SOCIAL DISTRUST: IMPLICATIONS AND RECOMMENDATION FOR SPENT NUCLEAR FUEL AND HIGH LEVEL RADIOACTIVE WASTE MANAGEMENT

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INTRODUCTION

The management of spent nuclear fuel (SNF) and defense high level waste (HLW) is a complex socio-technical systems challenge. Coordinated, reliable, and safe performance will be required over very long periods of time within evolving social and technical contexts. To accomplish these goals, a waste management system will involve a host of facilities for interim storage and longterm disposal, a transportation infrastructure, and research and development centers. The complexity of SNF and HLW management will also require an array of institutions and procedures. Waste management is multi-institutional, comprising multiple private companies and sectors (e.g., commercial nuclear utilities, trucking and railway companies), multiple government agencies at different levels (local, state, national), non-governmental organizations (NGOs) and other institutional stakeholders, as well as citizens. At the moment, experience of how this will work is limited. We are in the realm of social experimentation with institutional arrangements and procedures.

Trust and confidence in these institutional arrangements and procedures are central to discussions of how SNF and HLW can best be managed in ways that are socially and politically acceptable (DOE 1993, NRC 2001, NRC 2003, NMWO 2005, Rosa et al. 2010, Slovic et al. 1991). For example, a Canadian report argues that "the trustworthiness of the institutions and authorities implementing and monitoring the waste management approach is key to the perception of risk and managing risk in the minds of many citizens. This trust influences public support both directly and indirectly through risk perception, stigma associated with nuclear uses and facilities, and perceived benefits" (NWMO 2005).

No matter how many checks and balances are put into place, no matter how much information is disclosed, no matter how many instruments for monitoring, evaluation, and oversight are implemented there will ultimately be individuals and groups entrusted to make sure "it all works." Trust and confidence are necessary for stable arrangements in contexts of unequal power, whether in terms of access to information, economic resources, or ability to implement desired actions (Kuhn and Ballard 1999). Stable arrangements, in turn, are essential for the institutional continuity necessary for long-term projects such as the disposal of SNF and HLW. The need for *social* trust and confidence is typical in principal-agent relationships, in which a person or entity (the agent, such as the Department of Energy) acts on behalf of another (the principal, such as the public). Principal-agent relationships are commonly characterized by the agent knowing more than the principal, the principal needing to rely on information provided by the agent, incomplete monitoring, and the use of complex control mechanisms (e.g., budgets, personnel, and incentives). In addition, social trust can be a means for constructive decision-making, by allowing people and institutions to form expectations in uncertain contexts that enable actions to be taken and accepted as legitimate.

Unfortunately, the principal agencies responsible for nuclear wastes, the Department of Energy (DOE) and the Nuclear Regulatory Commission, are not trusted by majorities in public opinion polls (e.g., Whitfield et al. 2009) and other assessments (e.g., DOE 1993, DOE 2000). Social perceptions of mis-steps and failures in government and private parties' management of nuclear wastes have contributed to long term erosion of trust and confidence (DOE 1993, DOE 2000, Hewlett 1978, Kraft 1996, NRC 2001, OTA 1985, Pijawka and Mushkatel 1992, Rosa and Clark 1999). Reasons include Congressional scrapping of a site selection in the Eastern half of the US, Congressional scrapping of technical integrity and equity provisions in the Nuclear Waste Policy Amendments, attempts to coerce Nevada rather than negotiate, failure to clearly define regulatory criteria in advance and then adapt them to fit existing conditions, attempts to re-negotiate or circumvent compliance with cleanup agreements related to HLW at DOE sites, and treating the public as if their concerns are irrational. In short, social *distrust* is multi-lateral and "widespread in the nuclear waste domain, is deeply seated, reflects broader trends in society, and has a continuing history of events to maintain it" (NRC 2001, pg. 74).

In our view, with this legacy there is little evidence that social distrust in the context of nuclear waste management will soften in the near term, and certainly not within the time frame in which the Blue Ribbon Commission must do its work. This means that the development of a successful disposal program must take place in the context of social distrust. On the other hand, social distrust is not necessarily, by itself, an insurmountable impediment to a successful SNF and HLW waste management system. Institutions responsible for planning and operation can be designed to function in the presence of social distrust, rather than to seek trust before moving forward (NRC 2001, pg. 75). This review develops recommendations for moving forward with SNF and HLW management in a context of social distrust, while also working to regain social trust over the long term. We begin with a short overview of social trust and confidence, including definitions, how it is built and destroyed, and trends in social trust in the US. We then turn to the implications of dilemmas and trade-offs that arise for the design and implementation of a system that has requirements in addition to trust and confidence. Finally, before presenting recommendations, we discuss requirements for a SNF and HLW waste management system to obtain social and political acceptability and to exhibit a high degree of technical competence in conditions of social distrust.

THE NATURE OF SOCIAL TRUST

Trust is related to expectations about others and orientations toward an uncertain or risky future (McLeod 2008). The "others" about which individuals and groups can have expectations include actors at various scales (i.e., individual, group, institutions). Kasperson et al. (1999) argue that trust in the political system is "onion-like." The deepest level, the core of the onion, involves trust in the basic *political community* that underlies the constitutional structure of politics and democratic institutions. Next is a layer of trust in the *political regime*, the norms and rules of the game that provide the context for democratic processes. Then comes trust in governmental and other *political institutions.* And finally there is the level of trust that is often the most directly experienced and visible to people – that in the *particular representatives* of the institutions," and this is the level at which much of DOE's past efforts have focused (DOE 1993, DOE 2000).

We use *social trust* to refer to the level of trust held by members of a group or community about actors at these various scales in contexts of governance. Thus, nested hierarchies and networks of actors are important to the understanding of social trust. Both commercial utilities and local residents must view the regulatory agencies in the waste management system as trustworthy[1]. A member of a community can have a relationship with a staffperson from an agency as well as the agency. That community member may trust the staffperson, but distrust the agency. At the same time, a rarely discussed issue is that "institutional representatives may distrust the public as much as members of the public distrust them" (NRC 2001, pg. 74). Recently, Johnson and White (2010) conclude that social trust is not only related to *who*, but also to *who is doing what*, suggesting that both networks of actors *and* their activities must be considered together. For example, people may trust an institution or elected official in financial matters or the management of social services, but not in the protection of health and safety from environmental contamination.

In the context of risk and hazard management, trust has been the subject of research and lively discussion (Cvetkovich and Lofstedt 1999, Earle 2010, Kasperson et al. 1992, Kasperson et al. 1999, Johnson and White 2005, Petts 2008, Poortinga and Pidgeon 2006, Sjoberg and Heber 2008, Slovic et al. 1991, Terwell et al. 2009). Discussions have variously focused on general trust, interpersonal trust, social trust, institutional trust, and confidence without always being clear about the differences or connections. For

[1] A distinction is made between *trust* and *trustworthiness*: trust is an attitude we have towards others, whereas trustworthiness is a property of those others (McLeod 2008).

example, some make a distinction between *trust* and *confidence*, whereby trust is related to expectations about others intentions (e.g., value congruence) and confidence is related to beliefs that certain future events will occur as expected (Earle 2010, Seigrist 2010). Thus, some actions (e.g., independent verification or monitoring) can foster confidence in a process, but they may or may not foster trust in those responsible for the process. Others see less of a distinction and more of an inter-mingling of trust and confidence (McLeod 2008). We make no attempt to resolve this debate here. In general we will use *social trust* to account for both trust and confidence because both are necessary in the context of nuclear waste management. Actions that promote confidence, independent monitoring of performance, will certainly be critical. However, expectations about intentions will also be critical given the long duration necessary for safe SNF and HLW management and the indirect experience people will have with waste managers. Judgments about confidence will interact with judgments about trustworthiness in complex ways.

Interpersonal and social trust are often defined as having cognitive, affective, and behavioral components (McLeod 2008, also see Kasperson et al. 1992 for a review). People trust because they have knowledge, feelings (e.g., social bonds), and experiences based on observations of other's behaviors that allow them to make judgments and form expectations. Metlay (1999) argues that there are two dimensions of institutional trust (i.e., trust that people have in an institution): affective beliefs about institutional behavior (including openness, caring, integrity, reliability, credibility and fairness) and competence of the institution. Petts (2008) identifies four main dimensions of trust including openness, objectivity, caring, and competence in a study of waste management (see also Renn and Levine 1991). Tuler (2002) and Webler (2002) also argue that openness is an essential ingredient in the formation of social trust. Jenkins-Smith and Silva (1998) argue that the public makes judgments about who to trust based on institutional relationships that govern assessments and from perceived policy biases of those who conduct them.

Elsewhere we have identified four dimensions of social relationships that have cognitive, affective, and behavioral components that contribute to or erode social trust (Kasperson 2005, pg, 16-17; see also Kasperson et al. 1992, McLeod 2008):

- Commitment: to trust implies a certain degree of vulnerability of one individual to another or others, to an institution, or to the broader social and political system. Thus, trust relies on perceptions of uncompromised commitment to a mission or goal (such as protection of the public health) and fulfillment of fiduciary obligations or other social norms. Perceptions of commitment rest on perceptions of objectivity and fairness in decision processes and the provision of accurate information. Commitment, however, does not entail blind progress toward predefined goals, nor insufficient awareness of and response to changing circumstances.
- Competence: trust is gained only when the individual or institution in a social relationship is judged to be reasonably competent in its actions over time. While expectations may not be violated if these individuals or institutions are occasionally wrong, consistent failures and discoveries of unexpected incompetence and inadequacies can lead to a loss of trust. In particular, risk managers and institutions must show that they are technically competent in their mandated areas of responsibility. Technical competence includes the ability to recognize the limits of one's knowledge and one's ability to judge others' knowledge.
- Caring: perceptions that an individual or institution will act in a way that shows concern for and beneficence to individuals are critical. Perceptions of a caring attitude are important where dependent individuals rely upon others with greater control or authority over the situation and the individual's opportunities and well-being (i.e., principal-agent relationships).
- Predictability: trust relies on the fulfillment of expectations. Consistent violations of expectations nearly always result in distrust. It should be noted, however, that predictability does not necessarily require complete consistency of behavior. Complete consistency of behavior would require unchanging actions or beliefs, even in the face of contradictory information and also more consistency in values and related behavior than most individuals, groups, or institutions possess.

In the context of SNF and HLW, management institutions face dilemmas and trade-offs as they seek social trust by showing commitment, competence, care, and predictability. Many of these dilemmas have been discussed in great detail elsewhere. They include:

- Very high levels of social distrust, as we argue throughout this paper, threatens to stalemate progress in establishing a nuclear waste management system. But very high levels of social trust could tempt managers to proceed with a relatively closed decision process, relying strongly on experts and seeking little openness and public participation. Some measure of distrust, by contrast, if not overwhelming, can motivate more openness, participation, and collaboration, all of which help to build greater social, ensure better decisions, and win greater public acceptance. Achieving this healthy balance is not simple. One cannot simply assume that the more social trust, the better.

- Openness can enhance social trust, but it can also reveal problems and uncertainties that undermine how people think about competence. Learning is promoted by thorough assessments of failures and surprises, but these may simultaneously undermine confidence and trust. So when analysis and issues are evolving, do you communicate them even if you run a risk of being wrong or do you wait for things to become clearer?

- Institutional constancy and commitment can promote social trust and confidence. But, institutional constancy may compete with goals of flexibility, and suggest to some stubbornness in the face of contrary evidence and uncertainty – which can further undermine trust in those responsible for managing the waste system. When is it appropriate to adjust activities and institutional relationships, and what are the procedures for doing so?

- Decisions about when, where, and how to put wastes are associated with a variety of ethical concerns and trade-offs. These include concerns about a) *distributional equity*, as sites with waste facilities concentrate risks in a host community, while the benefits are more diffuse and the distribution of economic risks and benefits within a community may be unequal as well; b) *cumulative equity*, whereby past decisions and actions result in a legacy of risk-bearing in a community or region and differentially among groups, especially if opportunistic approaches (e.g., based on volunteerism) develop facilities or choose transportation routes in economically depressed, isolated, and politically marginalized communities; c) *inter-generational equity*, whereby, the benefits of nuclear power (i.e., electricity) accrue to the current generation and the risks associated with wastes are imposed on future generations, and; d) *procedural fairness*, as decisions are made with or without the participation or knowledge of affected parties or their representatives. Each type of equity (or inequity) may be associated with different economic costs, levels of control, and efficiency. How are decisions to balance equity concerns, especially if decisions affect those with less power or voice? How should the only dimly understood concerns and needs of future generations be balanced with those of the current generation?

- A requirement for voluntary consent by a host municipality, county, state, or Tribe can delay implementation of a waste management system. On the other hand, being responsive and caring enough to cease assessment of a prospective site or close a facility can lead to more trust in subsequent efforts (creating a legacy of trust). How might early expressions of interest create pressures against re-consideration, how should agreement be measured (e.g., local officials' decision, referendum), and how much time (and financial support) should be given to a sub-national governmental entity or Tribe to do its own investigations of a prospective site?

- Responsiveness to local preferences for hazard management and compensation can end up looking like a bribe and create (or exacerbate) conflict within a community, state, or Tribe when some individuals and groups are seen as winners and others as losers (distributional equity). Procedures

for voluntary consent may undermine efforts at public involvement and openness. Who makes a decision about compensation within a community, state or Tribe, and how much should intra-community conflict both as a barrier to decision-making and as a negative (and long-lasting) outcome factor into site selection?

- Flexibility is promoted by a staged, adaptive approach. But flexibility is gained, often, by under-specification of procedural requirements or mechanisms. However, this can open the door to poor practices. What is the right balance of pre-defined procedural requirements versus opportunities for procedural adaptation to local contexts, and can facilitators or conveners widely perceived as unbiased be found?

- Making more information accessible, especially about long term and uncertain risks, can be taken up by groups and media and result in social amplification of risks, feeding more opposition (social amplification of risk refers to the ways that media, social interaction, and other forms of communication can amplify or attenuate risk perceptions; see Kasperson et al. 1988, Pidgeon et al. 2003). People also systematically differ in the way they interpret information because of their pre-existing beliefs (e.g., Braman et al. 2005, Kahan et al. 2003): individuals who think both nuclear power is critical for America's energy security or is a low carbon energy source are likely to respond very differently to those who are concerned about nuclear power and risks associated with spent nuclear fuel storage. It is not just information alone that reassures people – it depends on what people make of that information and the degree to which people perceive biases in scientists. How can competing claims of scientists be presented and discussed in the public domain?

- "Reversibility" and "retrievability" may promote acceptance, but back-tracking can undermine perceptions of competence. Clear, accepted, and enforceable procedures for reconsidering and reversing decisions in a manner that is perceived as trustworthy can help, but even these may need to change as experience is gained or (social and political) conditions change.

- An interim storage facility for SNF and HLW may offer economic and safety benefits over at-reactor storage but can lead to a protracted fight over siting of the new facility. Conflict over a new facility in the near-term might exacerbate social distrust which can make future siting efforts harder. On the other hand, a "failed" siting process that occurs via an open, voluntary process may actually build social trust, which makes a long term solution more viable.

- Risk is inherent to the waste problem, and it is compounded by large technical uncertainties and unknowns. Communicating uncertainty is a problem and the public can be more accepting of some types of uncertainties than it is of others. How should uncertainties be presented and how much precaution is needed in light of them?

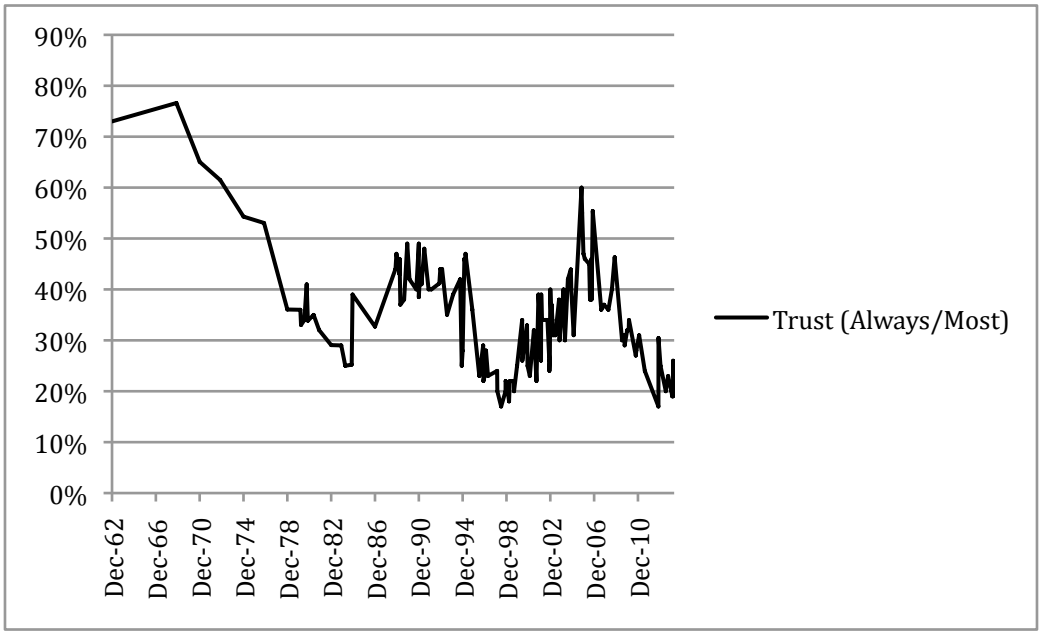
- Clear plans and commitments are important. Commercial enterprises must make decisions now based on what is likely to happen in the future. Promises can convey caring and commitment to addressing a problem. However, over-confidence carries its own problems, because when promises are not kept public confidence and trust can erode. Moreover, confidence can be undermined the more explicit are statements that something is unknown. What is the right balance in telling the public and businesses what is planned, but without sounding too over-confident and not being blamed when plans and schedules cannot be met?

THE NEED TO PROCEED IN A CONTEXT OF SOCIAL DISTRUST

Both at the big picture level and at the close-up level within the specific context of SNF and HLW management, social distrust has been dominant. Trust levels have been weakening within the deepest levels of society and democratic institutions; distrust is systemic (Kasperson et al. 1999, Rosa and Clark

1999, Seligman 1997). The long-term shortfall in public confidence in social institutions has been documented in numerous polls and surveys, as shown in Figure 1. At the same time, the rank-ordering of trust among specific institutions is relatively stable (Rosa and Clark 1999) and among the Executive, Legislative, and Judicial branches (Gallup 2008). Specific events can have more short-term effects (Gallup 2008; see Figure 1). Within a more narrow context of hazard management, a history of technological disasters and mis-management exacerbates social concerns about the capabilities of the very institutions that will play a role in nuclear waste management, including private industry and federal regulatory agencies. These events do not need to involve nuclear technologies to exacerbate such concerns; for example, they arise from oil spills, mining accidents, carbon capture and storage facility siting, and security lapses where private and public actors are perceived as not planning or responding adequately.

Figure 1. Trend in responses to the question: How much of the time do you think you can trust the government in Washington to do what is right? Percentages shown for summed values of "just about always" and "most of the time" (other categories: Chart from: "some of the time," "never," "don't know" or "refused"). Data from: http://people-press.org/trust/. Data compiled by: Pew Research Center, National Election Studies, Gallup, ABC/Washington Post, CBS/New York Times, and CNN Polls. From 1976-2010 the trend line represents a three-survey moving average.



This is not to say that events and activities associated with nuclear technologies have not played a role in the erosion of social trust. Lapses among the institutions responsible for managing and regulating commercial and defense-related nuclear technologies and wastes *have* exacerbated distrust in the waste management policy arena. In addition to the mis-steps and mistakes mentioned above, an additional contributor to this state of affairs is that responsible institutions have historically treated this classic problem of intermingled social and technical challenges as only a technical challenge. Remarkably few resources have been devoted to understanding the social dimensions despite early observations that it is the social and political challenges that may be the most significant challenges to overcome in a successful waste management program. For example, writing in 1976 Alvin Weinberg, the pioneer doyen of nuclear

power, said: "The public perception and acceptance of nuclear power appears to be the question we missed rather badly in the very early days. This issue has emerged as the most critical question concerning the future of nuclear energy." Similarly, Richard Hewlett, a DOE historian, remarked in 1978 that federal officials failed to solve many fundamental issues because they "were not asking the right questions" (Hewlett 1978, pg. 1 and 3). He furthermore remarked that, "lip service was given to the importance of such non-technical factors as public understanding and acceptance, but almost nothing was invested in the analysis or evaluation of these factors. There is no evidence at all that attention was given to such matters as social, cultural or psychological phenomena that might serve as constraints in implementing a technical solution." Similar observations have been expressed regularly ever since, both inside and outside the United States.

While there is considerable reflection on re-building social trust, there is scant evidence that this can be accomplished in the near term. In a case study of a DOE Environmental Management clean-up process, Tuler (2002) found that after a period of deep distrust and feelings of betrayal the re-emergence of support for a clean-up process was associated with people's ability to verify information and the reasons for decisions (i.e., build confidence), explore others' agendas, whether real or perceived, and maintain personal relationships with agency staff over the longer term. On the other hand, the level of trust in the agency as a whole did not change. Claims have also been made that the Finnish framework for selecting a deep geologic disposal facility has worked in part because initial levels of social distrust were overcome (Vira 2006), but others note that the outcome resulted from leveraging the broader socio-political context characterized by trust in the state bureaucracy and institutionalized experts (Lehtonen 2010). Moreover, the lessons of the Finnish (and other international experiences) may not be applicable to the United States; Finland has a small population, it has a parliamentary unitary democracy (no political body between state and locals), and among European countries it is an outlier in confidence in technology.

Two reasons for the difficulty of regaining social trust in the context of SNF and HLW management stand out for special attention. First, nuclear waste is thought of in largely negative terms, as shown in Table 1. Changing negative views can be hard. The "affect heuristic" explored in the work of Slovic and colleagues (Finucane et al. 2000, Slovic et al. 2007) suggests that when people like an activity or technology they tend to view it as having high benefit and low risk. On the other hand, if they dislike it, they see benefits as low and risk as high. Furthermore, recent work on "cultural cognition" reinforces findings that people tend to select and interpret information to support preexisting views, protect values and worldviews (e.g., anti-nuclear or pro-nuclear), or preserve identity with an ideological group (Braman et al. 2005, Kahan et al. 2007). Thus, information intended to educate or persuade is all too often impotent.

Second, evidence suggests that events and activities that erode social trust have a stronger impact on overall levels of trust than do those thought to strengthen social trust (Figure 2). This is often referred to as the "asymmetry of trust" (Slovic 1993). Slovic (1993) found that of the many trust-building actions investigated only one had a moderate effect: "An advisory board of local citizens and environmentalists is established to monitor the plant and is given legal authority to shut it down if they believe it to be unsafe." Earle and colleagues (Earle et al. 2007, Earle 2010) argue against this asymmetry. They argue that trust is based on a willingness to make oneself vulnerable to another based on a judgment of similarity of intentions or values (i.e., value congruence). When information reinforces in a positive way judgments of similarity of intentions or values any negative information about confidence (i.e., performance) will be "overpowered" and "trust may turn out to be easy to gain and hard to lose." This, of course, presupposes the existence of social trust in the first place, which is clearly not the case for many people in the context of nuclear waste management. Earle and colleagues (2007, pg. 2) also argue that trust building or eroding actions may not be perceived in the same way by all people: "negative/positive may be more a matter of subjective judgement than of objective fact, particularly when morally important issues are at stake." We do not disagree with this view, but we note that it reinforces the conclusion that the conditions required

for regaining social trust are very challenging to come by. The factors giving rise to social trust in specific contexts are not well-understood, let alone control in a context of diverse and deeply held views about nuclear technologies.

By now our messages should be clear. There is no simple answer to how to rebuild social trust. At best it will take a very long time. In fact, it must be recognized that social trust may never be completely given.

However, the existence of social distrust in the United States does not mean all is lost. In fact, some degree of social distrust can be useful. The proper goal should be to achieve – and proceed – in a middle ground along the continuum of social trust and social distrust. Functional distrust, or what Poortinga and Pidgeon (2003) call "*critical trust*," can serve important social functions, such as ensuring oversight and vigilance (see also Tuler 2002, Bradbury et al. 2003). Kasperson et al. (1999) argue that such critical distrust can hold in check the growing power of economic elites and technical expertise, generate alternative control mechanisms that enable democratic institutions to maintain social order as well as fragile political balances, and encourage realistic appraisal of the operation of elites and the imperfections of democratic institutions without fostering the withdrawal of social mandates. They further argue that "Indeed, the absence of full trust in governmental institutions and representatives and the presence of distrust seems entirely consistent with the Madisonian conceptions of democracy in which one economic interest in prevented from achieving dominance through the emergence of coalitions of other interests to hold it in check and to prescribe and limit the power of centralized authority. So the pressing need is not to maximize trust but to concoct the appropriate mixtures of trust and distrust that should prevail within the political system…At the same time, levels of distrust cannot grow so high as to dissipate the reservoirs of social trust imperative for effective governance…" (pg. 39).

PROCESS IMPERATIVES UNDER CONDITIONS OF SOCIAL DISTRUST

The idea that some degree of social distrust can be functional reframes the challenge facing a reconstituted SNF and HLW management system in the United States. Those responsible for planning, implementing, and operating a waste management system should seek a balance between social distrust and social trust, i.e. *critical trust*. We recommend a two-track approach.

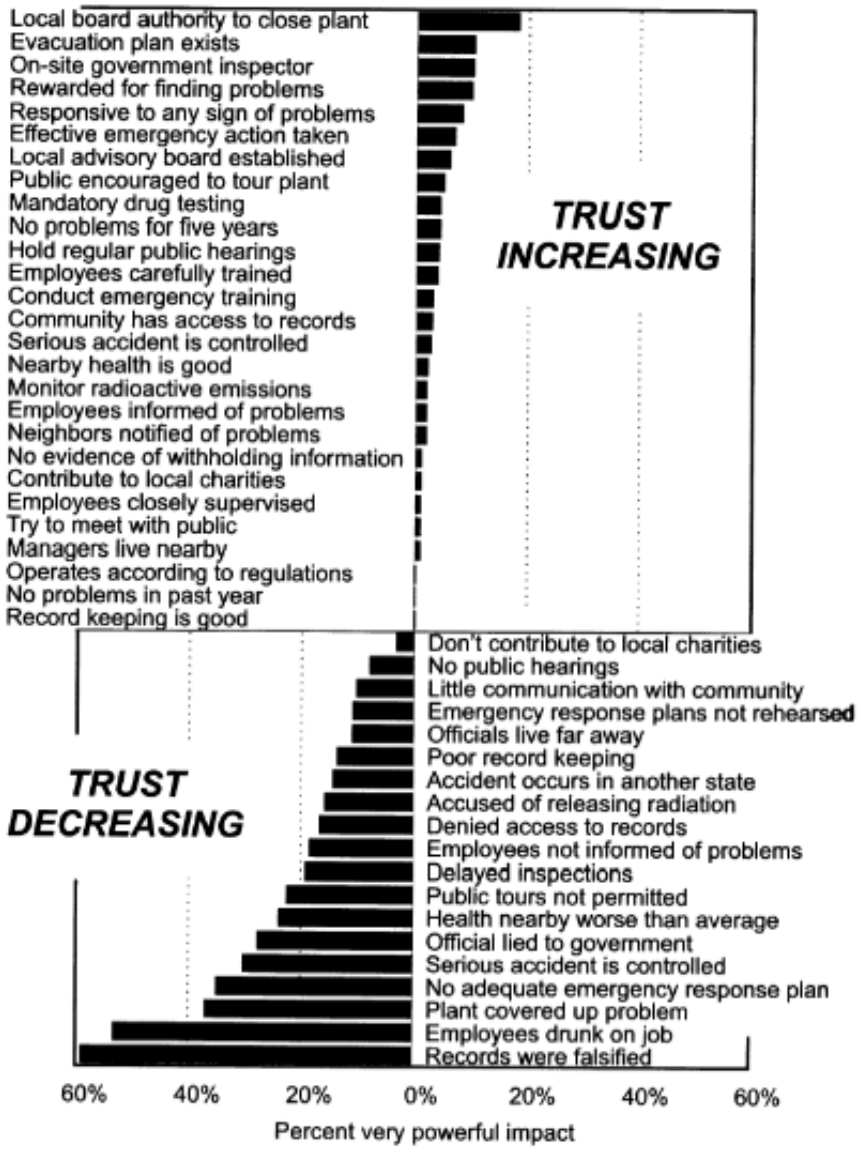
First, planning and operation of a waste management system should be designed to occur in the presence of social distrust. Social distrust is not necessarily, by itself, an insurmountable impediment to a successful waste management system. Second, implementing organizations must act on the recognition that programmatic choices have cognitive, affective, and behavioral consequences and that actions should be oriented to building critical trust.

Working along both tracks means that those responsible for planning, implementing, and operating a waste management system cannot simply perform a pre-specified set of actions on a predetermined check list. For every recommendation about what to do there are caveats that "success" is not guaranteed, whether in the narrow context of rebuilding social trust or in the broader context of a waste management program (Kuhn and Ballard 1999, Petts 2008, Rosa et al. 2010, pg. 763): "Addressing relevant social issues does not guarantee success, but ignoring them increases the chances of repeating past failures." Similarly, Kuhn and Ballard (1999, pg. 544) write that "the adoption of the open siting approach by project proponents will not ensure siting success. A community or communities may not volunteer, or all potential host communities may drop out of the siting process prior to an agreement to construct a facility. In other words, the open approach is not a panacea for siting hazardous facilities."

Table 1. Public images of a nuclear waste repository, reported as % of 10,000 images recorded in 4 surveys, 1988-1990 (From Flynn, Slovic, and Mertz 1993).

Image category	n
Negative consequences	
Dangerous/toxic	1683
Death/sickness	783
Environmental damage	692
Leakage	216
Destruction	133
Pain and suffering	18
Uninhabitable	7
Local repository area consequences	6
Negative consequences – other	8
Total negative consequences	*3546*
Negative concepts	
Bad/negative	681
Scary	401
Unnecessary/opposed	296
Not near me	273
War/annihilation	126
Societally unpopular	41
Crime and corruption	40
Decay/slime/smell	39
Darkness/emptiness	37
Negative towards decision-makers and processes	32
Commands to not build or to eliminate them	24
Wrong or bad solution	19
No nuclear, stop producing	15
Unjust	14
Violence	10
Prohibited	5
Negative – other	15
Total negative concepts	*2068*

Figure 2. Differential impact of trust-increasing and trust-decreasing events on levels of trust among respondents (From Slovic 1993). Respondents were asked about each event whether it would increase or decrease their trust in the management of a nuclear power plant. They, then, rated how strongly their trust would be affected (1 = very small impact on trust; 7 = very powerful impact on trust).



Note: Only the percentage of respondents giving category 7 ratings (very powerful impact) are shown here.

Proceeding in a context of social distrust *and* building appropriate levels of critical trust requires special attention to several process issues in both the short and long term. This will mean going beyond what is required by regulation or law. Organizations must be smart because difficult trade-offs may be necessary and what works (and doesn't work) in specific contexts is contingent on many factors that are not well understood. The following give process issues deserve special emphasis.

Processes for staged, adaptive management

In many aspects there is widespread agreement (but not necessarily consensus) about what is needed for the safe long-term management of SNF and HLW. But there is little understanding of exactly how to get there. Lack of knowledge applies to both technical and social dimensions of the waste management problem. For example, there is little understanding of how to implement long-term isolation, how to design an interim storage system to avoid making hasty decisions about a repository, how to obtain voluntary consent by host communities, and how to design effective public involvement. This has resulted in calls for a staged, adaptive management approach (NRC 2000, NRC 2001, NRC 2003, NEA 2004). The principles of adaptive management are that managers: 1) approach policy decisions as experiments, 2) gather data about how the system is responding to policy experiments, 3) involve key representatives of interested and affected parties in the design and evaluation of policy experiments, and 4) take mid-course corrections along the way, as necessary. Learning is important for improving processes and activities as they proceed. When citizens, especially those most directly impacted by siting, see improvements their trust and confidence in the system and its managers is likely to improve. A recent National Research Council study concluded: "Systematic evaluation is the most trustworthy way to gain understanding of the effects of participation practices and thus to ensure institutional learning and improvement in practice. Even when resources are limited, expenditures on systematic evaluation can add a great deal of value" (NRC 2008, pg. 4-10). Thus, assessment, decision, and evaluation *processes* should also be approached as a problem of adaptive management requiring diagnosis (Tuler and Webler 2010). Thus, learning via systematic evaluation is necessary to enable agencies to improve performance over-time. It is especially valuable when confronted with new situations.

A staged, adaptive management approach can increase the chances that the design and implementation process can proceed in the presence of social distrust. With that recognition as a foundation it will be better prepared to include "critical trust building" as an emphasis in the implementation process. It can contribute to re-building critical trust, as "discrete, easily overviewed steps facilitate the traceability of waste management decisions, allow feedback from regulators and the public, and promote the strengthening of public and political confidence" (NEA 2004, pg. 8). Specifically, a staged, adaptive management approach can promote the competence of waste managers – as well as confidence in those managers – by enabling them to:

- address surprises as they arise,
- learn from challenges, problems, failures, and successes and provide opportunity for integrating the knowledge gained into future design and implementation,
- address technical and societal questions and uncertainties as they arise,
- ensure opportunities for independent overview, quality control, and demonstration projects,
- monitor and evaluate performance as a condition for advancing to subsequent activities or phases,
- provide time for societal learning about complex technologies and ways to manage them safely, and
- demonstrate to regulators and the public through incremental actions that safety and security are being adequately addressed.

Processes for integrating analysis and deliberation with meaningful public participation

Managing risks and uncertainties associated with SNF and HLW is riddled with value judgments. Core questions, like "how safe is safe enough" cannot be answered by science nor technology; they are questions of human values (NRC 1996). And values, along with social trust, are key factors shaping the perceptions of nuclear waste risks (Whitfield et al. 2009). Moreover, a waste management system will require multiple phased activities, but also some activities that occur simultaneously. For example, criteria for site characterization must be established before potential host sites are assessed in parallel processes. Each activity may require different mechanisms for assessment, decision making, and public outreach. Consequently, it is now widely recognized that SNF and HLW management is not just a technical problem and is the kind of problem that requires substantial and integrated analysis and deliberation (Dietz and Stern 1998, NRC 1996, Renn 2006, NRC 2009a, NRC 2009b). This means crafting mechanisms – and institutions that support them -- for public involvement in assessment and decision-making. Three reasons are often given for doing so: normative (it is the right thing to do in our society), instrumental (it will promote legitimacy), and substantive (it will lead to more effective decisions; see Fiorino 1998, NRC 2008). For example, the Canadian process of waste disposal is driven by the understanding that social acceptance of waste management decisions will depend, at least in part, on the awareness and understanding of issues among the public and that the public can provide important information about their concerns and values to inform processes and decisions (NWMO 2010). These are also reasons that the scope of public participation has been increased in Sweden, Finland, France, and the United Kingdom (Elam et al. 2010, Lehtonen 2010, Vira 2006). While public participation can also lead to improvements in critical social trust (Bradbury et al. 1999, NRC 2008, Tuler 2002), others are more skeptical about this being an outcome of public participation alone (Petts 2008). Furthermore, public participation (and more often public consultation) can be used to control or deflect criticism (Elam et al. 2010, Lehtonen 2010, NRC 2008, Strauss 2010), which may result in short-term operational gains but at the possible expense of long-term trust and support. This has been recognized specifically as a possible problem for waste management assessment and planning efforts that have been put in the service of promoting commercial nuclear power (Elam et al. 2010, Hocke and Renn 2009, Lehtonen 2010). The cumulative evidence is unequivocally clear: there is a critical need for substantial – and substantive – attention to public participation in waste management. The need is critical because of these challenges:

- There is no reason to expect full agreement about what is an appropriate process for a decision problem because different people will have different values, beliefs, needs, experiences, and perceptions of the context (Tuler and Webler 2010, Webler and Tuler 2008). It is widely recognized that there is no singular "best" design for any process (Chess and Purcell 1999, NEA 2004, NRC 2008, Tuler and Webler 2010).

- The understanding of local contexts (e.g., past history, activism and controversy, site-type and demographic variables) will be important to assessments of local acceptability and preferences. Communities with nuclear facilities will differ in many ways from communities without nuclear facilities (e.g. Greenberg, 2009). Communities with existing (or closed) nuclear facilities may also differ in subtle ways from each other (e.g., Parkhill et al. 2010).

- More is required than the formal involvement of officials at local, state, and national levels. For example, there is evidence that preferences of elected officials (and regulators) may conflict with those of their constituents on specific issues such as waste management or facility siting (Baxter 2006, Richards and Brod 2004, Spies et al. 1993). Members of advisory boards may also not fully represent the diversity of views of local residents (Earle 2002, Satterfield and Levin 2002).

- What may be "success" or "failure" in one context can have implications for others, so that a systems perspective is vital when planning for public participation. As Petts (2008, pg. 830) writes: "At the end of an effective deliberative process, institutional representatives may have gained in personal trust,

members of the public might have come to understand some of the constraints that restrict official action, and all participants might have come to at least understand the perspectives of others if not necessarily agree with them. But arguably it is only the decision outcome and then the day-to-day performance of the decision-making institutions over a long period that will impact on institutional trust. If trust is context-specific then even an individual regulatory or decision body which gains a degree of trust from a single engagement process will not be able to rely on this transferring to the next decision."

Processes for establishing decision criteria

Too often in the past decision and performance assessment criteria have been made without public scrutiny or were not clearly defined in advance. This can give the impression that they are driven by narrow technical or political concerns as they, in fact, might have been. Inevitably such impressions undermine social trust in the management system. And, just as inevitably decision criteria and performance standards will be the subject of debate (Fischhoff et al. 1978): What is safe enough? Who decides? How much information is adequate? Answers to these questions will be particularly challenging when processes extend over decades and both members of the public and waste management institutions will change. As a Committee of the NRC (2001) wrote "In a democracy the acceptability of controversial decisions at the societal level depends largely on the use of criteria that have been established and understood in advance and on the use of procedures that are seen as fair" (pg. 420). The trustworthiness of decision makers and system managers depends on the use of criteria that have been established and understood in advance. These include, for example, health and safety standards, site characterization criteria, elements of joint hazard management and compensation packages. Of equal or more importance is performance that is consistent with the established criteria. The development of assessment and decision criteria through an iterative, participatory approach is a central feature of the Canadian approach (NWMO 2005).

Processes for independent technical assessments

In a context of social distrust, the current state of affairs, full disclosure of all information by itself will not guarantee the re-building of critical social trust. Instead, the ability to access or conduct independent assessments and evaluations in ways that ensure accountability and reliability are likely to have more value (Burger et al. 2005, Jenkins-Smith and Silva 1998, Petts 2008). Independent review and monitoring can take pressure off the need for trust in the agency and facility developers. Jenkins-Smith and Silva (1998, pg. 120) have concluded that "members of the public place substantial trust in *independent* scientists, but relatively little weight on the statements of those who they believe to be scientific guns for hire," although Kahan and Braman (2003) and Braman, Kahan, and Grimmelmann (2005) suggest this view may be overly simplistic. Nevertheless with independent review and monitoring the process may be able to proceed in a context of social distrust – or, more precisely where there is confidence in the *process* while there is distrust or skepticism in the institutional *actors*. Independent reviews can ensure that parties' concerns are being addressed and that they accept the validity of assumptions and information (and models) used to inform decisions. Independent reviews can also enhance social learning that will provide a better foundation for social judgments about the trustworthiness of system managers. External review can also push forward analyses and catch errors or weaknesses. Independent reviews should not be limited to government entities (e.g., potential host municipalities). The lack of resources and expertise among potential host communities and the general public to independently assess and monitor has been identified as a weakness of the Finnish and Swedish repository siting efforts (Elam et al., 2010, Strauss 2010, Vira 2006). Providing funding to critics, including community-based organizations and agency-established advisory boards, to assess and evaluate program elements can be a means for gaining trust and confidence, especially given the evidence that local leaders and residents may assess possible positive and negative impacts differently (Baxter 2006, Spies et al. 1998). For example, opportunities can be created for collaborative reviews that include participants chosen by various interests or who represent various

interests. Funding of critics to complete their own investigations can increase confidence that relevant issues are being thoroughly examined, and this has been done by EPA and DOE EM in the past. Trust can also be gained when the agency makes itself open to criticism, which is a kind of communication act that avoids the trap of having to say "trust us, we are from the government." Instead what is communicated is: "Here are funds for you to hire your own experts to check it out; you don't have to trust us." This show high confidence in the integrity of what has been done.

Processes for voluntary consent, joint hazard management, and compensation

When trust is low, coercion doesn't work. In the context of facility siting, to build critical social trust and ameliorate concerns about feared impacts of proposed facilities developers of projects can empower host communities to monitor and control risks (Ibitayo 2002, Johnson 2005). Control can have both a procedural and a hazard management component. A sense of control can both help to rebuild critical social trust and allow a siting process to proceed under conditions of social distrust. One way of providing control is to make acceptance of a facility voluntary (Castle and Munton 1996, Kasperson 2005, Rabe et al. 1996, Rabe et al. 2000, Richards 1996). A voluntary siting process gives the community a right to negotiate and even reject the facility, but it also raises challenging questions about how to assess consent of a *group* and especially consent over time. Nevertheless, a voluntary siting approach would build on the observation that people are more willing to accept voluntary risks (Fischhoff et al. 1978). The NRC (2001) argues that strategies for obtaining voluntary consent will benefit from partnership, power sharing, collaboration, and negotiation because they decrease the need for potential host communities to rely on trust of the responsible agency. Hazard mitigation and compensation packages are thought to work best when they are prepared in negotiation with a potential host community. The negotiation process should include community participation in all phases of the siting process, support for independent community review of facility design, safety systems, and operations, property value protection, and the right to initiate appeals for facility shutdown of health and safety standards are violated. These are examples of mechanisms which have been institutionalized elsewhere, including Sweden and Finland.

RECOMMENDATIONS FOR REBUILDING CRITICAL SOCIAL TRUST

Based upon the sizable literature in the social and psychological sciences on trust reviewed above we make recommendations for the work of the Commission itself. We also recommend elements of an approach that the Commission can consider recommending for moving forward with a new initiative on nuclear waste management.

Recommendations for the Blue Ribbon Commission process

- Present a clear plan for the remainder of the BRC effort, with a timeline.

- Commission a set of focus papers by leading experts on the major social and ethical problems that must be addressed in the Commission's deliberations. These should be brief (10-15 pages) and include options for solutions and their pluses and minuses. Most of these issues are complex and do not have easy answers. The Canada Nuclear Waste Management Organization provides a useful model for how to obtain and use such material.

- Recognize that the Commission composition and its staff expertise are inadequate in themselves for addressing the complex intertwining of technical and social issues (Rosa et al. 2010). We suggest immediately convening a standing advisory committee of leading social scientists and policy analysts from whom the Commission regularly draws upon.

- Enlarge the Commission's committee structure to include 3 new working groups on key cross-cutting issues: social trust, public engagement and stakeholder participation, and siting strategies.

- After each Commission meeting or work session, prepare a statement of the important things presented and discussed and how they will be addressed in the Commission's work to encourage further input and establish a basis for a final report. To minimize suspicions that can arise from closed deliberations all inputs should be clearly defined and outputs should be clearly based on those inputs.

- In its work, the Commission has generally opted for recruiting a wide diversity of views and opinions rather than depth of analysis of complex problems. The purpose of eliciting comments from a sample whose representativeness of views is highly questionable is unclear. Better balance and deeper discussion is needed. The focus papers will help. This can also be accomplished by convening, as the Commission seems to be doing, a number of focused seminars that probe in depth critical social and ethical problems that must be overcome. Include leading critics, and provide the resources so that they can participate. But, there should be no more cursory 10-minute presentations over a range of topics; this is a recipe for presenters to take more extreme views, simplify complex problems, and avoid facing trade-offs and complex nuances. Presentations from NGOs, industry, and government officials should be balanced with cross-cutting, comparative analyses from independent experts who focus on analysis indepth and designing new pathways.

- The credibility of some international efforts, such as that by the UK Committee on Radioactive Waste Management, have been questioned because they have been used to promote the revival of commercial nuclear power—with "new build" initiatives. A better strategy is to separate as much as possible commercial and defense "legacy wastes" from the future role of nuclear power in the US energy system. Maintaining this separation both in practice and in people's minds is likely to be very challenging. One approach is to explore alternative strategies for waste management based on a clearly articulated set of plausible scenarios for future nuclear development.

Recommendations for a new national approach

- A dual strategy must be adopted. First, planning, including the design of institutional architecture and procedures, should proceed in a way that recognizes the need to perform and be effective in a context of social distrust. It may be that proceeding on the recognition of a deficit in social trust will lay the foundation for transparent, participatory procedures that can rebuild functional, critical social trust over the long term. Second, while working in a context of distrust there must also be consistent efforts at all levels and in all aspects of nuclear waste policy-making - planning, implementation, and operations - to support the (re)development of critical social trust. It is important to get the nation on the right path for rebuilding social trust, when it has been on the wrong path for decades.

- Given the long, apparently obdurate distrust of the DOE it is time to think of putting waste management in the hands of alternative institutions. Instead responsibility should be placed in a public corporation, as many countries have done. This public corporation should have a diverse membership including industry, environmental groups, state and local officials, academic experts, and citizen bodies. There is a huge legacy of mistakes and false starts that are closely linked with DOE and the resulting distrust carries a very strong legacy that cannot easily be overcome. A successful waste disposal program is fully dependent upon addressing past mistakes.

- A premium should be placed on openness, inclusive stakeholder involvement, and truly independent peer review (by impacted communities and knowledgeable, demanding critics) during the planning, decision, and monitoring process for all stages of program development and operation. The role of public involvement and peer review should be clear and meaningful. Independent review by critics, including NGOs should be facilitated with resources and access to information.

- Contingent on geological suitability, the approach to siting should emphasize voluntary consent rather than coercion as much as possible. This is a tricky and complex issue. Note that voluntary approaches tilt the siting process to certain kinds of priority, enlarging the roles of openness and participation, and reducing the role of technical expertise. It may also lead to overbuilding for safety and spreading out the duration of the process, both of which can increase costs. To make decisions about facilities truly voluntary local officials and community residents should be empowered with resources to obtain independent scientific reviews of decision-relevant material.

- Joint hazard management of facilities and programs (e.g., transportation), benefits packages, and compensation packages should be provided to communities hosting waste facilities. Impacts can also occur to communities surrounding the host community (the so-called "donut problem"), so benefits should also be provided to them. The form, but not the amount, should be determined by negotiation.

- The overall process must have an architecture and a decision process fully and publicly committed to fairness and equity, informed by high quality science. This is not what emerged after the Nuclear Waste Policy amendments. This can only happen with broad participation and a time-consuming process.

- Repeating a recommendation for the BRC, SNF and HLW management should be separated as much as possible from the future role of nuclear power in the US energy system. Maintaining this separation both in practice and in people's minds is likely to be very challenging. The credibility of some international efforts, such as that by the UK Committee on Radioactive Waste Management, have been questioned because they have been used to promote the revival of commercial nuclear power—with "new build" initiatives. One approach is to explore alternative strategies for waste management based on a clearly articulated set of plausible scenarios for future nuclear development.

- Technical and social criteria for site selection, facility design, transportation routes, and other components of a waste management system are an essential element in a staged, adaptive management approach. They must be established in advance of decisions, assessments, or actions that will be based on meeting the criteria, with a careful decision process for reconsidering them based on new information and experience.

- Much closer critical attention should be given to international experience and models. While the US program has been well connected via international meetings and conferences, important lessons have not been integrated into the US system. Successful elements of other programs should be incorporated in the US program, especially on social issues to be addressed. At the same time, careful consideration should be given to the ways that cultural and political differences might *limit* the transferability of experience.

- The Nuclear Waste Technical Review Board has served an important confidence building function by providing advice and evaluation. A parallel review board for social issues related to nuclear waste management should be established to provide advice and evaluation on issues related to institutional design and performance, collaborative decision-making and public involvement, procedures for voluntary consent and reversibility, public outreach and communication, etc.

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