear power station have the same opinion as me about nuclear power	☐	☐	☐	☐	☐
The plant operators at Oldbury nuclear power station have different ideas about nuclear power to me	☐	☐	☐	☐	☐
The plant operators at Oldbury nuclear power station are ordinary people just like us	☐	☐	☐	☐	☐

Please turn over

Part D: The British Nuclear Industry

Please indicate the extent to which you agree or disagree with each of the following statements:

Please tick ONE BOX on EACH LINE	**Strongly disagree**	**Tend to disagree**	**Neither agree nor disagree**	**Tend to agree**	**Strongly agree**
The British nuclear industry is open and honest	☐	☐	☐	☐	☐
The British nuclear industry does not tell the truth about nuclear incidents and radioactive discharges	☐	☐	☐	☐	☐
We can rely on the British nuclear industry not to cut corners or make mistakes	☐	☐	☐	☐	☐
We cannot rely on the British nuclear industry to ensure that nuclear power stations are safe	☐	☐	☐	☐	☐
The British nuclear industry has the necessary skills to manage nuclear power stations safely	☐	☐	☐	☐	☐
The British nuclear industry is not competent enough to manage nuclear power stations	☐	☐	☐	☐	☐
The British nuclear industry does the right thing with regards to the safety of nuclear power	☐	☐	☐	☐	☐
The British nuclear industry puts its own profits before public safety	☐	☐	☐	☐	☐
The British nuclear industry is prepared to take account of studies linking nuclear power stations with elevated rates of cancer in nearby towns and villages	☐	☐	☐	☐	☐
The British nuclear industry distorts the facts to make its case for nuclear power	☐	☐	☐	☐	☐

Part D: The British Nuclear Industry continued

Please indicate the extent to which you agree or disagree with each of the following statements:

Please tick ONE BOX on EACH LINE	**Strongly disagree**	**Tend to disagree**	**Neither agree nor disagree**	**Tend to agree**	**Strongly agree**
When making decisions about nuclear power, the British nuclear industry considers all sides of the argument	☐	☐	☐	☐	☐
Decisions made by the British nuclear industry are usually unfair and unjust	☐	☐	☐	☐	☐
We can trust the British nuclear industry to act in the public interest	☐	☐	☐	☐	☐
The British nuclear industry is not interested in what ordinary people think about nuclear power	☐	☐	☐	☐	☐
The British nuclear industry has the same opinion as me about nuclear power	☐	☐	☐	☐	☐
The British nuclear industry has different ideas about nuclear power to me	☐	☐	☐	☐	☐
People who work in the British nuclear industry are ordinary people just like us	☐	☐	☐	☐	☐

Please turn over

Part E: The UK Government and Nuclear Power

Please indicate the extent to which you agree or disagree with each of the following statements:

Please tick ONE BOX on EACH LINE	**Strongly disagree**	**Tend to disagree**	**Neither agree nor disagree**	**Tend to agree**	**Strongly agree**
a) The government is open and honest about nuclear power	☐	☐	☐	☐	☐
b) The government does not tell the truth about nuclear incidents and radioactive discharges	☐	☐	☐	☐	☐
c) We can rely on the government not to cut corners or make mistakes with nuclear power	☐	☐	☐	☐	☐
d) We cannot rely on the government to ensure that nuclear power stations are safe	☐	☐	☐	☐	☐
e) The government has the necessary skilled people to regulate nuclear power safely	☐	☐	☐	☐	☐
f) The government is not competent enough to deal with nuclear power	☐	☐	☐	☐	☐
g) The government does the right thing with regards to the safety of nuclear power	☐	☐	☐	☐	☐
h) The government puts the profits of the British nuclear industry before public safety	☐	☐	☐	☐	☐
i) The government is prepared to take account of studies linking nuclear power stations with elevated rates of cancer in nearby towns and villages	☐	☐	☐	☐	☐
j) The government distorts the facts to make its case for nuclear power	☐	☐	☐	☐	☐

Part E: The UK Government and Nuclear Power continued

Please indicate the extent to which you agree or disagree with each of the following statements:

Please tick ONE BOX on EACH LINE	**Strongly disagree**	**Tend to disagree**	**Neither agree nor disagree**	**Tend to agree**	**Strongly agree**
k) When making decisions on nuclear power, the government considers all sides of the argument	☐	☐	☐	☐	☐
l) Decisions made by the government on nuclear power are usually unfair and unjust	☐	☐	☐	☐	☐
m) We can trust the government to act in the public interest with regard to nuclear power	☐	☐	☐	☐	☐
n) The government is not interested in what ordinary people think about nuclear power	☐	☐	☐	☐	☐
o) The government has the same opinion as me about nuclear power	☐	☐	☐	☐	☐
p) The government has different ideas about nuclear power to me	☐	☐	☐	☐	☐
q) People who work in the government are ordinary people just like us	☐	☐	☐	☐	☐

Please turn over

Part F: Oldbury Nuclear Power Station

5 **The following questions are about the possible risks and benefits associated with the nuclear power station at Oldbury**

Please indicate the extent to which you agree or disagree with each statement:

Please tick ONE BOX on EACH LINE	**Strongly disagree**	**Tend to disagree**	**Neither agree nor disagree**	**Tend to agree**	**Strongly agree**
There are risks to local people from the nuclear power station at Oldbury	☐	☐	☐	☐	☐
There are benefits to local people from the nuclear power station at Oldbury	☐	☐	☐	☐	☐

6 **How would you assess the benefits and risks of Oldbury nuclear power station?**

Please tick ONE BOX only

The benefits of Oldbury nuclear power station far outweigh the risks	☐
The benefits of Oldbury nuclear power station slightly outweigh the risks	☐
The benefits and risks of Oldbury nuclear power station are about the same	☐
The risks of Oldbury nuclear power station slightly outweigh the benefits	☐
The risks of Oldbury nuclear power station far outweigh the benefits	☐

7 **Please indicate your overall feelings about Oldbury nuclear power station:**

Please tick ONE BOX	**Very Negative**	**Fairly Negative**	**Neither Positive nor Negative**	**Fairly Positive**	**Very Positive**
Overall, how do you feel about Oldbury nuclear power station?	☐	☐	☐	☐	☐

8 **Please indicate the extent to which you would oppose or support the following:**

Please tick ONE BOX	**Strongly Oppose**	**Tend to Oppose**	**Neither Support nor Oppose**	**Tend to Support**	**Strongly Support**
The building of a new nuclear power station at Oldbury	☐	☐	☐	☐	☐

9 The following statements refer to your feelings about the area in which you live.
Please indicate the extent to which you agree or disagree with each statement

Please tick ONE BOX on EACH LINE	**Strongly Disagree**	**Tend to Disagree**	**Neither Agree nor Disagree**	**Tend to Agree**	**Strongly Agree**
a) I feel like I belong to the community where I live	☐	☐	☐	☐	☐
b) The power station is part of our community here	☐	☐	☐	☐	☐
c) For me this is the ideal place to live	☐	☐	☐	☐	☐
d) If I was to move, I would want to live somewhere like this, except without a nuclear power station nearby	☐	☐	☐	☐	☐
e) I am proud to have the nuclear power station in our area	☐	☐	☐	☐	☐
f) Having the power station here helps me to live my life the way I want to	☐	☐	☐	☐	☐
g) For better or for worse, the power station has featured strongly in my life	☐	☐	☐	☐	☐
h) The power station has featured strongly in our area (by 'area' we mean your village/town such as Oldbury/Thornbury NOT South Gloucestershire)	☐	☐	☐	☐	☐
i) I strongly value the place where I live (by 'place' we mean your village/town such as Oldbury/Thornbury NOT South Gloucestershire)	☐	☐	☐	☐	☐

Please turn over

Part G: Nuclear Power in General

10 The following questions are about the possible risks and benefits associated with having nuclear power stations in general

Please indicate the extent to which you agree or disagree with each statement:

Please tick ONE BOX on EACH LINE	Strongly disagree	Tend to disagree	Neither agree nor disagree	Tend to agree	Strongly agree
There are risks from having nuclear power stations in the UK	☐	☐	☐	☐	☐
There are benefits from having nuclear power stations in the UK	☐	☐	☐	☐	☐

11 How would you assess the benefits and risks of nuclear power in general?

	Please tick ONE BOX only
The benefits of nuclear power far outweigh the risks	☐
The benefits of nuclear power slightly outweigh the risks	☐
The benefits and risks of nuclear power are about the same	☐
The risks of nuclear power slightly outweigh the benefits	☐
The risks of nuclear power far outweigh the benefits	☐

12 Please indicate your overall feelings about nuclear power:

Please tick ONE BOX	Very Negative	Fairly Negative	Neither Positive nor Negative	Fairly Positive	Very Positive
Overall, how do you feel about nuclear power?	☐	☐	☐	☐	☐

13 Please indicate the extent to which you would oppose or support the following:

Please tick ONE BOX	Strongly Oppose	Tend to Oppose	Neither Support nor Oppose	Tend to Support	Strongly Support
The building of new nuclear power stations in the UK	☐	☐	☐	☐	☐

14 Please indicate the extent to which you disagree or agree with each of the following statements:

Please tick ONE BOX on EACH LINE	**Strongly disagree**	**Tend to disagree**	**Neither agree nor disagree**	**Tend to agree**	**Strongly agree**
a) I am willing to accept the building of new nuclear power stations if it would help to tackle climate change	☐	☐	☐	☐	☐
b) Promoting renewable energy sources, such as solar and wind power, is a better way of tackling climate change than nuclear power	☐	☐	☐	☐	☐
c) Britain needs a mix of energy sources to ensure a reliable supply of electricity, including nuclear power and renewable energy sources	☐	☐	☐	☐	☐
d) Reducing energy use through lifestyle changes and energy efficiency is a better way of tackling climate change than nuclear power	☐	☐	☐	☐	☐
e) It doesn’t matter what we think about nuclear power. Nuclear power stations will be built anyway	☐	☐	☐	☐	☐
f) The government and nuclear industry should fully involve local people in any decisions about siting a new nuclear power station here	☐	☐	☐	☐	☐

Please turn over

Part H: Your point of view on having a nuclear power station close to where you live

15a **Please indicate how well each of the following descriptions match your own point of view on having a nuclear power close to where you live.**

Each point of view is unlikely to replicate exactly how you feel, but try to read each description as a whole and assess how close it is, in an overall sense, to your own point of view

Point of view A

Nuclear power is not perfect, but I believe that it is the best option we have for electricity generation. I believe that nuclear power is safe and clean, and brings many benefits to the local community. I would much rather live near to a nuclear power station than a coal-fired one! I believe that we need nuclear power for the UK's energy security and I think we should build more nuclear power stations. Renewable energy is not reliable enough, and I consider that it should only be used alongside at least some nuclear power generation. There is no need to worry at all about nuclear power. People who fear it do so mostly because they don't understand how it works.

Not at all like my point of view				**Very like my point of view**
☐	☐	☐	☐	☐

Point of view B

I believe that we should stop using nuclear power and switch to renewable sources of energy as soon as possible. I do not believe that nuclear power is clean, and I do not accept the argument that it will help combat climate change or improve energy security. Nuclear power stations are not safe: terrorism, day to day emissions, and waste storage are concerns for me. If they tried to put a permanent waste storage facility at Oldbury, I would do whatever I could to stop them. We can't let the government think that this is a good place for a new nuclear power station.

Not at all like my point of view				**Very like my point of view**
☐	☐	☐	☐	☐

Point of view C
I reluctantly accept that nuclear power may be necessary to combat climate change and ensure a secure energy supply for the UK. Nuclear power is efficient and relatively clean, but it may also come with some risks. I am concerned about things such as the potential risks of terrorism and waste storage, but I believe that we must look beyond our personal concerns and see the bigger picture. We may all need nuclear power in the future whether we like it or not.

Not at all like my point of view				**Very like my point of view**
☐	☐	☐	☐	☐

Point of view D
I've not really thought about nuclear power and I definitely don't worry about it at all. I regard it as relatively clean but there may be some risks as well. Sometimes there are minor incidents at nuclear power stations, but the media blows the slightest thing out of proportion and turns them into major catastrophes. Everything is going to give you cancer according to the news! The possibility of a terrorist attack at a nuclear power station concerns me slightly, but I don't ever worry that there might be a big accident like there was at Chernobyl in the 1980s.

Not at all like my point of view				**Very like my point of view**
☐	☐	☐	☐	☐

15b **Please indicate which of the previous 4 descriptions is *MOST* like your point of view on nuclear power (tick one):**

Point of View A	**Point of View B**	**Point of View C**	**Point of View D**
☐	☐	☐	☐

15c **What thoughts, if any, went through your mind as you read through the 4 descriptions and chose the one most like your point of view?**

____
____
____

Please turn over

Part I

Finally, we need some information about your background. As we emphasised at the start, all information that you provide will be stored in an **ANONYMOUS** database.

16 Gender

- ☐ Male
- ☐ Female

17a Please indicate if there are any dependent children in your household

- ☐ Yes
- ☐ No

If NO, please go to Question 18

17b If YES, please indicate the age brackets that your children belong to (tick both boxes if necessary):

- ☐ 0-14 years
- ☐ 15-18 years

17c Do you consider yourself the primary caregiver for your children?

- ☐ Yes
- ☐ No

18 Which of the following age brackets do you belong to?

- ☐ 18-24 years
- ☐ 25-34 years
- ☐ 35-44 years
- ☐ 45-54 years
- ☐ 55-64 years
- ☐ 65 years or above

19 Please indicate the place in which you live:

- ☐ Oldbury-on-Severn
- ☐ Shepperdine
- ☐ Other town or village (please state)
- ☐ Oldbury Naite
- ☐ Thornbury

20 Please indicate how long you have lived in the Oldbury/Thornbury area:

I have lived in the Oldbury/Thornbury area for ____________________years

21 We are interested in whether you have any connections with nuclear power
Please indicate whether any of the following statements apply to you:

- ☐ I work, or I have worked at a nuclear power station
- ☐ I have family or friends who work, or have worked at a nuclear power station
- ☐ I work, or I have worked for the British nuclear industry
- ☐ I have family or friends who work, or have worked for the British nuclear industry
- ☐ No connections
- ☐ Other, please specify:

THANK YOU VERY MUCH FOR PARTICIPATING IN THIS STUDY

BEFORE YOU FINISH, PLEASE CHECK THAT YOU HAVE ANSWERED ALL QUESTIONS

For additional information, please visit our website:

www.understanding-risk.org

IF YOU WISH TO:

- **BE ENTERED IN THE PRIZE DRAW**
- **RECEIVE INFORMATION ABOUT THE END OF PROJECT EVENT**
- **BE CONTACTED ABOUT FURTHER RESEARCH**

PLEASE PROVIDE US WITH YOUR CONTACT DETAILS ON THE ACCOMPANYING SHEET

Appendix 4: Dissemination

The sections of this thesis which formed part of the overarching LWSTR project have been broadly cited in local and national press, and discussed on various special interest websites and blogs. Selected analyses have been presented at academic conferences and submitted to scientific journals. Appendix 4 provides details of such dissemination to date.

Press reporting of sections of this thesis are shown in Box 9:

Box 9: Media and press sources which have reported sections of this thesis

• news.bbc.co.uk	• Chester Evening Leader
• BBC Radio 4	• Shropshire Star
• The Guardian	• Reading Evening Post
• The Daily Telegraph	• Swindon Advertiser
• The Scotsman	• The Colchester Gazette
• The Mirror	• East Anglian Daily Times
• Birmingham Post	• Essex Chronicle
• Morning Star	• Yate & Sodbury Gazette
• newswales.co.uk	• Thornbury Gazette
• Western Daily Press	• Newcastle Journal
• thisiswesternmorningnews.co.uk	• Norwich Evening News

A4(i) Report to Funder:

Pidgeon, N., Henwood, K., Parkhill, K., Venables, D., & Simmons, P., (2008). Living with Nuclear Power in Britain: A Mixed-Methods Study. School of Psychology, Cardiff University.

***A4(ii) Academic Papers*:**

Venables, D; Pidgeon, N; Simmons, P; Henwood, K & Parkhill, K.., (2009) Living with nuclear power: a Q-method study of local community perceptions. *Risk Analysis*, 29, 8, 1089-1104.

Venables, D; Pidgeon, N; Simmons, P; Henwood, K & Parkhill, K. Living with nuclear power: Sense of place, proximity, and attitudes to nuclear power in local host communities *(under review: Journal of Environmental Psychology)*

Venables, D; Pidgeon, N; & Poortinga, W., Living with nuclear power: familiarity and the dimensionality of trust in risk regulation. *(in preparation).*

A4(iii) Academic Conferences:

Venables, D., Parkhill, K., Pidgeon, P., Henwood, K., & Simmons, P. Living with nuclear power: sense of place, perceived risk, proximity, and attitudes to new build in existing host communities. Oral presentation made on behalf of the author by Professor Nick Pidgeon at the *European Society for Risk Analysis*, London, UK, June 2010.

Venables, D; Pidgeon, N; Simmons, P; Henwood, K & Parkhill, K, "Reluctant Acceptance: relationships between concerns about climate change and attitudes towards nuclear power in the UK". Oral presentation at the *European Society for Risk Analysis*, Karlstad, Sweden. July 2009.

Venables, D., Pidgeon, N., Simmons, P., Henwood, K., & Parkhill, K. "Living with Nuclear Power: A Q-method Study". Poster presentation at the *Second World Congress on Risk*, Guadalajara, Mexico. June 2008.

Venables, D, Pidgeon, N, Simmons, P, Henwood, K, & Parkhill K, "Living with nuclear risk: preliminary results from a Q-method study", Oral presentation at the *Society for Risk Analysis: UK Chapter Conference*, Nottingham, UK. September 2007.

A4(iv) Local dissemination events:

- Oldbury: Thornbury Castle, Thornbury (September 2008)
- Bradwell, Five Lakes Hotel, Maldon (October 2008)
- Hinkley Point: Bridgwater College, Cannington (May 2009)

BBC News Report on the Living with Socio-Technical Risk (SCARR) Project

Mixed views on new nuclear build

By Mark Kinver
Science and environment reporter, BBC News September 30 2008

Residents living near existing nuclear reactors only have "qualified support" for new power stations, a study shows.


Residents near Hinkley Point power station were among those interviewed

While most locals trusted the operators of their nearby power station, some had a strong distrust of the UK Government and the nuclear industry, it added.

The team that compiled the data said the findings suggested that a "decide and defend" strategy for new build would be be met by strong opposition.

It had been assumed that locals would support new nuclear power stations.

The five-year study, which included a survey of 1,326 households, was carried out by the team of researchers from the universities of Cardiff and East Anglia.

'Interesting assumption'

Ministers are currently considering a range of options to replace the UK's ageing reactors.


New nuclear plants get go-ahead

"The government and some of the energy companies believe that the UK should have a new generation of nuclear power stations," said co-author Nick Pidgeon, from the University of Cardiff's School of Psychology.

"But one of the issues - the siting of any of these stations - is not going to be an easy matter.

"The initial proposals (from the energy companies) are almost certain to include some of the sites that currently house nuclear stations."

While there were a number of practical reasons for this, such as access to existing infrastructure, Professor Pidgeon explained that there was also an assumption that public acceptance of new reactors would be greater.

"It is an interesting assumption to make, and on the surface it looks like an easy thing to say but there has been very little detailed research."

The team focused their research on communities that lived within 10 miles of three nuclear power stations - Bradwell, Essex; Oldbury, South Gloucestershire; and Hinkley Point, Somerset.

Based on detailed face-to-face interviews and questionnaires, the researchers found that the respondents generally accepted their nuclear neighbour as part-and-parcel of everyday life.

> **"Strong mistrust of both the industry and government is voiced by a... significant minority of residents"**
>
> Professor Nick Pidgeon, University of Cardiff

"That sense of it being part of the everyday was combined with a considerable degree of trust in the local operators," revealed fellow co-author Peter Simmons, from the University of East Anglia's School of Environmental Sciences.

"But it is important to make clear that... some of the people we interviewed did work or had worked for the power station, or had family/friends that worked at the station.

"So, for some of the people, there were a number of linkages within their social networks with the power station.

"That was quite distinct from any statements they may have made about the trust they had in the industry more generally."

In contrast, a number of interviewees voiced varying degrees of distrust when it came to the national government and regulators.

The researchers said that a number were generic concerns, such as "not able to trust politicians", but others felt they had not been properly consulted over past developments at the power stations.

Concern triggers

The researchers also found that there were occasions when the local communities did become concerned about having a nuclear reactor on their doorsteps.

Mr Simmons said that one such event was news of a terror attack anywhere in the world.

"That would draw people's attention to the possibility of some sort of terrorism risk associated with a nuclear power station.

"But it could also be other kinds of events as well; it may be people

within the community suddenly being diagnosed with cancer.
"It was not because people were leaping to the conclusion that this was to do with the nuclear power station, but what it did was to raise uncertainties in people's minds."
The researchers were able to identify four main points of views among the local residents in relation to nuclear power:

'Beneficial and safe': 34% of the respondents viewed their local power station as being a source of benefits and essentially safe. The nearby reactors were not considered to be a risk to the community's well-being.

'Threat and distrust': 16% of the people surveyed believed the risks associated with nuclear power far outweighed any benefits. This group was also highly suspicious of claims made by the government and nuclear industry.

'Reluctant acceptance': This group consisted of 38% of the respondents, who viewed the technology as potentially risky, but were willing to accept it locally because of concerns about energy security and climate change.

'There's no point worrying': 12% of those questioned expressed few concerns about the technology, but were still critical of government and industry. But they also expressed distrust of environmental groups that "exaggerated" the risks.

Professor Pidgeon said the findings showed that if the government and nuclear industry failed to consult local people and address their concerns, it would be counterproductive in terms of winning support for a new fleet of nuclear reactors.
"Despite the apparent support for nuclear power that exists in these communities, our research also demonstrates that many remain ambivalent towards nuclear power.
"Strong mistrust of both the industry and government is voiced by a further significant minority of residents.
"What they have to avoid is what has happened in the past, which is a 'decide and defend' approach," he told reporters.
"Or a 12-week consultation that involves popping up some information in a local library, assuming that people will read it - that would be an absolute catastrophe."
The researchers presented their full findings on Tuesday at an event hosted by the Royal Society, London.