

Case studies of stakeholder decision making on radioactive waste management in the US and UK

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ABSTRACT

A case study of stakeholder engagement for UK nuclear decommissioning and waste management and another for waste management decision making in the US are presented. The UK nuclear industry has begun to consult stakeholders more widely in recent years. Historically, methods of engagement within the industry have varied, however, recent discussions have generally been carried out with the explicit understanding that engagement with stakeholders will be 'dialogue based' and will 'inform' the final decision made by the decision maker. Engagement is currently being carried out at several levels within the industry; at the national level (via the Nuclear Decommissioning Authority's (NDA) National Stakeholder Group (NSG)); at a local site level (via Site Stakeholder Groups) and at a project level (usually via the Best Practicable Environmental Option process (BPEO)). Work by the co-author focuses on the preliminary findings of a questionnaire that has been issued to all members of the NDA NSG and associated sub-groups to assess stakeholder perceptions of the engagement process to date. Findings are reviewed. In the US case study, the Department of Energy's (DOE) Savannah River Site (SRS) Citizens Advisory Board (CAB), in Aiken, SC, considered upgrading the seismic design for the Salt Waste Processing Facility (SWPF) at SRS. This decision, proposed by the Defense Nuclear Facilities Safety Board (DNFSB), provoked heated debate among DOE, SRS-CAB and DNFSB representatives. Theory advances are reviewed.

UK STAKEHOLDER ENGAGEMENT

Progress Report. The UK Nuclear Decommissioning Authority (NDA) is currently engaging national stakeholders on a wide range of issues associated with the NDA Strategy, which focuses on the decommissioning and clean up of the UK nuclear legacy. The NDA have asked stakeholders to shape and define the process through which they are being engaged with the help of independent facilitation. Whilst this approach is providing stakeholders with a considerable degree of power and influence, it is proving to be a challenge to participants and process managers alike. The engagement process is currently at an early stage (only two national meetings have been held to date), and it remains to be seen if early difficulties within the process impact the ability of the stakeholders group to produce meaningful output in terms of specific stakeholder recommendations.

A previous paper by the co-author [43] used the NDA NSG and the British Nuclear Group (BNG) Legacy Ponds and Legacy Silos (LP&LS) Stakeholder Engagement Framework at Sellafield, UK as case study examples to explore the role and type of 'dialogue' currently being used to engage stakeholders. The paper concluded that the term 'deliberative dialogue' best described the mechanism by which stakeholders are currently engaged by the NDA, however, that some of the recent 'consultation' activities carried out by BNG do not fit into this deliberative model.

This paper discusses the preliminary findings of a questionnaire that has been issued to all members of the NDA NSG and associated sub groups. This paper focuses on three areas of the questionnaire; stakeholder perceptions of deliberative dialogue; the stakeholder lead approach adopted by NDA and the facilitators, and the transparency of NDA decision making when considering stakeholder views and concerns. Preliminary findings have highlighted that the development of the dialogue process over time, the success of the stakeholder lead approach and the response by the NDA to the concerns that some stakeholders have expressed regarding how the NDA take into account stakeholder views and concerns during decision making are all worthy of future research. This will be carried out following the receipt of further completed questionnaires. From a theoretical perspective, differences in questionnaire results, discussion behaviours and organizational responses could be compared against the progress of cleanup activities in the field. From this comparison, it should be possible to determine the relationship between stakeholder behaviour, response and progress and the best way forward for the research.

UK: Introduction

The UK nuclear industry has begun to consult stakeholders more widely in recent years. Historically, methods of engagement within the industry have been based on consultation and at times have been antagonistic, however, recent discussions have generally been carried out with the explicit understanding that engagement with stakeholders will be 'dialogue based' and will 'inform' the final decision made by the decision maker. Engagement is currently being carried out at several levels within the industry; at the national level, (via the Nuclear Decommissioning Authority National Stakeholder Group (NDA NSG)); at a site level (via Site Stakeholder Groups (SSGs)) and at a project level (usually via the Best Practicable Environmental Option process (BPEO) [8]).

Openness, transparency and ensuring public confidence is stated as a key principle of the NDA, outlined in the NDA Stakeholder Charter [24]. A document outlining the arrangements for NDA engagement with local and national stakeholders has also been issued [25]. To achieve these objectives, the NDA National Stakeholder Group (NSG) commenced in October 2005. This was followed by the formation of a Waste Issues Group (WIG), a Nuclear Materials Issues Group (NIG) and a Scottish Forum (by action of the first meeting). The co-author sits on the NSG and WIG.

All meetings are managed through independent facilitation and comprise a broad range of representation from UK nuclear SSGs, Non Governmental Organisations (NGOs) and Industry Regulators. Two meetings of the NSG and four meetings of each of the forums have taken place at the time of writing.

The NSG has several aims, which are summarised below and outlined in full within the Stakeholder Charter [24]. In summary, the NSG will:

- Allow stakeholders to input and comment on the NDA Strategy [26], which outlines how the NDA are to progress decommissioning and carry out remediation activities at the 20 UK Civil Nuclear Sites.
- Allow stakeholders to input and comment on the prioritisation of work programmes.
- Sponsor sub groups to address specific national issues for the NDA.

The co-author issued a questionnaire to stakeholders participating in the NDA NSG, the aim of which was to elicit stakeholder views regarding current NDA stakeholder forums, particularly stakeholder perceptions of a dialogue based description of the process. The questionnaire is a component of a work based PhD (by Whitton) being carried out at the University of Manchester. It is important to note that the NDA engagement process is a year old at the time writing and to date has only held two national meetings. However, the author has purposefully issued a questionnaire at this early stage in the process so that further questionnaires can be issued to assess any shift in stakeholder perceptions and attitudes towards the process. As a result, the findings are considered to be preliminary.

UK: The Questionnaire

Distribution. The co-author distributed a questionnaire to all participants of the NSG and sub groups via the independent facilitators. This paper provides a preliminary ‘picture’ of stakeholder views, based on the questionnaires returned to date. The answers supplied in the returns are not considered representative at this stage, but rather are intended to provide an indication of the nature of stakeholder replies received to date.

Questioning and Answers. In summary, the whole questionnaire focuses on key areas of the NSG engagement process and requests stakeholder views on the following.

- Participants views on the stakeholder lead approach adopted to date by the NDA and facilitation team.
- The use of the term ‘deliberative’ to best describe the nature of dialogue carried out within the NSG and associated groups to date.
- Adequacy and suitability of stakeholder representation at the stakeholder fora.
- The range of issues discussed at the stakeholder fora.
- Areas of engagement (issues or process) that stakeholders have found difficult.
- Stakeholder perception on how their views are taken into account by the NDA.
- Stakeholder fatigue.

For the purposes of this paper, the co-author has focused on four questions that relate to stakeholder views on the co-author’s proposal that the NSG engagement process is ‘deliberative’ in nature, views on the stakeholder lead approach adopted by the facilitation team, the things that stakeholders like best and least with this approach and how stakeholders perceive that their views are taken into account by the NDA. The questions are outlined below, followed by a summary of

stakeholder responses. The questions selected for this interim report were Question 4 on deliberative dialogue; Question 7 on stakeholder led approach; Question 9 on stakeholder likes and dislikes; and Question 11 on the implementation of stakeholder views.

Selected Questions and Answers. The selected question numbers below are as they appear in the full version of the questionnaire. However, the scale that participants were invited to rank their responses against has been removed. The co-author intends to update this paper at a later date to include responses to all questions and a quantitative assessment of the responses. Clearly, at this early stage it would not be appropriate to do this on the selection of questions included here, due to the limited number of responses received to date.

Question 4. In my research to date [as a stakeholder], and through observation at the meetings, I have described the engagement process as ‘deliberative’* in nature.

*** Deliberation in this context refers to an open process of dialogue that promotes reciprocity and fair terms of co-operation during discussions. For this term to apply, participants are expected to take on board other participants views, which may or may not lead to a consensus of views.**

This question elicited a range of responses. For example, some participants fully agreed that the term ‘deliberation’ best described the engagement process to date and did not provide any further comment.

However, whilst some stakeholders were broadly in agreement with the proposal, they stated that it was too early in the process to state this with confidence. It was considered that with time it will be possible to assess the influence of deliberation on the process by reviewing the output of the NDA. For example, that NDA clearly demonstrate stakeholder views have been considered and ‘taken on board’ during future iterations the NDA Strategy.

One stakeholder in particular was undecided on the deliberative nature of the process and felt that the views that he had expressed at the meetings had made him unpopular and completely isolated from other participants. However, it was also stated that this situation was changing to the extent that he was now feeling less isolated. Clearly, for deliberation to be effective, actual or perceived isolation of participants is unacceptable.

Question 7. As mentioned in Question 3*, stakeholders have been encouraged to lead and define the areas that have been discussed to date. This approach has resulted in an even balance of discussion topics.

*** Question 3 proposes that the way that stakeholders have been encouraged to lead the NDA engagement process has given the process credibility.**

Although questionnaire responses to date have broadly supported the stakeholder lead approach adopted by the NDA, several participants expressed concern that the discussions have not focused on the ‘real issues’. This type of comment is inevitable given the wide range of

participants that are taking part in the dialogue and the various areas of discussion that are likely to interest and be important to some participants but not others. However, areas of discussion to date have been decided by group consensus.

One participant felt that a considerable amount of time had been spent providing stakeholders with background information at the expense of meaningful discussions. This comment was restricted to a sub group of NSG, the Waste Issues Group (WIG), rather than the process as a whole. The author is a member of this group and can confirm that the provision of background information to inform participants has been considered an important part of the WIG remit.

Question 9. List at least one thing, but no more than three things, that you like best and least about a stakeholder directed approach.

Three things you like best: A common theme was that participants were supportive of the type of environment that has been created, one in which stakeholders feel able to express a broad range of views openly. This is largely due to the stakeholders present who represent a range of view points, for example, from environmental campaign groups to Site License Companies. This creates an environment where, due to the participants differing perspectives on the same issue, several viewpoints are expressed. An example of this is the discussion that was held regarding the implication of nuclear license site closures at decommissioning. For some stakeholders the issues relate to the loss of jobs at the site, to others the eventual site end point. Interestingly, this workshop environment has encouraged discussion but has not been a cause of conflict between participants.

The 'comprehensive' information that NDA has published on its website was also highlighted as a positive step by a participant. This information comprises supporting technical information for stakeholders and also copies of the workshop reports that are produced for all stakeholder events. The aim of this is to allow stakeholders to participate more effectively in the discussions. The convenors also provide hard copies of the information to those without internet access.

Participants found the networking opportunities valuable. This is encouraged at stakeholder events with at least one dinner and evening event, where participants can discuss work issues but also use the opportunity to socialise with other participants. This has proved to be a successful component of all the NDA stakeholder events and may go some way to explaining the understanding that participants have of others viewpoints. This clearly does not constitute agreement, simply understanding of others viewpoints and priorities. One stakeholder commented that due to this positive interaction and effective communication of view points, any decisions made may 'stand the test of time'.

The SSG representatives found these opportunities to meet particularly effective, so much so that they have requested sessions specifically for themselves to discuss common issues that relate to local communities and nuclear sites. The minutes from these meetings are also issued to all participants of the NDA NSG.

Three things you like least: The time commitment required from participants to attend the workshops was highlighted as a concern by some of those who completed the questionnaire. The

NSG meets on average every 6 months with the two sub groups (WIG and MIG) meeting every 3 months. Approximately half of all NSG members attend one or other of the sub groups. As with attendance of the NSG, attendance at sub groups is by volunteerism. Whilst participants receive expenses, they are not paid for their time to attend.

Several questionnaire responses highlighted the concern that participants had regarding the dominance of some individuals during discussions. This view was expressed at several stakeholder fora immediately following the first NSG in October 2005 and related to the tendency of the representatives from one organisation to dominate group discussions with their views. This was seen by many stakeholders as unhelpful to the discussions and at the expense of other equally valid views.

The stakeholder lead approach frustrated some participants. For example, that the direction of the process and areas of discussion has been consistently put to stakeholders for a consensus decision. One response to the questionnaire felt that this process wasted time, however, based on the responses received to date this appears to be a minority view. Some participants did not provide any response to this part of Question 9.

Question 11. The purpose of the engagement process is to inform the NDA of stakeholder views regarding those issues relevant to the NDA Strategy. Do you feel that it is clear how your views are taken into account by the NDA? Please comment below.

Stakeholders who have responded to date do not feel that it is transparent how their views are being taken into account by the NDA. Stakeholders concur that it is important to demonstrate that stakeholder views are being considered as NDA review and develop their strategy. NDA have stated that stakeholder views will be considered, however, at the time of writing it is unclear how this will be carried out and by what mechanism NDA will demonstrate to stakeholders that this has been done.

UK: Discussion

Question 4. Deliberative dialogue: For clarity, Question 4 of the questionnaire provided the participant with the definition of deliberation shown below:

Deliberation in this context refers to an open process of dialogue that promotes reciprocity and fair terms of co-operation during discussions. For this term to apply, participants are expected to take on board other participants views, which may or may not lead to a consensus of views.

However, a single widely accepted definition of deliberation is difficult to identify as there is no single definition on which all theorist within the literature appear to agree [21]. However, themes do occur within the literature and core components of a deliberative process were identified to produce the above definition. For example, the term 'deliberation' has been referred to as:

- A style and procedure of engagement, which does not specify the participants who are invited to deliberate Renn [27].
- As a process that presumes and promotes reciprocity which requires people to find mutually acceptable ways of resolving moral disagreements whilst maintaining mutual respect [29].
- As a process that seeks reciprocity and fair terms of co-operation. The results of deliberation are seen as mutually binding [12].

Deliberation is also expected to lead to empathy with other participants views and a broadened sense of people's own interests through an egalitarian, open minded and reciprocal process of reasoned argumentation. Following on from this result other benefits can be identified. For example, participants are more enlightened about their own and others' needs and experiences and can better resolve deep conflict [23]. In this way, it is expected that deliberation can serve the common good where models of democracy based on narrow self-interest and negotiation may fail [22].

Those who have responded to the questionnaire at the time of writing have either agreed that the engagement process can be referred to as deliberative or have decided to reserve judgement to a later date, when the process has matured. A suggestion at this point is that this type of response is likely to have links with the answers provided in response to Question 11. That is, that the majority of responses to date state that it is not yet transparent how NDA are to consider the issues raised by the engagement groups. It is proposed here that this demonstration of reciprocity is essential for the process to be fully deliberative in nature. In addition, the feeling of isolation expressed by one participant would indicate that the intended process of full and affective deliberation is not perceived by some members of the group to be reaching all participants.

Question 7. Stakeholder Lead Approach. The first NDA NSG (October 2005) was held in as a plenary session over two days (The Environment Council [10]) and was a facilitated forum where all stakeholders could input to the definition of the type of process required. Although some stakeholders were frustrated by the 'process' content during these sessions (i.e. establishment of ground rules and the establishment of two Issue Groups on Waste and Nuclear Materials) it was agreed that more focus on 'issues' rather than process would be provided at the next meeting. Issues were highlighted by the group for future discussion comprising Skills (specifically how NDA were to address perceived nuclear skill shortages), Socio economics (how the clean up of nuclear sites impacts on employment within local communities) and Contracts and Competition (how stakeholders can be engaged during the contractual process).

The subsequent NSG (April 2006) succeeded in building on these areas put forward by the group for future discussion. The NDA presented information on each of these areas and the work programmes in place to address the concerns of stakeholders. Following the presentations, carousel group discussions were held for each of the three areas. The group discussions were designed to allow stakeholders to discuss each topic and particularly to highlight areas of concerns and suggestions for NDA consideration [11].

It is perhaps inevitable as part of any decision by consensus in this size of group, that there will be some participants who feel that other issues of equal importance are not scheduled to be

discussed. In this instance, the issue has been raised after the event via questionnaire feedback rather than at the event itself. This may be due to a variety of reasons, not least the ability for the individual to be heard in such a large group. However, it is important that facilitators make an effort to ensure that the less vocal members of the group are heard as their views are equally valid.

Also, an issue was raised regarding the provision of large amounts of information and the time spent discussing the background to some of the issues discussed, particularly in the WIG. Whilst it is important to provide stakeholders with the information required to discuss an issue it is also essential to make efficient use of the time spent together as a group.

Question 9. Stakeholder likes and dislikes. The responses to Question 9 regarding the things that stakeholders like best and least about the stakeholder directed approach are broadly supportive of this type of approach and the provision of information to support the discussions. The responses to this question also highlighted the importance of group dynamics and the environment created to generate interaction between stakeholders.

This interaction has been encouraged at stakeholder events. All events have an optional overnight stay at the venue with dinner arrangements made by the facilitators on behalf of the guests. Although predominantly an opportunity for social discourse, the nature of these events encourages relationships between individuals to develop and for a less formal exchange of views between participants. This social interaction supports the deliberative discussions that take place during the fora.

The dominance of some individuals during the plenary session of the first stakeholder event in October 2005 did raise concerns among some participants. There has not been a repeat of this at subsequent events, predominantly due to effective facilitation and process management to encourage deliberation rather than the dominance of individuals or groups. The outcome of this has been less use of the plenary session and more use of carousel discussion groups followed by a full group facilitated discussion. This has avoided the dominance of any individual or group of individuals.

Interestingly, the area of stakeholder dominance and ownership that has been encouraged and broadly supported by most participants was an area of concern for others. However, as commented on previously in this paper, it is inevitable that although some discussion topics may be of interest to the majority it may not be the case for all participants, despite broad group consensus.

Question 11. Implementation of Stakeholder Views. As discussed previously, participants are not yet satisfied that it is transparent how NDA intend to consider the views put forward by participants during the dialogue. This is clearly a fundamental element to the process if dialogue is to be reciprocal and deliberative. At the time of writing, members of the NDA report to the group on 'progress', for example regarding the NDA Strategy. However this type of approach (referred to as 'talking heads' by one participant) does not formally capture how views are considered and what action, if any, is taken by NDA.

UK: Conclusion

This paper has focused on three key areas of a recent questionnaire issued to all members of the NDA NSG, that is; stakeholder perceptions of deliberative dialogue; the stakeholder lead approach adopted by NDA and the facilitators, and the transparency of NDA decision making when considering stakeholder views and concerns. Although at this point in time (following limited returns), answers to the questionnaire should not be considered representative, the responses do raise issues suitable for consideration and areas of future research. This will be developed as more returns are received and assessed.

Areas to be developed comprise:

- The development of the dialogue process. For example, the role and development of deliberative dialogue over time.
- The success of the stakeholder lead approach. This appears to be working well at the moment, however, it is clear that some participants are reserving judgement until the process is suitably developed. Continued stakeholder support is essential if the process is to succeed.
- The response by the NDA to the concerns that some stakeholders have expressed regarding how the NDA take into account stakeholder views and concerns during decision making. This final point appears to be pivotal to how stakeholders perceive the process as a whole and the credibility that they attribute to the process.
- How deliberation, dominance, questionnaire and organizational response data differences relate to field data is a key question for future research. For example, does the reduction in the number of dominant voices dampen cleanup activities in the field as we reported has happened in the US [16,17]?

US STAKEHOLDER DECISION-MAKING

US: Overview. In 2005, there were nine CAB's providing advice on waste management and environmental cleanup decisions to DOE [15]. Four of these CAB's used consensus rules (CR) to reach decisions in agreement with the original policy for Citizen Advisory Boards previously established by DOE ([4]; the guidelines revised in 2006 are located at www.em.doe.gov/public/ssab), but five CAB's were permitted by DOE to make their decisions with majority rules (MR). The SRS Citizens Advisory Board (SRS-CAB) draws its members from a two-state area around the SRS (see www.srs.gov/general/outreach/srs-cab). It makes its decisions by MR [Note: The first author was a member of the SRS-CAB from 1994-2000; and from 2003 until the end of January, 2007].

US: Feedback from the public. In past field research [16], we had found that CR tended to increase the value of risk perceptions at the biannual meetings of CAB Chairs but especially by the Hanford CAB, which we associated with "gridlock" at the Hanford site. That is, CR decisions foster more illusions in the form of increased risk perceptions than under MR [18]. In contrast to CR, we had found that if the conflict generated by MR was managed by the presence of neutrals, it tended to reduce risk perceptions from citizen challenges, to increase the value of risk determinations more than risk perceptions and, as a result, to produce more practical recommendations to DOE [17]. This agreed with research by Dietz and his colleagues [5] who found that managed conflict promoted learning.

US Case Study: Salt waste processing

US: SWPF plant at DOE SRS. High-level waste (HLW) is generated during the reprocessing of irradiated target rods to recover plutonium (Pu) and other nuclear materials [42]. HLW is stored in 49 tanks at SRS; two of its original 51 tanks have been formally closed. However, like the two tanks that have been closed, 22 of the remaining 49 HLW tanks have exceeded their 50-year design lifetimes (Types I, II, and IV), many with identified cracks and past leak histories, and none with the required double containment of the relatively newer HLW tanks (Type III; [32, 38]). HLW settles into one of three fractions: a sludge of heavy metals, including Pu residues; a liquid supernate, composed of cesium-137, strontium-90 and other fission products; and a crystallized supernate known as saltcake, containing lesser amounts of Cs-137, Sr-90 and other nuclides. The Salt Waste Processing Facility (SWPF) is designed to decontaminate 75 million gallon of salt to acceptable levels prior to mixing it with concrete and disposing the "saltstone" in low-level waste vaults [31].

US: Contractor chosen. About three years ago, DOE management and its engineers completed the Phase I design for a PC-2 facility that would passively withstand earthquakes by containing any releases inside of its structure. Parsons was selected for the Phase II design (in 2003) and to build and begin to operate SWPF starting in 2009 (www.parsons.com; for Phase I, see www.srs.gov/sro/nr_2002/sr0206.htm).

US: Earthquake design decision by DNFSB and DOE. Well into the Phase II design, the Defense Nuclear Facility Safety Board (DNFSB) finished reviewing the PC-2 design criteria in 2004; it recommended an upgrade to PC-3 to better protect workers with active ventilation in the

event of a major earthquake [6]. Having concluded that its PC-2 design criteria was technically safe and protective, DOE [39] tried to compromise with DNFSB by offering to selectively upgrade its criteria for SWPF; however, DNFSB [7] persisted with its recommendation.

US: *The controversy erupts.* The SRS-CAB recommended that DOE should proceed with the PC-2 design [33]. However, the SRS-CAB also urged DOE and DNFSB to resolve their differences in order to minimize the delay in starting SWPF; in addition, the SRS-CAB asked DOE to estimate the additional system-wide risks and costs to the 50-year old tank farm in the event of a significant redesign and delay from adopting the DNFSB criteria. DOE [40] agreed with the SRS-CAB's support and in a presentation subsequently given to the Board estimated the impacts to the HLW system. Of foremost concern to the SRS-CAB was the possible shutdown of the vitrification of HLW by the Defense Waste Processing Facility (DWPF), the only operational facility at SRS currently reducing HLW risks. In addition to DWPF, the following reasons were raised by the SRS-CAB and openly deliberated by all parties. First, DNFSB only considered SWPF in isolation, not from a systems perspective. Looking at the entire HLW tank farm, which was built originally to PC-3 standards, HLW tank cracks and past leaks in the older HLW tanks and pipe transfer system suggested that the tank farm was unable to meet even PC-2 criteria in its present state. Second, by meeting at least the PC-2 design criteria that DOE had planned for SWPF, the public and environment would be protected. Finally, and more importantly, the redesign to PC-3 would add about \$1 billion in costs plus two or more years to the timeline before SWPF could begin to operate, but without reducing overall risks to the HLW tank farm system. Further, the delays from redesign would impact the State and Federally mandated milestones for regulated tank closures in the SRS Federal Facility Agreement and Site Treatment Plan. Mindful of these issues, the SRS-CAB recommended that to reduce overall risks, DOE should implement its PC-2 design in order to more rapidly empty, cleanout, and close the oldest HLW tanks at SRS.

US: *Resolution.* As the time neared to begin construction, the conflict between DNFSB and DOE came to a head. Despite the public's advice, DNFSB continued to hold to its position that the seismic design for SWPF had to be upgraded to PC-3. In late 2005 DOE [41] acquiesced to the changes requested by DNFSB. Subsequently, at another public meeting requested by the SRS-CAB's Waste Management Committee to discuss with DOE and DNFSB the problem created by DOE's acquiescence to DNFSB's recommendation, all of these issues were presented and contested by dominant voices in the public. Nonetheless, SRS-CAB accepted DOE's decision to reverse course and increase the SWPF criteria against earthquakes [34]. But it asked that DOE expedite the redesign to shorten the delays and that it keep the board informed of any future problems with salt disposition.

US: *Aftermath.* The SRS-CAB openly expressed its disappointment that DOE had lost two years and that DNFSB had not taken a systems-wide approach in its analysis, exposing the public and the environment to additional risk [35]. It recommended that in the future DOE perform risk and cost-based analyses from a systems-wide perspective before making new changes to the HLW system or before building other major facilities in the future.

US: *Larger issues.* Against the expressed wishes of the SRS-CAB [44], DOE forcibly reorganized the administration of the SRS-CAB from one administered by its prime contractor at

SRS to an 8(a) but directly under DOE's control (an 8(a) is a "firm owned and operated by socially and economically disadvantaged individuals and eligible to receive federal contracts under the Small Business Administration's 8(a) Business Development Program"; cf. www.sba.gov/8abd/). However, the SRS-CAB warned DOE that its apparent and actual conflict of interest brought about by the reorganization would diminish the SRS-CAB's independence from DOE in the eyes of the public and DOE's regulators (SC-DHEC, US-EPA, and US-NRC).

US: Future case study

The next US case study that we will consider appears on its way to becoming a success story for the SRS-CAB. Recently, the SRS-CAB encouraged DOE and the South Carolina's regulatory agency Department of Health and Environmental Control (SC-DHEC) to resolve a conflict that was preventing SC-DHEC from releasing a draft of the modified salt permit for SRS to allow DOE to restart saltstone operations at SRS. These differences arose with a letter sent from the Secretary of Energy [3] to the Governor of South Carolina that blamed the State for the day-by-day delay in restarting salt processing at SRS. In reply, the Governor blamed DOE for failing to provide adequate assurances that SWPF would be built [28]. To break this impasse, the SRS-CAB recommended that DOE and SC-DHEC resolve their differences and present the draft permit to the Board by August 15, 2006 and the final permit by October 15, 2006 [36]. The permit was finally published in draft and released for public review by SC-DHEC on October 3, 2006 [30]. The draft permit was strongly supported by the SRS-CAB; in addition, the SRS-CAB recommended that issuance of the final permit be expedited [37].

CONCLUSION. UK AND US CASE STUDIES

Determining whether deliberation by citizens increases social welfare (e.g., as their decisions become more practical and useful to their sponsor, community or region) when certain citizen voices are allowed or not allowed to dominate discussion is central to our joint work. Consensus-seeking rules designed to mute "dominance" have been characteristic of DOE's guidance for its Citizen Advisory Boards from the beginning in the mid-1990s (reviewed by Bradbury et al. [4]) but questioned by us for almost as long [14,15,16,17]. Recently, support for our position has grown, with findings that moderated competition promotes learning [5]; that consensus rules are easily hijacked by those with an authoritarian agenda [13]; and that questionnaires alone cannot be relied upon to assess the value of a group, its decision processes, nor the quality of its decisions [19]. While we agree that consensus is important, how it is reached is critical. Research has shown that forcibly arriving at a consensus reduces the value of the decision [20]. Under DOE's original guidance, consensus rules enhanced risk perceptions, increasing the likelihood that decisions would not be practical nor, in an irony, acceptable to the DOE sponsor; however, in a further twist, majority rules have been found to be more likely to produce a stronger consensus around more practical decisions and thus are much more preferred by the DOE sponsor. In effect, consensus rules impair the information processing necessary for learning to occur because no participant's personal risk perceptions have to be compromised, the primary justification for consensus rules, but consequently forcing consensus-ruled groups to struggle to fit their discordant perceptions into a common, normative, and usually ideological viewpoint more likely to be resistant to changing circumstances. In contrast, to be successful under majority rules, the dominant voices have to pitch their arguments to the neutrals among them to win,

effectively giving neutrals the power to moderate conflict and promote compromise. To be effective judges, neutrals have to be neutral to the arguments but not neutral to the outcome of a successful decision, enhancing the practicality of the decisions subsequently made.

Interestingly, although consensus rules produce more impractical decisions, their worldviews are consistent. But this also means that consensus rule decisions are the least adaptable. In contrast, the compromises necessary to make majority rules work also make its lack of an ideological worldview its hallmark. However, the search for practical outcomes also makes majority rules more adaptable.

The principal reason to undertake our research is to find a methodology to counter the inability of questionnaires to predict behavior [15]. Characteristic of this failure is the weak correlations found in a meta-analysis of over 30 years of documented research between questionnaires measuring self-esteem and measures of actual academic or work performance [1]. Indeed, our finding of non-ideology and practicality associated with majority rules can be generalized to results from the Iowa Electronic Markets (IEM) for the 2004 campaign for US Presidency as well as the recently held campaigns for the US Congress. In the 2004 presidential election, non-monetary futures predicted a Kerry landslide that failed to materialize; in contrast, IEM predicted a close but accurate margin of victory for President Bush [18]. In the recent Congressional election, IEM futures accurately predicted the Democratic sweep of both Houses of Congress (see the graphs at www.biz.uiowa.edu/iem/markets/Congress06.html). Based on a market's ability to efficiently process information, IEM has become a well-known prediction tool that aggregates dynamic, complex information into an unbiased forecast (e.g., market leaders make money and set prices with unbiased bets while biased market players lose it). Compared to traditional polling questionnaires and political handicapping [2], IEM's successes imply that political futures markets work when investors are neutral to the ideology of the politicians in play, but not to the outcome, driving them to seek and process all of the information available, which in turn is reflected in the price of a future (e.g., [9]). We believe the primary finding that can be derived from our paper is that neutrals as judges on nuclear waste management committees gain power by brokering more practical decisions just like neutrals as investors gain power in the futures market by making more money. In both cases, neutrals win by searching for the best outcome. But more importantly, from a theoretical perspective, our challenge is to find a methodology similar to IEM's that captures information better than the static information captured by questionnaires.

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