Identifying and Influencing the Essential Elements of Stakeholder Engagement Leading to the Success of Socially Controversial Projects

by

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ABSTRACT

At the heart of gaining stakeholder acceptance for any project, but especial socially controversial projects, is the need to build relationships and maintain a belief among stakeholders that the project's success is in the best interest of the group. In the nuclear enterprise, previous attempts to engage stakeholders and foster project acceptance have been well designed physically (i.e., technologically sound), but have struggled because they were tone-deaf to the complex, social, political, cognitive and technological factors that play a significant role in the formation of a stakeholder's acceptance of a project.

To mitigate societal and cognitive influences on the outcome of socially controversial projects, there is a need to rethink the way project implementers approach complex stakeholder relationships in order to align stakeholder interests, ultimately building a coalition of stakeholders committed to the project's success.

Building on system dynamics models of stakeholder acceptance, the work reported here used case study and interview data to identify the fundamental elements of stakeholder relationships that are essential to building mutually beneficial relationships that ultimately lead to project success. These essential elements of stakeholder relationships combined with the physical structure of stakeholder acceptance identified by system dynamics models were used to develop a framework with which to effectively engage stakeholders to build and maintain project acceptance over the life of the project.

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DEDICATION

My family is the source of every joy in my life. I would like to dedicate this thesis to my wife and best friend Amanda. From the day we met, you have been the foundation of all the success I have experienced in my career, school, and life in general. Thank you for your support and friendship. I love you.

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Lastly, I would like to dedicate this thesis to my parents. You both taught me how to work hard and to always maintain a positive attitude. I am who I am because of your love, the opportunities that you provided me, and your constant support throughout my life. Thank you for everything you have done and will continue to do for me.

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1. PROBLEM AND MOTIVATION

1.1. INTRODUCTION

The intent of this project is to refine and further research previously conducted in support of a larger study funded by the Department of Energy (DOE). The study is aimed at looking beyond effective communication to furthering the understanding of how to design enterprise projects that will garner stakeholder acceptability from start to finish. Previous work, has provided a foundation of knowledge identifying the structure and resulting causes of social attitudes concerning nuclear radiation (Chandra 2012) and understanding the causalities contributing to stakeholder acceptance with the use system dynamics modeling (Golay and Williams 2015). This research seeks to identify the most effective means of engaging stakeholders associated with socially controversial projects to foster and maintain a belief among the stakeholders that the project's success is in best interest of the group.

1.2. MOTIVATION

The mission of the Department of Energy is to ensure America's security and prosperity by addressing its energy, environmental and nuclear challenges through transformative science and technology solutions (Energy 2015). The DOE takes on complex projects in the best interest of the nation, unfortunately, often these projects are ultimately viewed as being controversial by at least some stakeholders. For example, the installation of high tension power distribution lines, construction of oil and gas pipelines, hydraulic fracturing and nuclear projects (both power generation and weapons), have a tendency to elicit extremely strong stakeholder attitudes toward the project. These large energy related projects are difficult to manage because of the complex, interconnected network of participants that includes stakeholders at individual, local community, state, and national levels. The inability to understand and manage these important stakeholder relationships often leads to significant project schedule delays and cost overruns and can potentially result in project failure.

The construction of advanced nuclear power plants that utilize passive safety systems could not only lead to energy independence for the United States, but would provide a reliable,

environmentally friendly way to reduce the greenhouse gas production that is currently stressing the environment around us. Accounting for the entire lifespan of a nuclear plant, nuclear power ranks comparably in terms of environmental impact with other green technologies such as solar panels and wind turbines. With a capacity factor of around 90 percent, nuclear power is more reliable than options that are subject to fluctuations in sun exposure or wind.

Because of the sheer magnitude of nuclear these new nuclear projects and the significant capital investment required to design, test, sell and build a nuclear plant, it is no longer enough to have a robust engineering design and a solid business plan; the nuclear enterprise needs to develop its social intelligence and understanding of the emotional components of stakeholder engagement. In addition to effective communication with all stakeholders, targeted engagement with a disparate number of stakeholder groups is required. In the nuclear enterprise, previous attempts to engage stakeholders have been well designed physically (i.e., technologically sound), but have been tone-deaf in terms of stakeholder acceptance. Though effective communication is necessary, it is insufficient by itself. There is a general lack of understanding within the nuclear enterprise in regards to the importance of gaining stakeholder acceptance for new controversial projects.

The nuclear enterprise has made significant evolutionary advances resulting in increased safety margins over the nuclear plants currently operating in the United States but the inability of the nuclear enterprise to gain stakeholder support for these projects will have lasting effects on the world around us. The nuclear enterprise needs to take a proactive approach to identifying and managing the complex stakeholder relationships associated with socially controversial projects in order to gain and maintain a net positive acceptance for environmentally friendly energy projects. In order to do this the industry has to rethink the way it engages and manages stakeholder relationships associated with complex, long term, capital intensive energy projects.

1.3. RESEARCH QUESTION

Controversial projects can be defined as aspects of modern technologies that some people question, or are cautious about. They could range from involving genetic modifications, biological hazards, effects of chemical agents, nuclear radiation or hydraulic fracturing operations to name a few. Projects tend to become socially controversial when public beliefs, decision-maker understanding and expert opinion are misaligned.

Stakeholder acceptance is comprised of complex, social, cognitive and technical components. In order to mitigate societal and cognitive influences on socially controversial projects, the essential elements of stakeholder acceptance must be identified and their influences understood well enough to be adequately designed, implemented and maintained to ensure project success.

Research Question 1: What are the essential elements of a stakeholder engagement needed to increase the likelihood of success in socially controversial projects?

The nuclear enterprise has worked for decades to gain acceptance for nuclear projects, but a myopic focus on the ineffective education programs and general stakeholders enlightenment have not proved fruitful in advancing the industry's objectives. As a result, the nuclear enterprise has been largely ineffective in gaining stakeholder acceptance to either extend operational life (e.g. San Onofre Nuclear Generating Station) or build (e.g., Mixed Oxide (MOX) Fuel Fabrication Facility) new nuclear facilities. The nuclear enterprise, led mainly by engineers, has failed to consider the social aspects and implications of these socially controversial projects. Gaining project acceptance among stakeholders is hypothesized to be an essential element for the success of long duration, capital intensive projects and should be treated as a design constraint given the enormity of the project risk and investment.

Research Question 2: How can the essential elements of a stakeholder engagement be influenced to increase the likelihood of success in socially controversial projects?

The primary objective of the work reported here is to gain a better understanding of the societal causalities associated with achieving levels of stakeholder acceptance that allow socially controversial projects to proceed. The second research objective is to develop a framework or method to help guide project implementers to identify and influence the essential elements of this complex concept and enhance the overall acceptance of socially controversial projects.

2. LITERATURE REVIEW

To develop a deeper understanding of the underlying mechanisms associated with stakeholder acceptance of nuclear energy projects, and to help identify the essential elements of stakeholder engagement that lead to the success of socially controversial projects, it is important to first explore and understand previously developed project acceptance philosophies and the current literature concerning the subject. An initial review of the literature identified the following research strands that merited further examination: risk vs. benefit analysis, technology adoption and acceptance, nuclear risk and acceptance, project management and finally trust and relationships. A summary of the relevant literature reviewed for each research strand is provided below.

2.1. RISK VS. BENEFIT ANALYSIS AND RISK PERCEPTIONS

With any large project comes both risk and benefit. This literature review started with the examination of "risk" and how it is often perceived differently by individuals than it is by the general population. Ultimately risk vs. benefit tradeoff determinations are impacted by the perception of risk.

Three approaches to decision-making were identified regarding nuclear energy attitude formation including: (1) cost/benefit analysis, (2) the use of reference groups (individual attitudes based on trust in the reference group), and (3) core values. (Kuklinski 1982). Risk perception is bigger than quantified probabilities (P. Slovic 1987). Trust, credibility, and social identification play a part in the risk perception of various industries and particular technologies (Wynne 1992) and is often contextualized as being part of a larger process (Fischoff 1995). When balancing risk versus benefit, there is a need to understand the relationship between preference, expected benefit and perceived risk (Weber 2002), where risk perception formation is both deliberate/analytical and intuitive/natural (Epstein 1994).

When it comes to the communication of risk among stakeholders and identifying ways of representing probabilistic risk, it is important to use common, understandable language when engaging disparate stakeholder groups with technical information about risk and when reporting technical problems to stakeholder groups to increase risk understanding (V. Bier 2001).

An asymmetry was identified to exist between the effects of stubborn beliefs and the revelation of new information on individual acceptance (Cvetkovich 2002). If a persevering bias is generally positive toward the project, then new information, whether positive or negative, will be understood from that positive perspective. The opposite is also true leading to a cognitive anchoring of opinion wherein new information, regardless of the actual impact, it is normally seen as reinforcing the previous beliefs (Plous 1991).

Bodmar et.al (2012) explained that the popular perception of risk is greatly skewed more by dread risk (a rare event that kills many people as a result) instead of continuous risk (frequent events that kill many people over a long period of time) even if the total number of fatalities is the same (Bodemar 2012). Margolis (1997) identified a difference in the way that risk is perceived by experts when compared to laypeople. Experts tend to have a greater level of direct experience and as a result tend to understand risk quantitatively (expected deaths or injuries as a result of an accident) while laypeople tend to perceive risk qualitatively (emotional fear) due to their lack of experience. Margolis argues that it is vital to understand the positions from which each group forms opinions about risk. The understanding of cultural influences on risk perception can help in the identification of the values of various stakeholder groups and understanding of how they align with nuclear project acceptance. Risk and benefit perceptions are functions of both individual exposure to information and cultural predispositions that result in the filtering of new information according to established beliefs (D. M. Kahan 2008).

Cognition is pattern driven and as such, the source of intuition or 'habits of mind', in decreasing order of importance, are: direct experience in everyday life, social experience for topics that fall outside daily life and default anchoring of more obscure topics. Margolis describes a statistical or objective component and a visceral or subjective constituent of risk perception. Margolis argues that such items are 'not so much a list of extra dimensions that worry lay people as a list of things that might be used to rationalize lay concern in the absence of evidence of danger in its usual sense (Margolis 1997, 42).'

Individuals are psychologically disposed to believe that behaviors they find honorable are socially beneficial while behaviors that are perceived as dishonorable are socially detrimental (D. M.-S. Kahan 2011).' Attempting to fuse 'cultural theory of risk' with this individual psychometric paradigm, Kahan discusses how 'culturally diverse persons tend to form opposing perceptions of what experts believe (D. M.-S. Kahan 2011).' In many ways this process of cognitive thinking

applies predisposed biases in such a way that new information that aligns with an individual's current position is given a heavier weighing factor while new information that opposes one's current position gets a lower priority. Thus, in order to change the mind of an individual in a stakeholder group with a different view 'communicators must attend to the cultural meaning as well as the scientific content of the information (D. M.-S. Kahan 2011).'

An individual's perception of risk plays a part in forming the individual's propensity to accept new technology. To gain a deeper understanding of how and why individuals and groups decide whether or not to adopt new technology I turned to the literature for further insight.

2.2. TECHNOLOGY ADOPTION AND ACCEPTANCE

Nuclear power has a tendency to polarize the population with camps that are both adamantly opposed and others passionately in favor of the technology. To better understand this discrepancy a review of literature associated with technology adoption and acceptance was conducted.

Technological acceptance tends to be dependent on the perceived usefulness, the ease of use and the expectation that the technology will be used in socially responsible manners (Pavlou 2003). The process of accepting and adopting new technology tend to be personal and varies from stakeholder to stakeholder (Waarts 2002) in most cases gaining acceptance requires face-to-face contact, convenience, reliability, personal sense of ability, and access to customer service (Walker 2002) and is often influenced by the views of the larger social group (Gupta 2012).

Tripsas found that expected customer preferences can be changed by the broader socio-political context where changes in the individual's 'system of use' and the identification of efforts to influence the individual are capable of changing an individual's mind (Tripsas 2008). Fornell incorporates the concept of treating customers as business assets as they are valuable to the future of the company. The point of this work is the need to 1. Optimize customer satisfaction 2. Understanding customer expectations as customer demands 3. Balance expected utility with quality and price and 4. Understand that satisfaction is a function of customer experience and performance as judged by the customer (Fornell 2007).

With a better understanding of how individuals tend to analyze the usefulness of a technology in deciding whether to accept a new technology or not, more research was needed to

understand how perceived nuclear risks impacts the stakeholder analysis of the risk vs. benefit (usefulness).

2.3. NUCLEAR RISK AND PROJECT ACCEPTANCE

Following the review of literature on the general acceptance of new technology, the next area of research focused specifically on the acceptance of nuclear projects. Nuclear acceptance is highly based on "who pays and who gets the benefits" (Peele 1974). A study on acceptance of nuclear power plants pre- and post-Fukushima suggests that the level of trust in nuclear energy is related to trust in nuclear energy after a catastrophic event (V. H. Visschers 2013). Nuclear accidents tend to lead to a sharp decline in public support of nuclear projects as these events challenge pre-conceived notions of the value for nuclear energy.

Risk perception of nuclear energy can be thought of as a surrogate for ideological issues with larger/systematic social changes (Rothman 1987). Nuclear attitudes are often based on psychological risk, economic and technological benefits, sociopolitical risks, and environmental/physical risk, with those favoring nuclear focusing on the economic and technological benefits and those opposed focusing on the uncontrolled or unknown risk (H. J. Otway 1978). The perceived risk is a function of the perceived technology attributes, characteristics and the developer's plans and actions (Maphisa 2012).

Factsheets have long been used as communication tools by environmental groups to serve two purposes: (1) educate readers to move them to action and (2) communicate technical concerns to regulators and those who have decision-making power (Tillery 2003). Factsheets set out to sway stakeholders with the 'simultaneous reliance on scientific and technical discourse coexisting with a distrust of scientific and bureaucratic culture (Tillery 2003, 406).' In other words, they emphasize the negative attributes of the regulating bodies and attempt to undermine technical credibility and fact. For example, opposition groups used their rhetorical device to present scientific information about nuclear waste repositories to a non-specialist audience to move them to oppose these sites, and their major source of information is also their major opponent (Tillery 2003, 418).'

Trust and transparency in nuclear management drive public attitudes toward nuclear projects and are vital to gaining project acceptance (Mulder 2012). Proximity, familiarity and the

perceived impact of nuclear energy effect public attitudes toward nuclear projects (H. C. Jenkins-Smith 2012). Technologies viewed as risky tend to be more widely accepted by the general public when individuals feel they are partner in the project (Poetz 2011) and gaps in projects often reduce acceptance of nuclear projects and play a substantial role in stakeholder attitudes toward the project (Ash 2010).

With the identification of the importance that trust and transparency in nuclear project implementers plays in individual nuclear risk assessments, the next area of study focused on the project management practices that seek to engage stakeholder groups.

2.4. PROJECT MANAGEMENT

Project management is an area that has gained significant traction in recent years. With the creation of project management professionals, a great deal of effort has been focused on developing more efficient ways of managing complex projects and more specifically, working with stakeholders. Stakeholder Strategy is the process of not only establishing interactions but also maintaining positive, stakeholder relationships that benefit the larger group. Building Collaborative relationships with stakeholders requires a fusion of ideas adopted from a variety of disciplines such as community relationship managers, marketing and sustainability experts and project managers to name a few (Svendsen 1998).

In a seminal book on stakeholder relationships, Freeman identifies management practices as the basis for building strong relationships that are essential to the success of a project (Freeman 2010). While specifically geared more toward business organizations, The Stakeholder Circle Methodology developed by Lynda Bourne describes a set of processes and practices that guide project managers in establishing, building and maintaining the necessary relationships for project and organizational success that can be applied to any project. It is important to identify and map the essential stakeholders in order to understand each stakeholder's attitude toward the project in order to effectively engage each stakeholder early and often (Bourne 2009). Social network theory is a way of identifying communication pattern densities to help predict whether and how the salience of stakeholders may shift as projects progress to develop emergent models of stakeholders. Use of both social network and stakeholder theories, while theoretical tools, can be integrated to describe a more precise approach to managing stakeholders throughout the project

life cycle (Assudani 2010). Myllykangas et. Al (2011) argue that analyzing stakeholders is not enough with regard to value creation; an analysis of stakeholder relationships is needed. The question of who and what really counts should be replaced by the question of how value is created in stakeholder relationships.

As the manager of a complex project it is important to focus internally and align principles and values to create lasting long term mutually beneficial relationships. In essence, stakeholder management should be thought of as a project branding activity focusing on collective benefit, authenticity, honesty and discipline to build trust and reputation (Foley 2006).

This review of project management specific literature identifies the importance of fostering open and trusting relationships between the project implementer and other stakeholders suggesting the need to further study trust and relationships.

2.5. TRUST AND RELATIONSHIPS

Trust is established, maintained, and sometimes lost through our relationships with others. These relationships are often dynamic as they will vary in depth and richness over time based on interactions with others. "Working together often involves interdependence, and people must therefore depend on others in various ways to accomplish their personal and organizational goals" (Mayer, Davis and & Schrooman 1996). Mayer, Davis, and Schrooman (1996) went on to examine the factors for why a trustor would trust a trustee. These factors including "ability, benevolence, and integrity" contribute to the trustor's ability to trust a trustee and how to establish an individual relationship based on trust. 'Ability' can be thought of as an individual's or group's ability to influence the level of trust between stakeholders. 'Benevolence' is "the extent to which a trustee is believed to want to do good to the trustor, aside from an egocentric profit motive." Finally, 'integrity', "involves the trustor's perception that the trustee adheres to a set of principles that the trustor finds acceptable." (Mayer, Davis and & Schrooman 1996)

Sitkin and Roth (1993) found that "trust reflects a focal actor's positive expectations about a partner's reliability in accomplishing tasks in a particular context." They also found that "distrust arises from the perception of incongruence between a focal organization's values and those of its partner." This finding contains two fundamental understandings for why distrust is so prevalent in socially controversial projects. The first is that an actor's perception of another stakeholder has a

direct impact on their ability to trust. The formation of distrust can be a result of the reputations and rumors associated with other stakeholders. Secondly, values and how each party perceives the values of other stakeholders can enforce the perception of distrust. Values are what an organization or actor considers important. If misaligned, it creates an environment of distrust and erodes the relationship between stakeholders (Sitkin and Roth 1993).

Trust in relationships evolves overtime until the ability to identify with the other's values and goals enables parties to act in a manner that ensures mutual interest. "When trust reaches this level, the resulting partnership becomes a key ingredient in a successful relationship" (J. Gansler 2001).

There are several models of the trust lifecycle available, each with slightly different nuances. For the purpose of providing a mental model to use in this discussion I propose to use the lifecycle below developed by Joshua Williams (Williams 2015) based on Graebner's (2009) examination of trust asymmetries between a buyer and seller. Figure 1 below is a slightly modified version of Grebner's lifecycle as some minor changes were made to remove reference to the buyer and seller relationship and extend the model to more useful for a generic project. The stages of the lifecycle are described below.

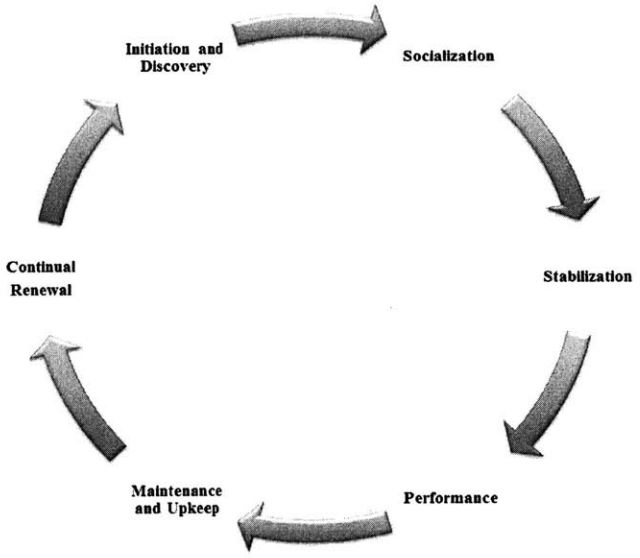

Figure 1 - Trust Lifecycle (Williams 2015)

Initiation and Discovery – Much like first dates, activities in the initiation and discovery phase are intended to be a way of introducing stakeholders to each other and defining the purpose

of the relationship. Stakeholders define roles and describe how each will contribute, establish expectations and develop a mental framework of the larger group's relationships.

Socialization – Is where the various stakeholders start adapting to their new environment and becoming more comfortable with newly formed relationships with other stakeholders. Past experiences and mental frameworks start to form the sense of trust or distrust within the new relationships as each group explores their role, dependencies and boundaries.

Stabilization – As stakeholders start to interact with one another, additional experience is gained through observation and interactions and a level of trust begins to stabilize between stakeholders. Interactions become more meaningful as stakeholders begin to rely on each other for the achievement of a joint goal.

Performance – As the relationship continues to stabilize stakeholders are continually reassessing project goals based on progress. Adjustments are made to roles and responsibilities as required as the project matures. Communication continues to play a vital role in the performance phase. The trust previously established allows stakeholders to update project vision, goals, and objectives.

Maintenance and Continual Renewal – Even once established, a great deal of effort is required to maintain a level of trust because there is always the potential lose trust. If trust is lost your ability to regain that trust is limited.

'The establishment of trust between [stakeholders] starts with the initiation and discovery of a relationship. The initial expectations formed in the initiation and discovery phase are further defined based on an increased understanding of each actor and their willingness to trust one another; this is encountered during the socialization phase. As the evolutionary cycle continues to mature, [stakeholders], their environment, relationship, and trust begins to stabilize. Additional experience is gained through observation and interaction. Each [stakeholder's] actions start to become more meaningful as the two actors begin to rely on one other to achieve the joint vision and goals established during the initiation phase. A trust-based relationship achieves maturity during the solidification and implementation phase (Williams 2015)'.

Established with effort over time, trust is built through stakeholder interactions. Once established, trust must be continually fostered because the continuance of trust is not guaranteed. Once lost, trust is hard to regain.

2.6. LITERATURE REVIEW SHORTCOMINGS

This literature review started with the examination of the idea that there is a tradeoff between risk and benefit in the decision making process. Current literature increased our understanding of "risk" and how it is often perceived differently by not only individuals but also groups. It raised questions surrounding the way individuals and groups see technology and how they decide whether or not to accept and adopt technology in general. After reviewing general technology acceptance, the focus shifted to understanding how the perception of risk associated with nuclear power impacts the acceptance of nuclear projects.

The importance of trust and transparency in the project implementer focused the literature review on project management practices that seek to engage stakeholder groups. With the advancement of project management as a profession, efforts are being made to develop and identify best practices for stakeholder engagement. Current project management literature encourages a focus on relationship building based on trust among stakeholders. A review of literature related to trust and relationships the idea of the trust lifecycle was identified as model to help understand the evolution of trust based relationships in a project.

The shortcoming identified by this literature review is the lack of implementation strategies for the theories of stakeholder engagement. Much of the literature mentions the importance of building mutually beneficial, trust based relationships using effective communication in passing and allude to them as being fundamental interactions only to move on to explore less intractable matters as shown in Figure 2 below.

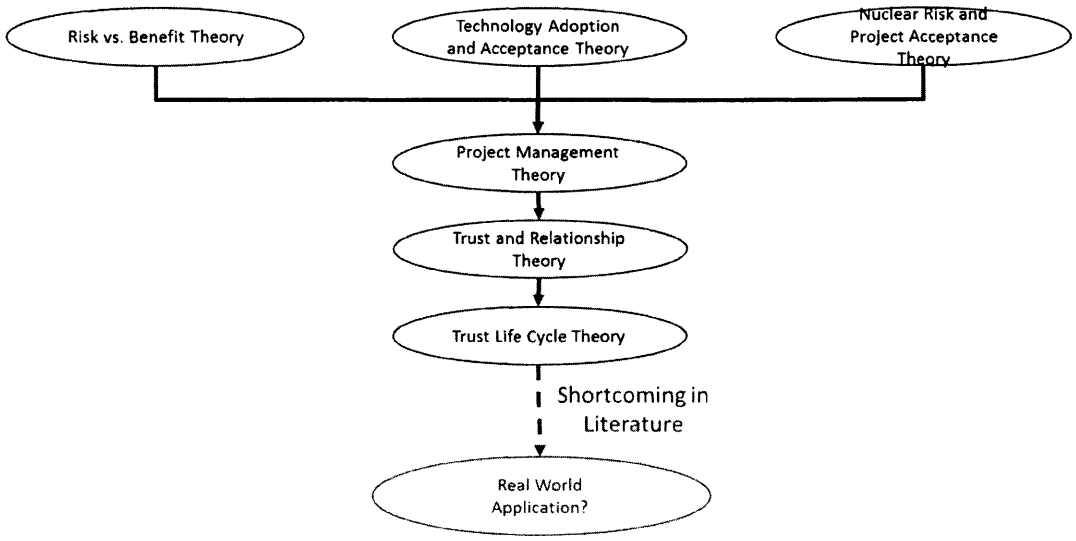

Figure 2 - Literature Review Shortcoming

During the course of this literature review, it was also noted that literature on the acceptance of nuclear projects tends to be dated and only partially considers the complexity of stakeholder engagement in socially controversial projects. Previous research using non-linear models of acceptance have helped to identify several key concepts that with further research, could increase our ability to understand and develop a theory of stakeholder acceptance toward complex, socially controversial projects including:

- Behavioral patterns relating to the cognitive anchoring of attitude at individual and group levels are influenced by societal pressure.
- Social trust in a project and confidence in project implementer ultimately impact risk/benefit analysis associated with project acceptance.
- Understanding of controversial projects can be are improved by the inclusion of cognitive psychology models that include the perception of risk caused by diverging values.

To further build on this current understanding of stakeholder acceptance there is a need for a new approach capable of analyzing the underlying issues and dynamic behaviors associated with stakeholder relationships.

3. A New Approach: Stakeholder Acceptance as a Dynamic System Level Priority

3.1. Dynamics of Complex Systems

At its most basic level, a complex system is a collection of highly interrelated or interconnected entities whose behavior is not easily described or predicted. The complexity of the system is the result of the numerous interactions between the entities that ultimately results in the behavior of the larger system. Adding to the complexity of a system is non-linear component behavior that can result in irregular components and system behavior. These interconnecting relationships and non-linear behaviors must be taken into account in order to better understand the entirety of the system's behaviors.

Society's reaction to controversial projects can be modeled as a complex system made up of many related agents including people, groups, institutions and governments. Each individual with his/her own unique thoughts and actions has an impact on and is impacted by the other agents within society. The individual is essentially a subsystems within larger social groups and society in general. Individuals and social groups ultimately contribute to the behavior of society. The behavior of these groups is often hard to predict because of the constantly changing interconnected relationships within the group.

Social behaviors such as the stakeholder acceptance of socially controversial projects tend to be complex nonlinear systems that exhibit dynamic behavior resulting from the complex interactions between the various social agendas of the system's stakeholders. Mathematical modeling is often used to predict future dynamic behavior based on past performance, but many of these models fail to uncover the time varying patterns of the system. Unlike many other mathematical models, system dynamics incorporates a system thinking approach to problem analysis where the problem is viewed as a system with an output that is dependent on the interconnectivity that exists between the components of the system. System dynamics is an effective tool for modeling complex non-linear dynamic systems because imbedded feedback loops are used to account for the transmission and return of information within the larger system.

System dynamics models can be used to better our understanding of how complex systems behave over time.

The concept of system dynamics was developed at the Massachusetts Institute of Technology as a way of modeling the simultaneous interactions of multiple nonlinear causal feedback factors. The founder of system dynamics, Jay Forrester, defined it as follows- "Industrial [System] dynamics is the study of the information-feedback characteristics of industrial activity to how organizational structure, amplification, and time delays interact to influence the success of the enterprise." (Forrester 1961) The basic assumption of system dynamics is that dynamic, continuously evolving relationships between system components results in the complex behavior exhibited by the systems. System behaviors are the result of the system's causal feedback structure.

3.2. SYSTEM DYNAMICS TOOLS

The system dynamics concept of analyzing a complex system combines model construction ideas from control engineering, cybernetics and organizational theory to account for the impact of a system's input(s), subsequent reaction(s) on the system, and the rate at which each occurs in the analysis. This concept of feedback is one of the most important characteristics that sets system dynamics apart from many other mathematical models. The ability of system dynamics to account for system feedback improves the accuracy of modeling the dynamic behavior of the system.

There are two types of system dynamics feedback loops used represent system interdependencies. The first is a reinforcing loop. In the case of the reinforcing loop, a variation in any variable propagates through the loop and returns to the original variable reinforcing the initial deviation. For example, money invested in a savings account earns interest. The interest earned in the interest period is then added to the original account balance. In the next interest period, the larger account balance will earn more interest than was earned in the previous interest period because of the larger bank balance at the start of this new interest period. This behavior will continue as long as the bank continues to pay interest assuming money is not withdrawn from the account. Figure 3 below provides the structure of the system in causal loop form and the resulting system behavior.

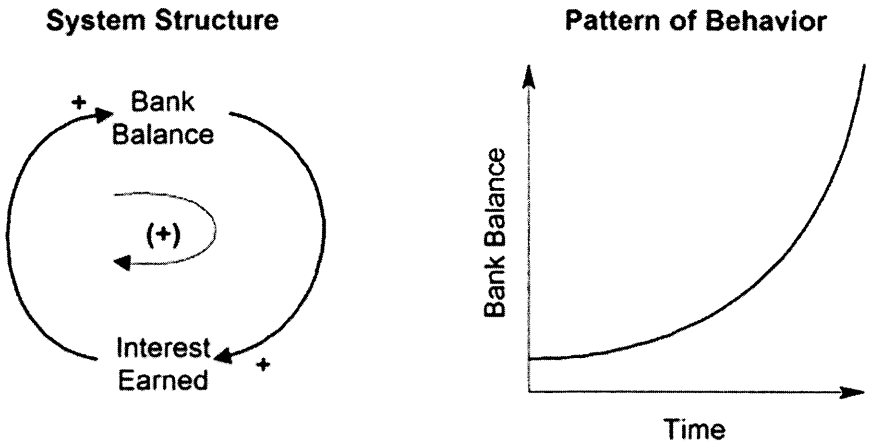

Figure 3 - Reinforcing loop Example (Kirkwood 1998)

In contrast to the reinforcing loop, a variation in any variable in a balancing loop will propagate through the loop and result in a system output that is opposite to the initial input. The classic example of a goal seeking balancing loop is a temperature control system. If the temperature of a room drops below a set point (desired temperature), the heating system is activated to raise the temperature to the desired set point. In this case the decrease in temperature below the desired temperature results in system actions (heating system turns on) that will ultimately cause the temperature to increase. Figure 4 provide the system structure and possible system behaviors that ultimately converge on the desired temperature.

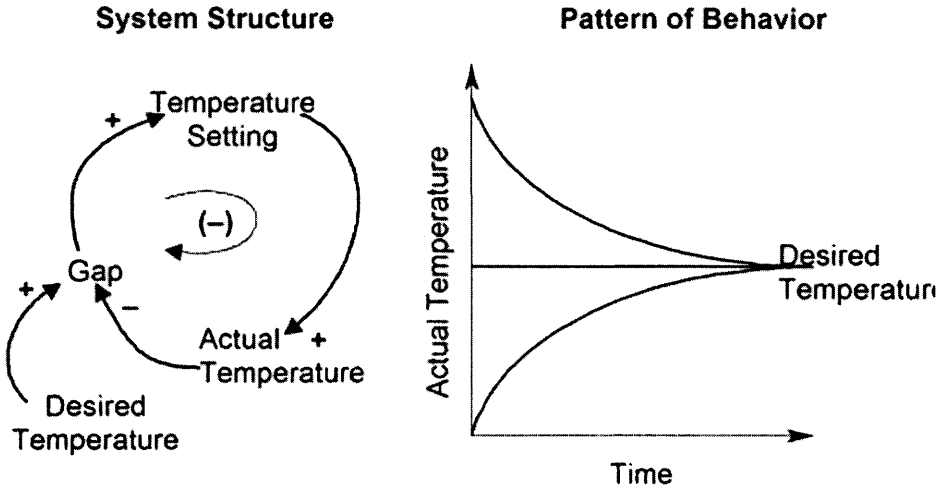

Figure 4 - Balancing Loop Example (Kirkwood 1998)

Combinations of balancing and reinforcing loops can be used to explain complex system behaviors by modeling nonlinearities, heterogeneity, temporality, asymmetry and micro/macro scale effects of complex systems. This ability of system dynamics to simply model complex system behaviors led to the selection of system dynamics to model stakeholder acceptance of social controversial nuclear projects.

3.3. STAKEHOLDER ACCEPTANCE MODELS

Myllykangas et. Al (2011) argue that analyzing stakeholders is not enough; a deeper analysis of stakeholder relationships is needed. The question of who and what really counts should be replaced by the question of how value is created in stakeholder relationships for socially controversial projects. To do so, it is necessary to study and understand in more detail, the essential elements upon which such relationships are built. Ultimately, a theory and model that captures the structure of relevant phenomena that can be used by those wishing to understand the underlying stakeholder dynamics to accomplish their goals was needed.

The goal of the system dynamics models used in this research is to define explicit statements of causality between variables within the causal loop diagrams. The causal loop diagrams were created by deconstructing complex behaviors and identifying variable interactions extracted from interview data and case studies. The causal loop diagrams were developed to capture the dynamic, nonlinear feedback effects associated with the general acceptance of socially controversial projects and ultimately aid project implementers in determining whether or not controversial projects have the support required to allow the project to move forward. If the project does not have adequate support, understanding the structure of the model will help to suggest actions that will strengthen stakeholder acceptance.

Initial models continued to mature based the insight gained from lessons learned in case studies. Ultimately the creation and refinement of three interrelated CLDs was necessary to fully capture the intricacies and complexity of stakeholder acceptance at the individual, local and national levels (Golay and Williams 2015). The revised causal loop diagrams used in this project consist of precisely defined variables and the relationships between those variables to illustrate the dynamics contributing to the level of project acceptance. As it is hypothesized that stakeholder

acceptance should not only be thought of as an initial project design parameter, but also an ongoing process of stakeholder engagement, the system dynamics models were created to increase the understanding of the complex, social, cognitive and technical aspects of complex projects enabling project implementers to successfully engage stakeholders to manage acceptance of the project over time (Golay and Williams 2015).

3.3.1. INDIVIDUAL CAUSAL LOOP DIAGRAM

Stakeholder acceptance of nuclear projects can be thought of as a state of acceptance that falls within a spectrum spanning from Active Rejection to Active Acceptance as shown in Figure 5 below (Golay, Williams and Paramonva 2013).

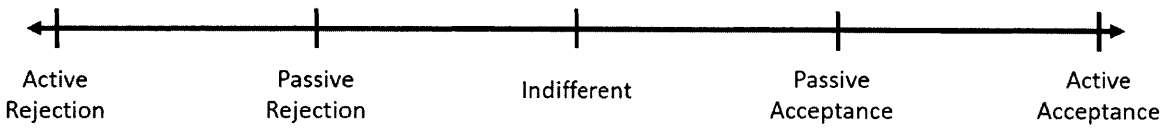

Figure 5 - Acceptance Spectrum

An individual's perception of a socially controversial project, is vital to understanding the stakeholder relationship dynamics of acceptance of nuclear technology projects. Attitudes towards nuclear technology have been found to be different than those of other technologies perceived as hazardous, such as hydraulic fracturing, genetic engineering or biohazard facilities (Chandra 2012). Even within the subset of nuclear technology, different applications invoke different reactions. Medical uses of the technology are generally viewed as positive, whereas nuclear power plants and radioactive waste management facilities can sometimes cause fear and anxiety in the minds of some people. Chandra's work is one attempt at explaining the causes and structure of Radiation Attitudes, and the dynamics of the various factors influencing them (Chandra 2012).

Acceptance of socially controversial projects can be thought of as a condition where a project is allowed to proceed, given specific (tolerable) constraints (Golay and Williams 2015). There are three general factors leading to personal decisions about project acceptance that have

been identified regarding nuclear energy attitude formation including: (1) a cost/benefit analysis, (2) the use of reference groups (individual attitudes based on trust in the reference group), and (3) individual core values. (Kuklinski 1982). Balancing these factors became the initial basis for the model of Individual Acceptance, Figure 6 below.

Interviews conducted with potential stakeholders helped to reinforce the ideas that 1. trust, credibility, and social identification play a part in the risk perception of various industries and particular technologies (Wynne 1992) and 2. expected customer preferences can be changed by the broader socio-political context where changes in the individual's 'system of use' and the identification of efforts to influence the individual are capable of changing an individual's mind (Tripsas 2008).

Located at the center of the Individual Acceptance causal loop diagram is "Radiation Attitudes" which is defined as a comprehensive reflection of personal attitudes toward radiation or nuclear-related technologies, processes or facilities (Golay and Williams 2015). This model of radiation attitudes accounts for an individual's evaluation of benefit or perceived personal benefit, weighed against perceived personal risk. This idea that an individual's evaluations of risk versus benefit is affected by the extent to which the individual has control over or is able to provide inputs to the decision making process. The extent to which an individual trusts the project implementer to act in the best interest of society is also captured in the model.

On the right hand side of the CLD, the model accounts for an individual's fears associated with nuclear catastrophe, the influence of the media and popular culture and to an extent the way the individual frames the available information related to the associated project. At the periphery of the model are the external variables that help to shape individual radiation attitudes.

Interviews that will be described in more detail in Chapter 4, helped to shape and validate this update to Chandra's model of radiation attitudes as it relates to stakeholder acceptance of socially controversial projects. In particular these interviews shed new light on how an individual's education level and exposure to specific nuclear knowledge contributed to the way the individual perceived the risk of nuclear power and the contributed to the extent in which that individual felt they had a degree of personal control in the decisions associated with nuclear projects.

Case study data indicated that personal trust in a project implementer and the perception of how the project implementer would respond to issues as they arise are significant contributors to an individual's perception of risk (Golay and Williams 2015).

Table 6, located in Appendix A provides detailed information about specific variable definitions and Table 9, found in Appendix B describes specific loop dynamics that aid in understanding the Individual Acceptance Causal Loop Diagram shown in Figure 6 below.

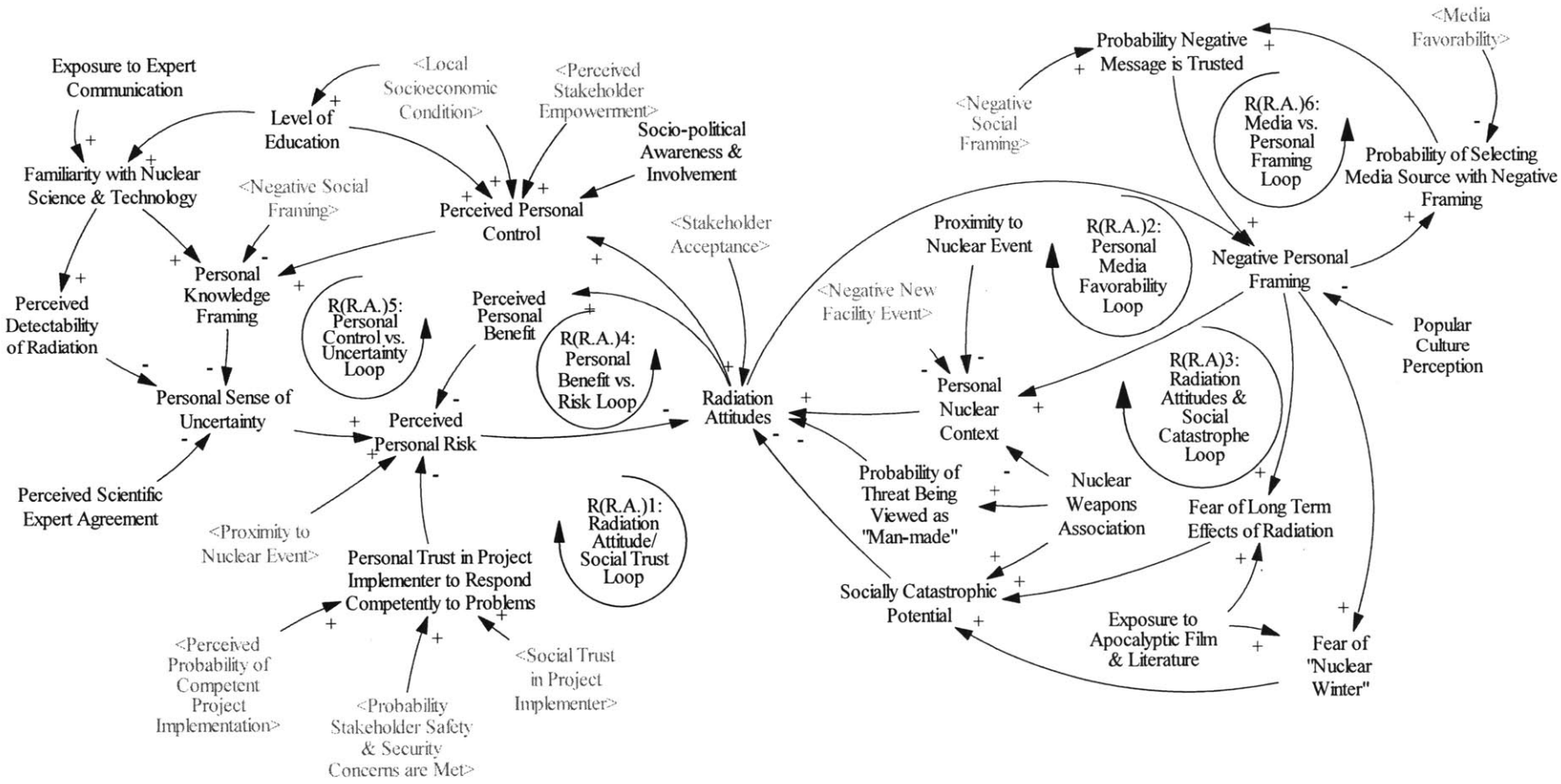

Figure 6 - Individual Acceptance CLD [(Chandra 2012) Modified]

3.3.2. Local Causal Loop Diagram

In the development and refinement of the Individual Acceptance Model, Figure 6 above, case study and interview data reinforced the idea that individual attitudes are affected by trust in local reference groups as proposed by (Kuklinski 1982); as such a model was created to capture the impact of local influence on stakeholder acceptance in regards to socially controversial projects. This model represents the elements that affect local stakeholder groups' support of a particular project.

Stakeholder acceptance at the local level describes the complexity of balancing the perceived benefits associated with the project with the perceived risks that accompany the project. For example, large construction projects generally add local employment opportunities within the community in the form of construction jobs. These additional workers spend money in the community improving the local economy are just a few examples of local benefits. Perceived risks associated with a new nuclear facility might include reduced property values, increased construction traffic, the possibility of an accident or the uncertainty around the storage of spent fuel. When balancing risks versus benefits, there is a need to understand the relationship between preference, expected benefit and perceived risk (Weber 2002), where risk perception formation is both deliberate/analytical and intuitive/natural (Epstein 1994). It is also important to note that the focus in this research was on "perceived" benefit and risk as opposed to "actual" benefit and risk. I point out this distinction because in most cases, especially in the case of controversial projects, there is a gap between the actual benefit and actual risk compared to what is believed to be the benefit and risk associated with the project.

Trust and transparency in nuclear management drive public attitudes toward nuclear projects and are vital to gaining project acceptance (Mulder 2012). This trust in the project implementer has an impact on the magnitude of perceived benefits and risks associated with the controversial project. The more effort by the project implementer to identify and mirror local values, the higher the stakeholder acceptance and ultimately the probability of project success (Sietgrist, Cvetkovich and Roth 2000). As long as there is a perceived net benefit, stakeholder acceptance will remain positive toward the project (Golay and Williams 2015).

Similar to the Individual Acceptance Model above, the key aspects of this model include balancing perceived benefit with perceived risk. This model not only takes this concept of benefit

vs. risk one step further by focusing on social risk and social benefit as opposed to the individual risk and benefit in the previous model, but it also provides more insight into how the perception of social risk and social benefit are formed. The model accounts for the degree to which the project implementer's values align with stakeholder values, the importance of reporting mistakes and providing a level of project transparency and how each contributes to the level of trust in the project implementer over time. One of the important ideas, and sources of non-linearity, captured in the models is the cognitive inclusion of frequency, or the extent to which low frequency adverse events at nuclear facilities are included in stakeholder group risk determination (Golay and Williams 2015).

This model also takes a closer look at the impact of various information sources such as the media, stakeholder groups (both supporting and opposition groups) and how this information ultimately is framed by stakeholders as they analyze the benefit and risk tradeoff.

Interviews helped to shape and validate this model of stakeholder acceptance as it relates to socially controversial projects at the local level. In particular, interviews conducted with professional stakeholder relationship manager roles helped to identify key variables that contribute to social trust in project implementers and reinforced the understanding of those phenomena.

Table 7, located in Appendix A provides more information about specific variable definitions and Table 10, in Appendix B describes specific loop dynamics to aid in understanding the Local Causal Loop Diagram shown in Figure 7.

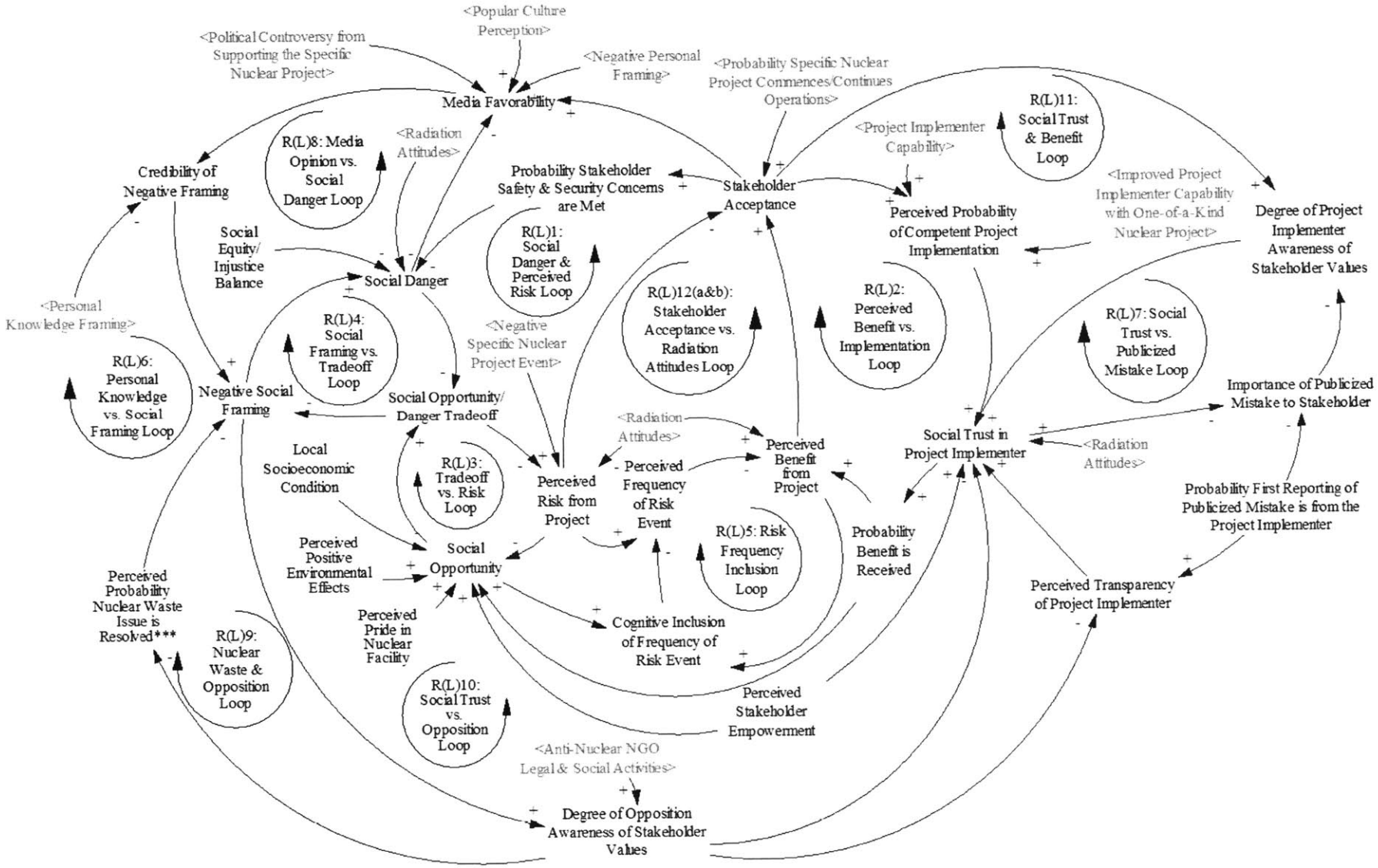

Figure 7 - Local Causal Loop Diagram (Golay and Williams 2015)

3.3.3. STATE/FEDERAL CAUSAL LOOP DIAGRAM

Research indicated that the groups and organizations at the state and national level also had an influence on stakeholder acceptance of socially controversial projects. Again, as we continue to zoom out from the individual stakeholder, there is additional complexity as now project funding and facility operational benefits are considered by political and national leaders across the country.

In this model, the probability that a controversial project is allowed to begin or will continue to operate is influenced by the way that the project is perceived by the stakeholders in terms of project performance (accidents, mistakes and mishaps), schedule delays and cost overruns. The longer the project continues to operate within its means, the more valuable the project becomes to the various stakeholders at the state and national level in terms of providing jobs, solving challenging issues at the state and national levels (i.e. reducing nuclear waste) and/or generating tax revenues.

The model at the State/National level focuses on project execution in regards to not only project mistakes, mishaps and required rework, but also regulatory compliance, budget and schedule adherence, social benefit compared to alternatives and the political controversy associated with supporting the project. While each of these can be hard to understand, this model effectively describes the phenomena and seems to accurately illustrate the interrelated structure of variables with which to identify possible mechanisms by which system behaviors can be influenced.

A highly regarded project can help stem attempts to generate controversy associated with publically or politically supporting the project. As long as any associated controversy is minimal or decreasing, the likelihood of national financial support increases, which in turns reduces opportunities for cost overruns or schedule creep. The fewer budget and schedule issues that emerge, the more likely it is that the project will be supported both politically and financially.

Interviews helped to shape and validate this model of stakeholder acceptance as it relates to socially controversial projects at the state and national levels. In particular, interviews conducted with individuals that manage federally funded government contracts as a profession helped to validate the model's attempt to define the government funding process and to an extent, reinforced the idea that political support for the project is dependent on the amount of political controversy associated with backing or continuing to back a controversial project.

Case study data indicated the importance of project progress in terms of schedule and budget and how each contributes to a stakeholder's willingness to continue to support the project and the project implementer. This was particularly evident in the case of political and financial support (Golay and Williams 2015).

Table 8, located in Appendix A provides more information about specific variable definitions and Table 11, found in Appendix B describes specific loop dynamics to aid in understanding the State and National Causal Loop Diagram in Figure 8.

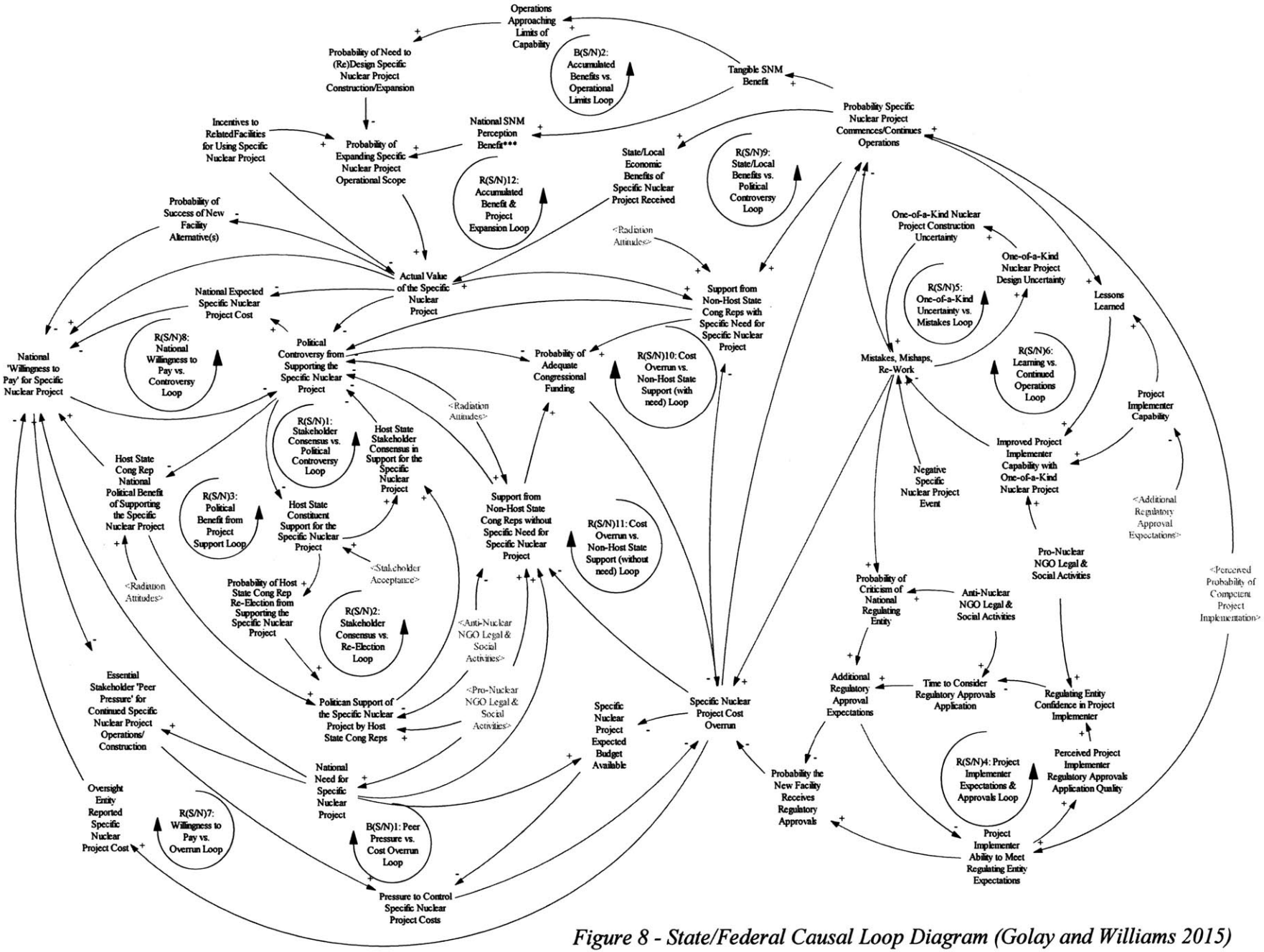

Figure 8 - State/Federal Causal Loop Diagram (Golay and Williams 2015)

3.3.4. MODEL SUMMARY

Oftentimes, the more controversial a project is, the more strongly held are the attitudes supporting or opposing the project and as such, there is need to fundamentally understand the dynamics of stakeholder relationships associated with controversial projects. It is vital to understand stakeholder attitudes and be able to mirror the social values of the local community in order to maintain the belief that success of the project is in each stakeholder's best interest. Technologies viewed as risky tend to be more widely accepted by the general public when individuals feel they are a partner in the project (Poetz 2011) and gaps in projects often reduce acceptance of nuclear projects and play a substantial role in stakeholder attitudes toward the project (Ash 2010).

It should be noted that the causal loop diagrams above are a simplified representation of complex, emotionally driven relationships and as such will be more accurate for certain situations than others. The model however, has proved to capture much of the real world behavior described in case study reviews and stakeholder interviews. These models, while complex and overwhelming at first, provide a significant step towards understanding and visualizing the structure of complex, social, political, cognitive and technological factors that play a significant role in the formation of a stakeholder's acceptance of controversial projects.

With this new understanding of the structure of interrelated variables associated with stakeholder acceptance, the focus of this research shifts to identifying the vehicles or the essential elements of stakeholder acceptance that provide the most leverage to a project implanter to influence the level of acceptance of social controversial projects.

More interviews will be conducted to identify and prioritize the key phenomena of stakeholder acceptance described in the model. Once the key phenomena identified, the essential elements will be extracted and the structure of these models will be used to identify the most effective ways of influencing the behavior of the model.

4. METHODS AND DATA

4.1. RESEARCH METHODOLOGY AND PROTOCOL

Understanding individual sensitivity toward socially controversial projects and the complexity of the numerous stakeholder interrelationships, it was determined that surveys, questionnaires and similar tools for data collection were not an adequate means of collecting the data needed to reveal the underlying issues that contribute to a stakeholder's level of acceptance for such projects. Instead, an approach using grounded theory method (Corbin and Strauss 1990) and conversational interviews (Weiss 1994) was used in the course of this research to validate the system dynamics causal loop diagrams presented in Chapter 3 and to identify essential elements of stakeholder engagement leading to project success. This approach was used because grounded theory seeks not only to uncover relevant conditions of the target population but also to determine how members of the target population actively respond to those conditions, and to the consequences of their actions (Corbin and Strauss 1990). The goal is to gain a deeper understanding of stakeholder perceptions under current environmental circumstances.

Conversational interviews were conducted where the interviewer used a list of pre-determined questions to serve as conversation starters and were designed to elicit responses that will most likely reveal the interviewee's true beliefs and values toward various projects and stakeholder groups. The list of conversation stating questions can be found in Appendix C. This method for conducting interviews has been termed as "qualitative interviewing". The analysis of these interviews relies less on counting and correlating, and more on interpretation, summary and integration. This method enables one to gain in the coherence, depth and density of the material which each respondent provides (Weiss 1994).

This interview approach was chosen because active, in depth interviews tend to produce more information with deeper insight into personal feelings and attitudes than would have been revealed through other data collection mechanisms. Ground theory data collection is optimized with conversational interviews because the interviewee has more freedom in answering questions and the interviewer can gain additional insight from non-verbal communication and anthropological observations (Gordon 2013).

Throughout the course of the work reported here, the core tenets used in the development of causal loop diagrams presented in Chapter 3 and the extraction of the key behavioral phenomena have focused on understanding two main elements:

1. The differing perspectives toward nuclear projects as viewed by industry experts compared to the views of the general population with significantly less exposure to the nuclear principles. In general when it comes to nuclear debates, experts tend to see 'solvable technical problems' but the public and policy-makers see an 'intractable policy issue.' This impasse influences the arguments used to support and oppose nuclear-related endeavors, often attempting to convert a stakeholder with a differing perspective using the wrong kind of argument (Margolis 1997, 132)
2. There is a gap between perceived and objective benefits and/or truths in relation to the acceptance of nuclear projects. This perception disparity, while hard to quantify, is important to account for variations to the cognitive connection to complex nuclear projects. These cognitive connection variations help to capture important dynamics effects resulting from the gap between objective and perceived truth

All interviews were governed by MIT protocols including COUHES for use of human subjects, including assurance of interviewee confidentiality.

4.2. Interview Subject Overview

The use of time intensive conversational interviews as described above made it impossible to interview a large enough pool of participants to run statistical analysis of the data collected, but an effort was made to gain insight from as large a cross section of the population as possible given the time limitations of the project. With this in mind the use of snowball sampling (Babbie, 2012), where interviewees were asked to identify other individuals whose insights and experiences would prove helpful to the project. This led to the introduction of individuals from other areas of the country and stakeholders with experiences in various industries allowing us to determine the extent to which the developed models can explain phenomena across different demographics.

Interviewees were chosen based on how the individual related to the working list of stakeholder groups including (Golay and Williams 2015):

- Local bystanders (e.g., members of the local population, 'soccer-moms', first responders)
- Local decision-makers (e.g., immediate mayor, county clerk, city council)
- Local opposition (e.g., local independent groups, local affiliates of national opposition groups)
- Neighboring bystanders (e.g., members of the surrounding population, 'soccer-moms', first responders)
- Neighboring decision makers (e.g., surrounding mayor, county clerk, city council)
- State decision makers(e.g., governor, state U.S. Congressional representatives, state legislative/executive representatives)
- Federal decision makers (e.g., the White House, non-host state Congressional representatives, Department of Energy)
- National regulator (e.g., Nuclear Regulatory Commission or Department of Energy)
- National opposition (e.g., Sierra Club, Greenpeace)
- Facility funding organizations (e.g., shareholders, federal government)
- Facility customers/service users (e.g., nuclear power plants)

Interviews were also conducted with individuals that conduct or participate in stakeholder relationship management as a profession. The hope for these interviews is to further refine and validate both the phenomena identified and the causal explanations that generate the behaviors in the CLDs.

Table 1 below provides an overview of key interviews that were conducted through the course of this research. As short summary of interview data is provided in Section 4.4.

4.3. SUMMARY OF INTERVIEWS

Table 1 - Overview of Key Interviews

Interview*	Date	Duration (min)	Interview Objectives	Interviewee Data	How Conducted	Interviewers
A	10/21/2014	45	Stakeholder Engagement Model Validation	Late 50's large project manager with many stakeholders	Via phone	R1, R2, R3
B	11/3/2014	60	Stakeholder Engagement Model Validation	Mid 40's Stakeholder manager at local university	In person	R1, R2, R3
C	11/5/2014	55	Model Validation	Late 40's High School Social Studies teacher	Via phone	R1, R2, R3
D	11/12/2014	55	Model Validation	Late 40's High School Physics teacher	Via phone	R1, R2, R3
E	11/17/2014	50	Stakeholder Engagement Model Validation	Mid 30's Experienced Project Manager (IT projects)	In person	R3
F	11/18/2014	80	Stakeholder Engagement Model Validation	Mid 30's US Air Force Project Manager	In person	R3
G	12/9/2014		Model Validation	2 high school students from the mid-west enrolled in AP classes	Via phone	R1, R2
H	12/10/2014	50	Model Validation	2 high school students from the mid-west enrolled in AP classes	Via phone	R1, R3
I	12/12/2014	55	Engagement Model Validation	Mid 40's Stakeholder manager at local university	In person	R1, R3
J	12/19/2014	40	Engagement Model Validation	Researcher Nuclear Reactor Laboratory, MIT	In person	R1, R3
R1= Prof. Goaly R2= Adam Williams R3= David Walsh						
*This is a partial list of the most representative interviews. Other interviews that were conducted with only one interviewer were given a lower priority to minimize interviewer biases and ensure the validity of interview interpretations.						

4.4. SUMMARY OF INTERVIEW DATA

Candid interviews with individuals representing many stakeholder groups provided a great deal of insight into how stakeholders form opinions related to socially controversial projects. While each of the interviews provide unique data, some common themes emerged across many of the interviews. Some of the common themes include:

Risk - The determination of the amount of risk associated with various activities such as nuclear power, hydraulic fracturing or rail transport of oil/gas to name a few, tends to be based on the way in which readily available information is interpreted by each individual. Interviewees discussed how they determine to what extent various information related to that particular topic is being sensationalized before framing their opinions.

Benefit – In general, stakeholders expected to receive some form of benefit from allowing the project to proceed. Depending on the proximity to the controversial project, stakeholders expected to receive more of a direct benefit the closer the project was to their personal property or day to day lives.

Trust – Trust in project implementers came up in every interview that was conducted. In general it seemed that individuals were less trusting of corporations than they were of the government. Stakeholders expected to have a level of external oversight that roughly corresponds to the perceived risk associated with the project. The concept of trust asymmetry also came up where stakeholders acknowledged that it was harder to gain trust than it was to lose trust.

Values – When describing how they determine if a project is justifiable, several interviewees discussed using their own personal beliefs or values and comparing them to those of the project implementers. Core values were used to help individuals guide themselves through the decision making process in the case of controversial projects.

More detailed information about specific interviews can be found in Appendix D.

4.5. INTERVIEW VALIDATION OF MODELS

In validating the CLD models specific variables, relationships and loops were interrogated in an attempt to identify how the model's structure of variables could be used as a mechanisms for

influencing the system's behavior with deliberate actions by project implementers to gain and/or maintain a net positive acceptance of the project.

Interviews were used to assess research data, underlying theory and assumptions built into the models of stakeholder acceptance of socially controversial projects and were used to validate the variables used within the model and confirm our understanding of the dynamic interrelationships between those variables.

Based on lessons learned from early interviews the causal loop diagrams have undergone several major revisions to more clearly articulate the dynamics that influence stakeholder acceptance at the individual, local and state/national level. Recent interviews with stakeholders from various stakeholder groups lead us to believe the models have converged on an accurate representation of the complex interdependencies associated with stakeholder acceptance of socially controversial nuclear projects. As research continues and new data is collected, these 'living models' will continue to be updated as needed.

Conceptually these models are useful, but the question that remains is, how can these models be operationalized to identify – and ultimately influence – the essential elements of stakeholder engagement leading to success?

5. IDENTIFICATION OF ESSENTIAL ELEMENTS OF STAKEHOLDER ENGAGEMENT

One of the tenants of system dynamics modeling is to use simple dynamic loops to tell complex stories. The interviews discussed in Chapter 4 helped to refine causal loop diagram variable names, definitions and system interactions to simplify and more accurately express actual behavior of stakeholder acceptance. Further interrogation of the model helped to identify key behavioral phenomena associated with acceptance. It is hypothesized that these phenomena can be manipulated by project managers to either reinforce or negate facets leading to individual attitudes toward socially controversial projects in the desired direction.

Data collected throughout the research project from both a detailed literature review and interviews was used to identify the following phenomena at the heart of the dynamic models that tend to best describe the behaviors associated with dynamics of stakeholder acceptance. The identified phenomena include (Golay and Williams 2015):

Individual Model Phenomena:

- **Personal Benefit** – What advantages are gained by supporting the project? The personal context is usually the first filter individuals use to assess or evaluate a project. For example, using tax dollars to expand a city's schools within a community will be more accepted by stakeholders that have or are expecting to have children in that school district than it will by stakeholders without children or a whose children have already graduated from school. The stakeholders without children may think that tax dollars could be better used in a program that will benefit them more directly.
- **Cognitive conception of risk** – Risk perception is often a subjective judgment by an individual base on the information they believe to be true at the time. Different people can, and often do, estimate the degree of risk or benefit differently given the same information. This perception is pattern driven and as such, the source of intuition or 'habits of mind', in decreasing order of importance, are: direct experience in everyday life, social experience for topics that fall outside daily life and default anchoring of more obscure topics. Risk and benefit perceptions are functions of both individual

exposure to information and cultural predispositions that result in the filtering of new information according to established beliefs (D. M. Kahan 2008).

- **Personal Framing** – Personal framing is a result of the way an individual internalizes the external world. Each of us sees the world through a different lens that in one way or another psychologically distorts our perceptions of reality. These psychological lenses with which we view the world are often developed early in life and are influenced by our parents and culture. In risk assessment, 'when intense emotions are engaged, people tend to focus on the adverse outcome, not on its likelihood. That is, they are not closely attuned to the probability that harm will occur...this phenomenon...produces serious difficulties of various sorts, including excessive worry and unjustified behavioral changes (Sunstein, 62-63)'
- **Trust asymmetry** – Trust is difficult to earn and easy to lose while distrust is easy to gain and hard to lose. In general, bad news tends to have a bigger effect on attitude formation and decision-making than good news (P. J. Slovic 1991). This trust can be in relation to an individual, a specific technology, a specific facility, a specific company or a specific activity.

Local Model Phenomena:

- **Social trust and credibility in project implementer** – The extent to which stakeholder groups are willing to rely on the project implementer of a specific nuclear project to make decisions in situations where the group lacks the resources to make a decision (Golay and Williams 2015). Whether it was as simple as a schoolboy prank or a more contemptuous dumping of toxic chemicals in local waterways or the misuse of funds by various organizations, our experiences have caused us to be cynical of the intent of others especially in the case of perceived controversial projects. Trust and credibility have to be earned and maintained. Without trust and credibility the project is not expected to go far.

- **Core values** – Core values are the fundamental beliefs of a person or group. This set of principles serves as the foundation or baseline form which decisions are ultimately made. These core values provide a way to prioritize the facets of a decision and guide

us through the decision making process. Core stakeholder values play a role in determining or influencing benefit and risk associated with nuclear projects (de Groot and Steg 2013). While this idea of core values is modeled under local phenomena, it is important to point out that core values play a role in decisions at all levels, individual, local and state/federal. For the sake of this research, core values are modeled at the local level in respect to aspects of social trust.

- **Media and Popular Culture** – The portrayal of topics in the media and in popular culture influences individual attitudes towards that subject. 'Americans spend two-thirds of our waking lives consuming mass media. Be it television, movies, music, video games or the internet, media consumption is the number one activity of choice for Americans – commanding, on average, 3700 hours of each citizen's time annually' (Dill 2007). We live in the world of 24 hour news networks, reality TV shows and tabloids among others, that sensationalize the world around us to boost viewership and profits. Popular culture and social perceptions of nuclear power (especially during the formative years) has a significant impact on radiation attitudes and stakeholder decision making (Zemand 2004).

State/Federal Model Phenomena:

- **Political dynamics** – To characterize individual and social political dynamics within a country accurately, one must consider interactions between leaders, their constituencies, and political, economic, and environmental conditions. (Bier, Bernard and Backus 2010). There are many factors that influence the activities and policy decisions of political leaders. In the case of large-scale projects that require federal financial support or regulatory approval, there are dynamic relationships between Congressional representatives from states that directly benefit from nuclear facilities and the representatives from states that are not served by the project. These political dynamics have an impact on a project's approvals and funding.

Table 2 below identifies specific causal loops within the three models where each of these phenomena are modeled:

Table 2 - Identification of how phenomena are modeled

Phenomena	Model Level	Specific Loops
Personal Benefit	Individual Acceptance	R(R.A.)1:Radiation Attitude/Social Trust Loop R(R.A.)4: Personal Benefit vs. Risk Loop
Cognitive conception of risk	Individual Acceptance	R(R.A.)3: Radiation Attitudes & Social Catastrophe Loop R(R.A.)5: Personal Control vs. Uncertainty Loop
	Local	R(L)5: Risk Frequency Inclusion Loop
Personal Framing	Individual Acceptance	R(R.A.)2: Personal Framing Loop R(R.A.)3: Radiation Attitudes & Social Catastrophe Loop R(R.A.)5: Personal Control vs. Uncertainty Loop R(R.A.)6: Media vs. Personal Framing Loop
	Local	R(L)4: Social Framing vs. Tradeoff Loop R(L)6: Personal Knowledge vs. Social Framing Loop (c) R(L)10: Social Trust vs. Opposition Loop
Trust asymmetry	Individual	R(R.A.)1: Radiation Attitude/Social Trust Loop
	Local	R(L)7: Social Trust vs. Publicized Mistake Loop R(L)9: Nuclear Waste & Opposition Loop R(L)10: Social Trust vs. Opposition Loop R(L)11: Social Trust vs. Benefit Loop
Social trust and credibility in project implementer	Individual	R(R.A.)1: Radiation Attitude/Social Trust Loop
	Local	R(L)2: Perceived Benefit vs. Implementation Loop R(L)7: Social Trust vs. Publicized Mistake Loop R(L)10: Social Trust vs. Opposition Loop

Table 2 - Identification of how phenomena are modeled (continued)

Phenomena	Model Level	Specific Loops
Core values	Local	R(L)10: Social Trust vs. Opposition Loop R(L)11: Social Trust vs. Benefit Loop
	State/Federal	R(S/F)3: Political Benefit from Project Support Loop R(S/F)4: Project Implementer Expectations & Approvals Loop B(S/F)1: Peer Pressure vs. Cost Overrun Loop
Media and Popular Culture	Individual	R(R.A.)6: Media vs. Personal Framing Loop
	Local	R(L)8: Media Opinion vs. Social Opinion Loop
	State/ Federal	R(S/F)1: Stakeholder Consensus vs. Political Controversy Loop R(S/F)8: National Willingness to Pay vs. Controversy Loop B(S/F)1: Peer Pressure vs. Cost Overrun Loop
Political dynamics	State/ Federal	R(S/F)1: Stakeholder Consensus vs. Political Controversy Loop R(S/F)2: Stakeholder Consensus vs. Re-Election Loop R(S/F)3: Political Benefit from Project Support Loop R(S/F)9: State/Local Benefits vs. Political Controversy Loop R(S/F)12: Accumulated Benefit & Expansion Loop B(S/F)2: Accumulated Benefit vs. Operational Limits Loop

5.1. PRIORITIZATION OF KEY PHENOMENA

With the identification of the above phenomena, the next phase of the work reported here focused on prioritizing the phenomena in order of importance to stakeholders as noted in data collected during the course of interviews. It is hypothesized that identifying the most important phenomena will help in identifying the essential elements of stakeholder engagement leading to the success of socially controversial projects.

Identification of these essential elements of stakeholder engagement is important because, in the case of most projects, resources including time and money, tend to be in short supply. Resource constraints limit a project implementer's capacity to influence stakeholder acceptance effectively. The identification of the essential elements of stakeholder engagement will allow a project implementer to focus project resources maximizing their ability to influence the general acceptance of the project.

With eight key phenomena within the models identified, the research team reviewed interview notes to determine if each particular phenomenon was "activated" in the course of the interview. A phenomenon was determined to be activated if the interviewee described a situation or condition that was in line with the description of the phenomena described above. Examples of interview quotes that would "activate" a particular phenomenon include:

- Interview B – "After the project got off to a slow start, we were able to turn the project around by tracking the values, resentments and history of individual stakeholders" activated the core value phenomena.
- Interview C – "In my opinion, fracking is being sensationalized in the news because there is a focus on increasing newspaper sales not necessarily trying to informing the public" activated the media and popular culture phenomena.
- Interview I – "For many politicians, it is not a matter of how he or she feels personally about the project it is more a matter of how the project is viewed politically" resulted in the activation of the political dynamics phenomena.

Table 3 below provides a summary of the analysis results for each interview corresponding to the interviews in chapter 4.

Interview	**Social trust and credibility**	**Personal Benefit**	**Trust asymmetry**	**Core values** Activated	**Cognitive conception of risk**	**Personal Framing**	**Media and Popular Culture**	**Political dynamics**
A	X	X	X					X
B	X	X	X	X	X	X	X	X
C	X	X	X		X		X	X
D	X	X	X	X	X		X	X
E	X		X			X		
F	X	X	X	X	X	X		
G	X	X		X	X	X	X	
H	X	X	X	X		X	X	
I	X	X	X	X	X	X	X	X
J	X			X	X			X
Frequency of Activation	**10**	**8**	**8**	7	7	6	6	6

Table 3 - Summary of Interview Activated Phenomena

5.2. IDENTIFICATION OF THE ESSENTIAL ELEMENTS OF STAKEHOLDER ENGAGEMENT

At the heart of gaining stakeholder acceptance for any projects, but especial socially controversial projects, is the need to maintain a belief among the stakeholders that the project's success is in the best interest of the group. There is a need to be able to link the success of the project to the success of the individual stakeholder groups. With this in mind, interview data was examined to identify the essential elements of stakeholder engagement that enable project implementers to align the motivations of stakeholders and make them want to support the project.

Further interrogation of the insight gained from the interviews conducted in the course of the research indicated that **Social Trust and Credibility of the Project Implementer** was activated in every interview that was conducted. This included every interview that was not listed in Table 1. This was followed by **Personal Benefit** and **Trust Asymmetry** both of which were activated in 80% of interviews. **Core values** and **Cognitive conception of risk** were activated in 70% of interviews while **Personal Framing, Media and Popular Culture** and **Political Dynamics** were each activated in 60% of interviews.

It was interesting to note that the two obvious phenomena associated with trust, Social Trust and Credibility of the project implementer and Trust Asymmetry, were in the top three most activated phenomena as identified by interviewees. An advantages of using the conversational approach to interviews, is that because the interviewee has more freedom in answering questions we were able to gain additional insight from not only the discussion but also non-verbal communication. It was also found that trust and credibility had a big impact on most interviewees' perceptions of other phenomena. For example, interview discussions revealed that trust and credibility are important contributors for the following phenomena:

- Core Values – Trust and credibility contribute to the way individuals assess the extent to which the project implementer's core values align with their own.
- Personal Framing - The way in which individuals internalize project related information is dependent on the trust and credibility they have in the source of the information being reviewed.
- Cognitive conception of risk - Risk perception is often a subjective judgment by an individual bases on the information they believe to be true at the time of the decision

including the level of trust they have in the project implementer to manage the project in a safe manner.

- Media and Popular Culture – When evaluating the validity of media outlets and information sources, personal credibility in the source has an impact on how he or she chooses which sources to follow and how they frame the information provided by that source.
- Personal Benefit - To a lesser extent than the phenomena listed above, there was indication that trust and credibility in the project implementer was a factor in determining if the project manager would actually deliver on project promises of individual benefits.

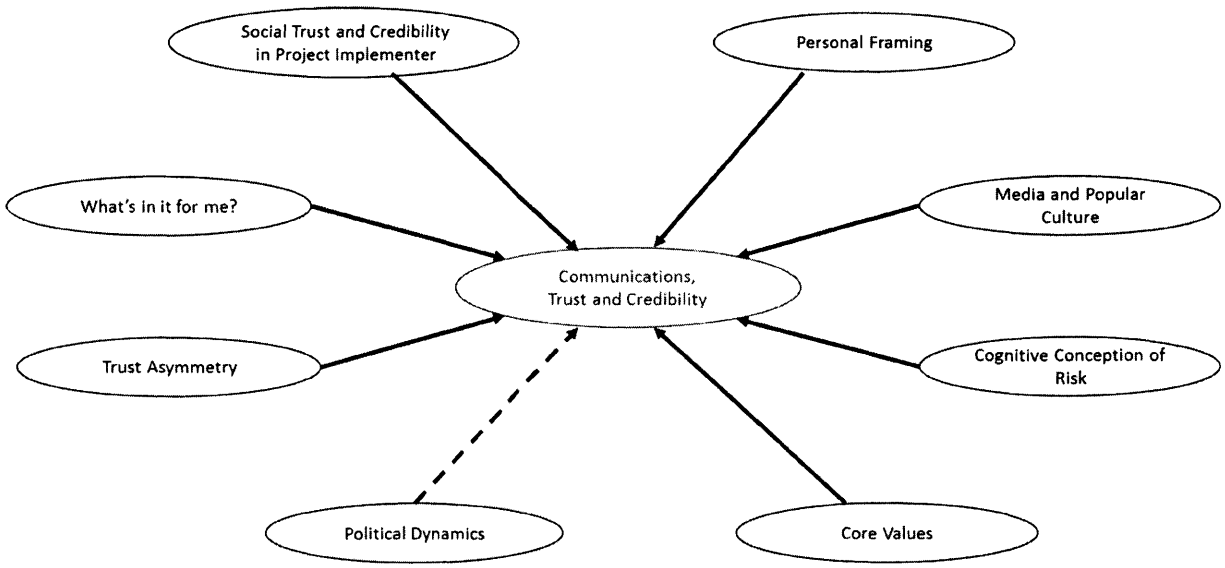

Figure 9 - Converge on Communication, Trust and Credibility in Project Implementer

Further interrogation of stakeholder interviews helped to identify a link between trust and credibility in the project implementer and the project implementer's ability to effectively communicate with stakeholders. This relationship between trust and communication has been examined in the literature in notable detail. Morgan and Hunt (1994) proposed that communication is an antecedent of trust and credibility. 'It may be equally relevant to address the proposition that

better quality communication may increase the level of trust among [stakeholders] (Bialaszewski and Giallourakis 1986)."

Effective communication goes hand-in-hand with trust and credibility. Communication, both verbal and nonverbal, is the mechanism by which we develop relationships and build trust and credibility. The existence of trust and credibility leads to more efficient communication. These two elements of stakeholder engagement are at the heart of building and reinforcing strong relationships.

In the case of socially controversial projects, project implementers should be aware that there is a great deal of sensitivity among stakeholders when it comes to opinions toward the project. Because of this sensitivity, even small setbacks within the project will cause stakeholders to change their opinion of the project in a negative direction. Effective communication, trust and credibility are required to build and maintain stakeholder acceptance of the project. A relationship foundation built on trust and credibility through communication can be used in conjunction with our understanding of the model's structure to influence stakeholder acceptance and reduce opinion sensitivity toward the project.

For these reasons, communication and the idea of trust and credibility in the project implementer have been identified as the essential elements of stakeholder engagement that form the relationship foundation that will enable a project Implementer to establish and maintain a belief among stakeholders that project success is in their best interest, ultimately determining if a project will be successful or not.

Utilizing the model's structure that drives stakeholder behavior, the next step is to identify specific ways communication, trust and credibility can be used as strategic vehicles to effectively engage stakeholders and influence the level of project acceptance.

6. ESSENTIAL ELEMENTS OF STAKEHOLDER ENGAGEMENT TO INFLUENCE RELATIONSHIPS

With communication, trust and credibility identified as the essential elements of stakeholder engagement, this section further interrogates the specific model causal loops associated with these essential elements of stakeholder engagement. Specific variables contained within those loops will be used to suggest real world actions to improve stakeholder relationships. A consolidated list of suggested actions is used to develop and describe key actions that can be used to build and maintain a belief among the stakeholders that the project's success is in best interest of the group.

This high level framework outlines key steps for building project support to be used as a tool to assist project implementers in engaging stakeholders. It should be pointed out that every relationship is special and unique and as such, the way that a project implementer approaches each relationship will vary based on the current state of the relationship. It is expected that project implementers, by virtue of their appointment, have the required skills to use the suggestions provided here as a starting point to assess the current state of project relationships and to adapt the framework as required to effectively engage stakeholders associated with the specific use case.

6.1. MODEL INTERROGATION

The models discussed in Chapter 3 define the structure of variables that influence the behaviors leading to stakeholder acceptance. This structure was interrogated first at the loop level to identify which loops include aspects of the essential elements including communication, trust and credibility. With key specific loops identified, the individual variables were analyzed to identify specific ways to influence behaviors described by the model.

6.1.1. KEY MODEL VARIABLE IDENTIFICATION

Building on the understanding of the behaviors of stakeholder acceptance gained from interviews, each of the loops within the models was reviewed to determine if the loop could be directly influenced by improved communication, trust and credibility.

As an example, loop R(R.A.) 4: Personal Benefit vs. Risk Loop, shown below in Figure 10 with dashed red lines, was determined to be a loop that could be influenced by the essential elements of stakeholder engagement. This was determined by the realization that effective communication with stakeholders can be used to develop a more realistic understanding of both risk and benefit among stakeholders. Credibility in the project implementer will govern the extent to which the projections of realistic risk and benefit by the project implementer will be trusted by stakeholders.

With the loop identified, the next step is to isolate the variables of interest in each loop that can be manipulated to influence a stakeholder's acceptance of a particular project. The Personal Benefit vs. Risk Loop is made up of the variables 'radiation attitudes', 'perceived personal benefit' and 'perceived personal risk' and as such, each of these variables provides possible ways to influence a stakeholder's acceptance of the project.

Zooming on the particular variables, it was determined that to increase a stakeholders acceptance of a project, a project implementer can do any combination of increasing 'radiation attitudes' increasing 'perceived personal benefit' and decreasing 'perceived personal risk'.

This analysis was conducted for each of the loops in the model. Details of this analysis can be found in Table 12 and Table 13 located in Appendices E and F.

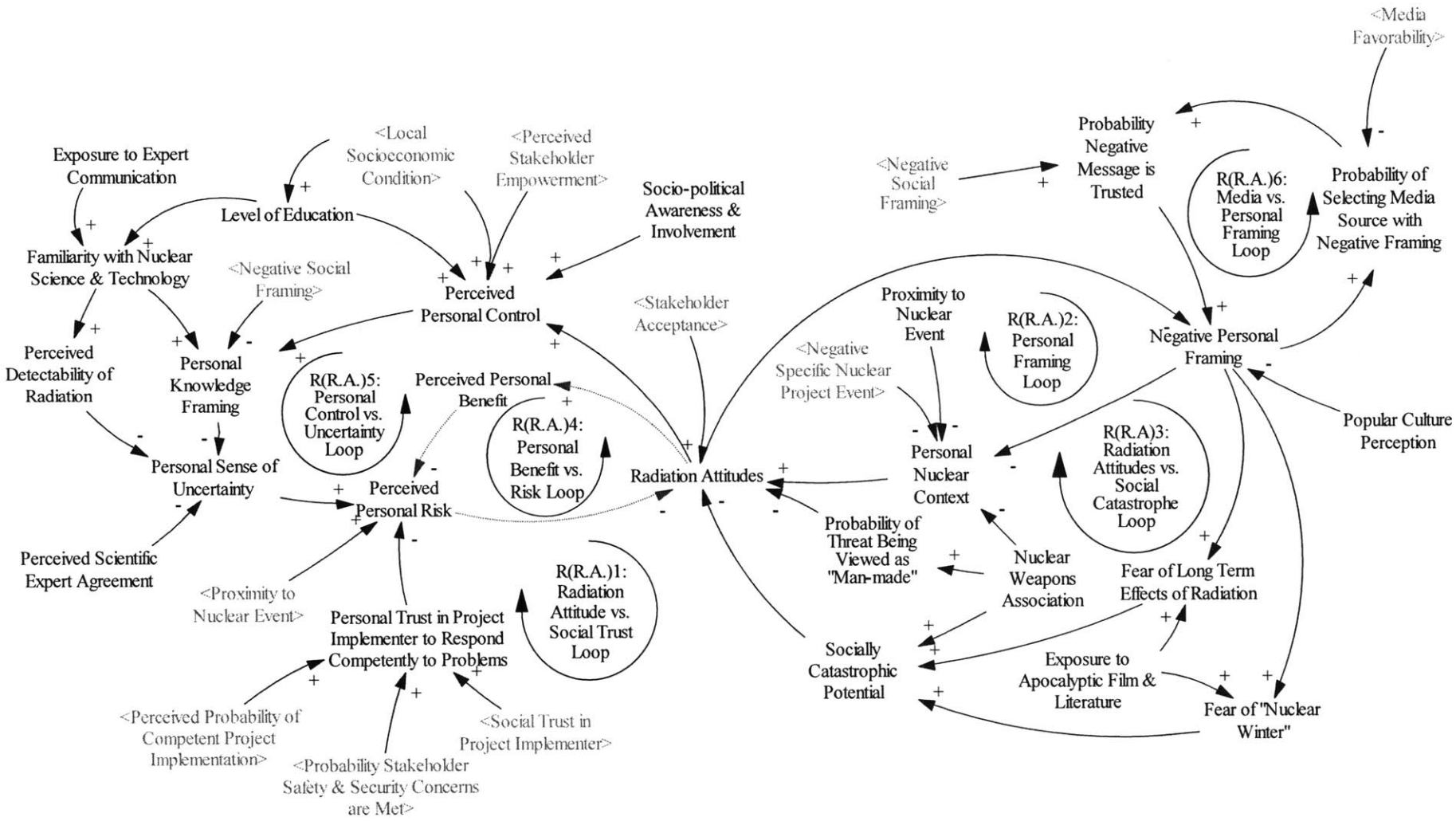

Figure 10 - Personal Benefit vs. Risk Loop Example (Golay and Williams 2015)

6.1.2. VARIABLE INFLUENCE SUGGESTIONS

With the identification of all the variables (and the desired direction of change) that could potentially provide a means of influencing a stakeholder's acceptance in Table 12 and Table 13, suggestions on how to stimulate each variable in the desired direction were identified. The suggested actions are not intended to be an all-inclusive list, but rather a list of actions hypothesized to be effective based on interview and case study data. These suggestions should be thought of as a way to spark action ideas for the project implementer.

To stay with the example used above, we know that increasing 'perceived personal benefit' and or decreasing 'perceived personal risk' will increase stakeholder acceptance. With that in mind, the following suggested action can be used to influence stakeholder acceptance.

Table 4 - Suggested Actions to Influence Loop Variables Example

Loop Variables	Desired change to the variable	Suggested actions
'perceived personal benefit'	Increase	• Make stakeholders part of the decision making process to create shared visions and goals • Donate time and resource to the community and take credit for it • Encourage employees to volunteer and take part in the community through local charities, schools & non-profit organizations • Align project values with social values • Provide updates on both direct benefits (jobs created, reduced electricity prices etc.) and indirect benefits (state and federal funding for infrastructure etc.) related to the project. • Identify and track the progress of benefits for each stakeholder

Loop Variables	Desired change to the variable	Suggested actions
'perceived personal risk'	Decrease	• Provide educational tours, professional training and genuinely reach out to potential stakeholders • Make stakeholders part of the decision making process to create shared visions and goals • Develop and implement multiple feedback mechanisms (focus groups, town hall meetings etc.) and act on them • Align project values with social values • Agree to, and help maintain an independent, third party review group • Provide stakeholder access to senior level project decision makers (CEO, VPs etc.) • Provide access to problem response procedures • Be upfront with stakeholders by providing information about the project's risks and include safety measures • When mistakes do happen, report them before outside sources do and take ownership for them • Develop realistic plans to recover the project when needed • Develop designs and procedures that maximize safety • Establish and disseminate emergency plans and procedures including accident notification plans • Follow up promptly and accurately and with integrity to stakeholder concerns • Work to define stakeholder roles and responsibilities

A complete list of suggested actions for each of the variables identified in section 6.1.1 can be found Table 14 and Table 15 located in Appendices G and H

6.1.3. SUMMARY

Understanding the structure of the stakeholder models provides access points with which to influence stakeholder relationships and ultimately stakeholder acceptance. It is important to reiterate that every stakeholder relationship is different and as such the most effective actions for influencing the variables with in these models will vary. A consolidated list of suggested actions to improve stakeholder acceptance that occurred at least three times in this analysis of variables can be found in Appendix I.

In the next chapter the list of representative actions compiled in Appendix I is used to identify how to strategically employ the actions and in what phase of the relationship they are most effective.

7. STAKEHOLDER RELATIONSHIP GUIDING PRINCIPLES

Unfortunately, there are no shortcuts in building relationships where each party develops an emotional stake in the success of other stakeholders. It should come as no surprise that communication, trust and credibility are vital to building a coalition of stakeholders that support controversial projects. What is alarming, however, is that even though the importance of building these relationships is understood, many project implementers fail to allocate the necessary resources to effectively engage stakeholders. When surveyed, experienced project managers from the Project Management Club at MIT, acknowledged the importance of effective stakeholder engagement practices in building project relationships, but admitted that lean practices within organizations often resulted in neglecting a disciplined adherence to current best practices.

As the practice of project management continues to mature and expand, so do current best practices. Various attempts have been made to define and standardize project management best practices, but these attempts lack flexibility limiting the usefulness of these practices to only a small subset of projects that fall within a narrow window of scope and complexity. For example, the best practices developed to engage stakeholders interested in installing a community playground are not necessarily the same practices best served to build support for a nuclear power plant. The reactions of stakeholders to each case is likely to be vastly different and will require a different approach.

I propose that, rather than trying to define a detailed, step by step procedure for engaging stakeholders, it would be more beneficial to develop a set of high level fundamental project management principles for engaging stakeholders. These principles build off the suggested actions for improving stakeholder acceptance described in Chapter 6 and are designed to guide project managers, leaving enough flexibility to deal with the nuances associated with a specific project.

7.1. KEY PHASES OF STAKEHOLDER RELATIONSHIPS

As identified in Chapter 2, there are several models of stakeholder relationships and relationship life cycles. For the sake of this discussion, I propose that many of these relationship models can be simplified into 3 main stages that include 1. Building Relationships, 2. Maintaining

and Monitoring Relationships and, 3. if needed, Restoring Relationships as shown in Figure 11 below.

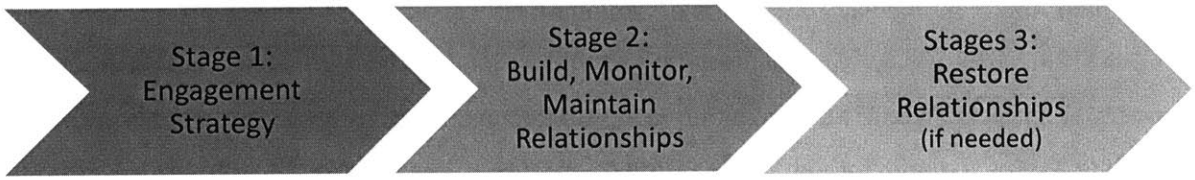

Figure 11 – Stage of Stakeholder Engagement

The intent of this work is to develop a set of interrelated, guiding principles for each of these stages. The principles will form a suggested framework designed to build and maintain stronger project relationships by effectively engaging stakeholders, ultimately increasing the likelihood that the project will succeed.

7.1.1. Stage 1: Develop an Engagement Strategy

An effective stakeholder engagement campaign starts with developing a well-organized, strategic plan designed to build mutual trust and professional respect. While each relationship is different and will require its own approach and varying levels of effort, there are fundamental principles from which to guide the development of a stakeholder engagement strategy. These principles are designed to help a project manager develop an engagement strategy by clearly defining project objectives and gaining a deeper understanding of project requirements and constraints in order to define the larger environment in which the project exists. After defining the internal project requirements to the point that the project manager is comfortable with the project's responsibilities, the focus shifts to identifying, categorizing and prioritizing stakeholders in order to increase effective engagement strategy.

The following principles are designed to guide the development of an engagement strategy in more detail:

1. **Self-Analysis** – Before a project manager can successfully engage stakeholders, he or she should start with an internal analysis of the project. Taking the time to clearly define project goals and the organizational values, will help to accurately frame and define project objectives. Developing a better understanding of the project, will enable the project manager to clearly articulate project scope, objectives and the shared benefits associated with supporting the project to stakeholders. This self-analysis will yield dividends in both the strategy development and engagement stages. This internal analysis should include the following areas at a minimum:

    - Define the problem(s) being solved by the project. These problems could include providing electricity, extracting natural resources, energy independence, global warming or nuclear cleanup to name a few.
    - Identify other options available to solve this problem. What technologies are you competing against? What are the advantages and disadvantages of each? What sets your technology apart from the others?
    - Clarify the desired business goals and objects for the project. Is the goal to increase profits, improve productivity expand into new markets? What are the short and long term goals of the project?

2. **Explore the Environment** – It is not uncommon for a project manager to be assigned to a project after contracts, location selection and any number of other project decisions have been made. These prior decisions ultimately place constraints on the project options. It is important for project managers to identify project boundaries, limitations, legal restrictions, contractual obligations and political implications associated with the project. A historical review of similar projects might provide insight in to previous successes and failures and identify trends that may help in forecasting future project conditions. The project manager should review existing project documents (charters, agreements, policies, procedures, contracts etc.) to identify project constraints and areas for future opportunity.

3. **Identify Stakeholders** – Stakeholders are any individuals or organizations actively involved in a project that can have an influence on the performance of the project. That is to say that a

stakeholders' support is needed in order for the project to be successful. Interviews with project managers revealed that identifying stakeholders is not always as easy as it sounds, but usually starts with simple brainstorming. The following list can be used to help in stakeholder brainstorming process.

Table 5 - Potential Stakeholder Groups

Employees (Managers & Non-Managers)	Financiers	Interest Groups
Senior Executives	Lenders	Government (Local, National, International)
Customers/Potential Customers	Industry associations	Regulators
Shareholders	The press/ Media	Unions
Partners	Local Community	Competition
Suppliers	General Public	

Stakeholders should be ranked and mapped according to their relative power as a stakeholder and their relative interest in the project as shown in Figure 12.

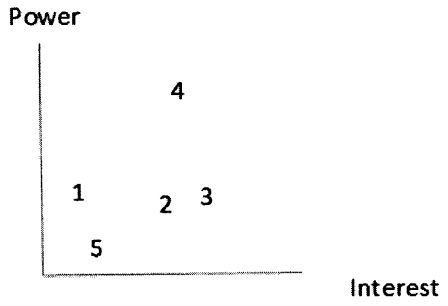

Figure 12 – Stakeholder Mapping Example

In many cases it may be useful to develop a criteria to help to determine whether a particular group or organization is a stakeholder worth engaging. For example, a stakeholder group that is indifferent to the project may not need to be engaged, but rather the focus should be on maintaining that group or organization in an unimportant status in regards to the project's success.

With the important stakeholders identified the next step is to identify each group's core values or fundamental beliefs that serve as the foundation or baseline form which decisions are ultimately made.

4. **Identify value gaps for each stakeholder** – With interest and values identified and mapped the project manager can start to identify gaps or variations between the project's values and goals and those of various stakeholder groups. Performing this value gap analysis is important to identify and quantify the potential resistance to the project. This analysis can be used to help identify the potential issues each stakeholder might have with the project plan and help to forecast primary roles each stakeholder will take in the project.

   It is possible to further categorize stakeholders in relation to their support of the project. These categories might include:

   - Project resistors that require additional focus because of their potential ability for project influence.
   - Advocates where assistance in increasing their power and or influence can be valuable.
   - Stakeholders less likely to influence project outcomes, but who should be continually monitored.

5. **Identify opportunities to bridge value gap** – After categorizing and prioritizing important stakeholders based on value gaps, the next step is to focus on bridging the value gaps. In the case of controversial projects, bridging this value gap often requires more than just clearly articulating the expected benefits associated with supporting the project. It is often necessary

to investigate the key interests of the group or organization that may lead to opportunities in negotiations.

The effort put in to principle number one, Self-Analysis, to understand and clearly define and prioritize project goals and the organizational values will also help to identify potential areas for compromise to help bridge value gaps.

6. **Identify the most effective method of communication for each stakeholder** – As the plan continues to come together and the outgoing message starts to solidify, it is time to identify the decision makers within the each stakeholder group and identify the most effective way to communicate with those stakeholders. Face-to-face communication tends to be the most efficient way to convey a message because it allows for both verbal and non-verbal communication saving time and reducing subsequent communication requirements. Face-to-face communications can also be useful in humanizing socially controversial projects. For these reasons, face-to-face communications should be seriously considered, especially early in the relationship. Once the relationship is established other forms of communication such as phone calls, written communication (formal letter and email) can be considered.

7. **Predict engagement outcomes** – It can be hard to predict accurately how stakeholders will react early in the relationship, but this kind of thought provoking activity will force you to put yourself in the shoes of your stakeholders and can assist in viewing the project from their point of view, helping to close the strategy cycle loop. Understanding the other side's point of view can help identify a mutually beneficial relationship that both sides will commit to. Predicting the engagement's outcome will help to identify the cost of and potential benefits gained by the engagement as planned. This analysis should help to identify the potential impact the engagement will have on narrowing the value gap.

8. **Refine engagement strategy as needed, and choose course of action** – The results of predicting engagement outcomes should be used to refine the strategy and finalize a course of action realizing that, as more information is gained during the actual engagement, the plan will require updates.

While it is important to understand that every project is different, these principles provide a basic framework from which to develop strategies for stakeholder engagements and should be used to the maximum extent possible given project schedule and cost constraints.

The principles for developing an engagement strategy form the basis for the actual stakeholder engagement that will be discussed further in Stage 2.

7.1.2. Stage 2: Build, Monitor and Maintain Stakeholder Relationships

Building on Stage 1 above, this section is dedicated to identify guiding principles to help foster relationships in their infancy as well as to maintain more mature relationships. With an engagement strategy developed using the principles above, it is time to implement the plan. Phase 2 combines relationship building (i.e. the early stages of the project relationship) and maintaining a more mature relationship because of the many parallels between building and maintaining stakeholder relationships. In other words, the principles used to build the relationship will also be used to maintain the relationship. Once the relationship is established, it may not be as laborious a task as it was to initially build, but the fundamental principles used to build a relationship are the same used to maintain the relationship.

As discovered in the literature review, a relationship builds off of itself with each engagement in a cyclical manner as shown in Figure 13. Because of the iterative nature of relationships, many of the engagement strategy principles identified in section 7.1.1 will be used to build, monitor and maintain project relationships by helping to continually refine engagement objectives with each engagement cycle. The principles of strategy development will help to fine-tune engagement objectives as the relationship develops and more is learned about each stakeholder's values and opinions.

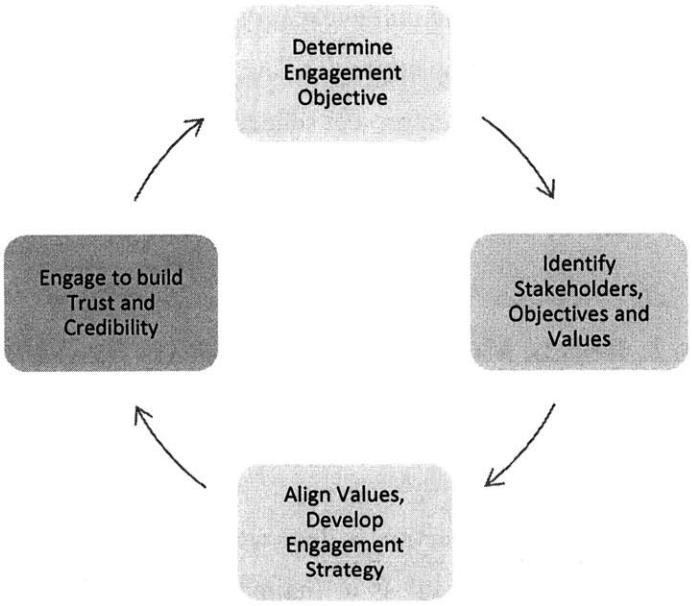

Figure 13 – Relationship Cycle

With this relationship cycle in mind, the following principles of stakeholder engagement form a guiding doctrine to maximize the effectiveness of each stakeholder engagement. It is recommended that the intent of these engagement principles should regularly reviewed so as to encourage fruitful engagement habits.

1. **Build trust:** Mutual trust is essential in healthy relationships. With each engagement it is important to be open, respectful, responsive, consistent and timely in communications with stakeholders. It is important to lead by example in the relationship, avoid placing blame for problems, but rather identify ways to work together to overcome obstacles.
2. **Be accountable:** Be proactive rather than reactive, but take ownership for your decisions and actions. Provide clear actions and/or response following the engagement and be ready to deliver on promises.
3. **Manage expectations:** Make certain that all parties agree on clear, realistic and achievable project outcomes. Don't assume you know what stakeholders expect. Communicate regularly and be honest in what you are able to deliver. When possible under promise and over deliver.

4. **Engage the right stakeholders:** Identify the right stakeholder groups that will help to further project objectives. Remember that only key individuals within an organization will have the authority to make decision. Engage representatives who are empowered to make decisions on behalf of their constituents. Consider stakeholders' expertise, level of influence, interest in the project and impact on the company.

5. **Engage effectively:** Prepare ahead of time to make the most of each engagement. Choose the appropriate format for the meeting (e.g. private meetings, roundtable discussions, stakeholder panels, etc.) to achieve the objective of the engagement. Use engagements to drive decisions on topics that are important to your organization and important to the success of the project.

6. **Listen to stakeholder views:** Listen to understand not necessarily to respond to stakeholder concerns. Ensure the engagement is a two way flow of information. Allow stakeholders to voice their views without restriction and fear of penalty or discipline. The experiences and expertise of stakeholders can be valuable assets for managing the project.

7. **Set relationship rules:** Inevitably, the relationship will be strained from time to time and stakeholders will not always see eye to eye. Establish the objectives, roles and rules at the beginning of the relationship. Agree on the processes for decision-making, conflict resolution and evaluation. In the case of controversial projects consider establishing an independent review panel to oversee the project.

8. **Provide adequate resources:** Devote adequate resources (time, money and people) to ensure successful engagements. At times it will be necessary to include experts such as engineers, accountants or senior leaders to the meeting. Understand that some of the experts may require training prior to meeting with stakeholders. For example, engineers may not be used to dealing with stakeholders and may need coaching on how to properly interface with outside groups, especially if the relationship is fragile. Where appropriate, reimburse stakeholders for their time and travel expenses.

9. **Look beyond the engagement:** Learn from the engagement. Involve stakeholders to assess the success of both the process of engagement as well as its outcome. Examine whether any next steps are require

10. **Consolidate allies**: Leverage existing relationships and lean on the skills and experiences of partners to advance the project.

These ten principles serve to focus the efforts of resource constrained project managers as they try to foster project relationships and should be used in conjunction with the engagement strategy principles to continue to build mutual trust and strengthen project relationship over time.

7.1.3. Stage 3: If Needed, Recover the Relationship

Once lost, trust and credibility can, understandably, be hard to regain. Depending on the egregiousness of your action(s) or inaction(s), repairing the relationship can take serious effort. Unfortunately, in the case of complex socially controversial projects, it is generally not a question of if, but rather when project relationships will be strained. It is important to have the appropriate actions in place to be able to weather relationship storms and hopefully maintain a net positive acceptance of the project.

Once the relationship becomes strained, it is up to the project manager to determine how to recover the relationship and get the project back on tract. There are two general approaches to recovering project relationships. The first is proactive in nature and the second is reactive. These approaches will be described in more detail later on, but ideally a combination of the two methods should be used to recover strained relationships.

The combined approach should be significantly more reliant on proactive relationship building activities as discussed in Chapter 6 guided by the principles described in Stages 1 and 2 above. The reactive response, or the actions taken after the relationship breaks down, is important, but project managers generally will have less direct control as these actions are overly dependent on external stakeholder reactions.

The reactive actions taken by a project manager to restore credibility will be very dependent on the situation and the status of the relationship with the stakeholder. Because of the variability and unpredictability of stakeholder response to various relationship strains, it is difficult to develop an all-inclusive solution, but a high level framework of reactive response to restore the relationship might include the following steps:

Step 1: **Open the lines of communication –** Open communication will be required to move forward. It may be necessary to remove certain individuals that caused or appeared to contribute to the loss of credibility in order to convince stakeholders to continue to contribute to the project's success.

Step 2: **Admit your mistakes** - It is important to act early and admit your mistakes openly. It is better if your stakeholders hear about issues from you personally before someone else identifies the issue. Do not try to make excuses for they often make it seem you are not taking accountability and are merely deflecting blame.

Step 4: **Apologize** - Apologize for the part in the breakdown. Be sincere! Be very specific in your apology acknowledge what you did was wrong and how it affected the relationship. Never pressure the other side for forgiveness.

Step 5: **Propose a solution** - Propose a possible solution to the current situation and explain the benefits.

Step 6: **Listen** - Really listen to the response of the other stakeholders and understand that there may be parts of the relationship that may not be fixable.

In rebuilding trust, actions will speak louder than words. Throughout this process let **your actions do the talking**. Once your credibility is questioned, it is the stakeholder that holds the power in determining where the relationship goes and how your recover. As the project manager, all you can do is merely react to your stakeholders' reactions and demands. Because of this lack of control in reactive response, more effort should be put into proactive, relationship building actions prior to the event that strains the relationship.

Understanding that at some point the relationship could go sour, proactive efforts should be taken to minimize the impact of a straining event by building a positive relationship reserve. This reserve, based on trust, can be built by successful stakeholder engagement outcomes or delivering on promises. Efforts should be made to build up the relationship reserve prior to any straining event to minimize the relationship impact. The principles outlined in Stage 2, Build,

Monitor and Maintain Stakeholder Relationships, will help to build stronger relationships, but additional principles to really maximize the relationship strength include:

1. **Strive to be both respectable and likable:** In a relationship it is important to be liked and respected in both a professional and personal manner. Making others feel welcomed and that they are an appreciated member of the project team will go a long way towards building allies. Be a team player and contribute to the success of other stakeholders. Be genuinely interested in what we have to say.
2. **Maintain a positive attitude:** Smile. Given the option, most of us would rather be around the person that has a sunny disposition and lights up the entire room. Acting as if every setback is a catastrophe to the project does not build confidence in your ability to manage the project.
3. **Be Transparent:** Provide educational tours, professional training and genuinely reach out to potential stakeholders. Make stakeholders part of the decision making process to create shared visions and goals. Develop and implement multiple feedback mechanisms (focus groups, town hall meetings etc.) and act on them. Agree to, and help maintain an independent, third party review group.
4. **Keep your promises.** Make sure you can follow through on all your commitments. If breaking a commitment is unavoidable, let everyone else involved know as soon as you are aware that you cannot make it. It may still be annoying to the other parties, but at least they can adjust their schedules as necessary.
5. **Make the effort:** We all get bogged down with busy schedules, so put in the effort to maximize each engagement. Go above and beyond: and do little favors for others, even if you don't know them. Hold a door for others, say hello to the janitorial and security staff. The little things add up and say a lot about your character.
6. **Communicate:** Whether it's making it to a meeting on time or finishing up the project, it's important to keep your stakeholders in the loop about your progress. Even if the project is ultimately completed on time and in top-notch quality, not knowing what's going on can be extremely frustrating.
7. **Be humble:** Be approachable, personable, compliment others and give credit where it is due.

In short, this proactive approach to relationship building boils down the golden rule-- do onto others as you would have them do on to you.

7.1.4. SUMMARY

The principles outlined here are designed to focus and maximize the impact of the efforts of project managers in building project relationships that will ultimately lead to the success of the project. In lean organizations where great emphasis is put on minimizing waist and removing unnecessary work steps, some of the first areas cut or neglected are time consuming relationship building activities. While many of these principles seem obvious, it is amazing how many project managers do not follow them because they find it hard to quantify the benefit associated with the effort. Once the project falls behind schedule and/or over budget, panic sets in and project management actions become more reactive and less proactive. This is also true in relationship building efforts.

Understanding the importance of building strong stakeholder relationships, and noting that when the going gets tough we tend to neglect these relationships, there is a fundamental need to increase the emphasis placed on relationship building by changing the way we view stakeholder relationships. Adherence to these principles should be thought of as a project insurance policy that will increases the likelihood of project success rather than a time consuming annoyance.

7.2. PROJECT INSURANCE

Project managers in lean organizations stated that it can be hard to justify to their managers the expense, both monetary and effort, associated with adhering to these principles because there is no way to quantify the benefit gained by the effort. I propose that stakeholder relations can be likened to and insurance policy. The purpose of insurance is to minimize the risk of loss from circumstance beyond your control. It is possible that you will never benefit from taking out an insurance policy, but in the event that something does happen you will be compensated should your property become damaged. In many ways building relationships is like paying insurance premiums.

The expense of building a coalition of stakeholders that believe the project's success is in best interest of the group should be thought of as a project insurance policy. The hope is that the project will go smooth and will reach completion on schedule and within budget, but in the event the project runs into issues, it is important to have the support of the key stakeholders willing to

continue to support the project and help it survive the storm that follows significant project issues as they arise.

The time to build this stakeholder support for the project is the calm before the storm when the project is running smoothly. If you wait until project problems make headlines you are too late. You will be fighting an uphill battle and without the support of other stakeholders the project could be doomed. In many ways the efforts to build strong relationships and support for the project will ultimately serve as a project insurance policy that will mitigate losses should the project run into problems.

7.3. RECOMMENDATIONS TO PROJECT MANAGERS

I would like to propose a couple of question to the project manager as food for thought.

1. **Why have so many nuclear projects failed in the United States?**
2. **What are you, as the manager of your project going to do differently to prevent your project from failing?**

There is a need to maintain a belief among stakeholders that the project's success is in best interest of the group. As the project manager, you are where the rubber meets the road in not only overseeing and managing the project, but also fostering the relationships vital to project success. It is no surprise that communication, trust and credibility are essential elements in building relationships, but the real world application of these elements tend to be problematical because of limited project resources.

In the case of socially controversial projects, more emphasis has to be placed on building a coalition of project supporters. The time to start engaging with stakeholders is as early as possible. Rome was not built in a day and neither are strong relationships. If possible, make stakeholders a part of the early decision making process to make them feel that their ideas and points of view are important. Giving stakeholders a voice in the decision making process will make them much more likely to be accepting and supportive of your project if they believe their concerns and comments have been addressed.

In the case of long duration, capital intensive, socially controversial projects, the need to build relationships among project supporters is important enough that stakeholder relations should be assigned its own budget and given the authority to engage stakeholders. Stakeholder engagement is more of an art than it is a science and is as much about understanding the process of engaging stakeholders as it is about understanding the structure of the dynamic relationships. Every project is unique and will have its own complications, but you as the project implementer can increase the likelihood that your project will be successful, or at least mitigate risk, by building mutually beneficial project relationships.

8. CONCLUSIONS

8.1. SUMMARY

The goal of work reported here was to identify the essential elements of stakeholder engagement that will increase the likelihood that a socially controversial project will be successful. This work builds on research conducted under the supervision of Professor Michael Golay, by Adam Williams and Aditi Chandra at the Massachusetts Institute of Technology. A conversational approach to conducting interviews, was used to gain a deeper understanding of the underlying phenomena associated with the acceptance of socially controversial projects. An interrogation of interview data lead to the convergence on the importance of communication and the credibility of project implementers as the essential elements of stakeholder engagement.

Focusing on building trust based relationships through effective communication, the research reported here utilizes the structure of complex stakeholder relationships captured in system dynamics models to provide a framework to guide the efforts of project managers in developing stakeholder engagement strategies, building and maintaining project relationships, and, if needed recovering damaged relationships.

8.2. LIMITATIONS

While the research team has assessed the current models as being complete and accurate in the way they capture stakeholder behaviors contributing to the formation of stakeholder acceptance, it is important to point out that this assessment is based on the limited number of interviews conducted to date.

A grounded theory approach to data collection using conversational interviews was used in the course of the research to validate the system dynamics causal loop diagrams. The analysis of these interviews relies less on counting and correlating, and more on interpretation, summary and integration. While this method enables one to gain in the coherence, depth and density of the material which each respondent provides (Weiss 1994), there were limitations associated with the research reported here.

Identified limitations of this evaluation include:

1. The first limitation of this evaluation is that, as Weiss points out, the analysis relies on interpretation, summary and integration. As such, there is the potential to reach arbitrary or biased conclusions based on the interviewer's background and experience. To ensure the fairness of data collection and subsequent interpretation, multiple researchers were used to collect and independently interpret results whenever possible. After each interview was conducted the team got together to consolidate information to maximize the reliability of data.
2. The time consuming process of identifying interview candidates, setting up meetings, conducting conversational interviews and finally compiling results made it impossible to interview a large enough pool of participants to run statistical analysis of the data collected.
3. Efforts were made to gain insight from as large a cross section of identified stakeholders as possible, but due to time restraints and the willingness of some participants to commit to interviews prevented us from reaching all of the desired stakeholder groups. In particular there is a noticeable absence of interviews conducted with stakeholders representing anti-nuclear and political groups.
4. In the analysis of the phenomena that describe the behavioral dynamics of the causal loop diagrams, each phenomena was only analyzed as being activated or not activated based on the discussion that took place. Interviewees were not directly asked to comment on each of the phenomena. Additional research could be done to better determine the extent to which each phenomenon is activated.

8.3. FUTURE WORK

Understanding that the causal loop diagram models of stakeholder acceptance are intended to be a living document that will change over time as the environment in which controversial projects are undertaken, it is recommended that additional interviews be conducted across all stakeholder groups with an emphasis on seeking input from anti-nuclear groups and individuals with direct experience in politics. Efforts should seek out stakeholders from a variety of age groups and socio-economic backgrounds. Interviews should continue to seek a deeper understanding of

stakeholder attitudes, but should also seek to quantify the extent to which the essential elements of stakeholder engagement can influence stakeholder attitudes.

It is recommended to identify and pursue an opportunity to be used as a case study to test the ability of project implementers to use the suggestions provided in this thesis to improve communications, and build trust and credibility to influence stakeholder acceptance. In this case study, the research team should partner with project implementers to define the structure of current stakeholder relationships associated with the project and develop a process for building and creating a coalition of stakeholders that believe the project's success is in best interest of the group. With a plan developed, the research team should take on the role of an observer and monitor the progress of the project.

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APPENDIX A – CAUSAL LOOP DIAGRAM DEFINITIONS

Table 6 - Individual Acceptance CLD Variable Definitions

INDIVIDUAL ACCEPTANCE CLD VARIABLES				
CLD Variable	**Stock/Flow Variable**		**Meaning of Lowest Value**	**Meaning of Highest Value**
	Description	**Range**		
Exposure to Apocalyptic Film & Literature **(i)**	Degree to which movies, books or popular media depicting nuclear technology as the cause of global destruction are encountered by an individual	0 to 1	'0' indicates absolutely no popular media depicting nuclear technology as the cause of global destruction are encountered	'1' indicates extremely high degree of popular media depicting nuclear technology as the cause of global destruction are encountered
Exposure to Expert Communication **(i)**	Degree to which expert talks, research papers, journals or meetings regarding nuclear technology are encountered by an individual	0 to 1	'0' indicates absolutely no expert communications are encountered	'1' indicates extremely high levels of expert communications are encountered
Familiarity with Nuclear Science & Technology	Extent of an individual's understanding of or experience with nuclear science and technology	0 to 1	'0' indicates absolutely no understanding of or experience with nuclear science or technology	'1' indicates extremely high level of understanding of or experience with nuclear science or technology
Fear of "Nuclear Winter"	Fear of global devastation and/or (near) extinction of the human race resulting from a nuclear detonation or extreme negative nuclear event	0 to 1	'0' indicates absolutely no fear of global devastation and/or extinction of the human race resulting from a nuclear-related incident	'1' indicates an extremely high level of fear of global devastation and/or extinction of the human race resulting from a nuclear-related incident
Fear of Long Term Effects of Radiation	Fear that negative human or environmental effects of nuclear technology linger over long time periods (including into future generations)	0 to 1	'0' indicates absolutely no fear that negative human or environmental effects of nuclear technology linger over long time periods	'1' indicates extremely high level of fear that negative human or environmental effects of nuclear technology linger over long time periods
Level of Education	Degree of formal education received by an individual	0 to 1	'0' indicates that an individual is uneducated	'1' indicates that an individual has an extremely high level of education

INDIVIDUAL ACCEPTANCE CLD VARIABLES				
CLD Variable	**Stock/Flow Variable**		**Meaning of Lowest Value**	**Meaning of Highest Value**
	Description	**Range**		
Negative Personal Framing **(c)**	Degree to which the context an individual uses to understand nuclear technology is negative ['S' Curve @ threshold 'Radiation Attitudes' value]	-1 to 1	'-1' indicates an absolutely positive context an individual uses to understand nuclear technology	'1' indicates an absolutely negative context an individual uses to understand nuclear technology
Nuclear Weapons Association **(i)**	Degree to which the specific nuclear project is associated with nuclear weapons	0 to 1	'0' indicates 0% association of specific nuclear project with weapons	'1' indicates 100% association of specific nuclear project with weapons
Perceived Detectability of Radiation	Ease with which the presence or existence of radiation can be identified by an individual	0 to 1	'0' indicates that radiation is perceived as highly undetectable	'1' indicates that radiation is perceived as completely (e.g., easily) detectable
Perceived Personal Benefit	Sense of economic, social or environmental advantage an individual associates with nuclear technology	0 to 1	'0' indicates that an individual perceives no economic, social or environmental benefit from nuclear technology	'1' indicates that an individual perceives high levels of economic, social or environmental benefit from nuclear technology
Perceived Personal Control	Degree to which an individual perceives an ability to influence nuclear technology-related projects	0 to 1	'0' indicates that an individual perceives a complete lack of influence over nuclear technology-related projects	'1' indicates that an individual perceives high levels of influence over nuclear technology-related projects
Perceived Personal Risk	Sense of cost/risk (e.g., economic, environmental, or health-effects) associated with nuclear technology	0 to 1	'0' indicates that an individual perceives absolutely no cost/risk associated with nuclear technology	'1' indicates that an individual perceives extremely high levels of cost/risk associated with nuclear technology
Perceived Scientific Expert Agreement **(i)**	Consistency and compatibility between different sources of scientific information regarding nuclear technology	0 to 1	'0' indicates complete disagreement among scientific sources	'1' indicates complete agreement among scientific sources
Personal Knowledge Framing **(c)**	Degree to which new knowledge regarding nuclear technology gained is positive	-1 to 1	'-1' indicates all new knowledge regarding nuclear technology is perceived as negative	'1' indicates all new knowledge regarding nuclear technology is perceived as positive
Personal Nuclear Context	Inherent, tacitly believed narrative about nuclear technology that influences an individual's risk perception and decision-making	-1 to 1	'-1' indicates that the context in which nuclear technology is viewed is completely negative	'1' indicates that the context in which nuclear technology is viewed is completely positive

INDIVIDUAL ACCEPTANCE CLD VARIABLES				
CLD Variable	**Stock/Flow Variable**		**Meaning of Lowest Value**	**Meaning of Highest Value**
	Description	**Range**		
Personal Sense of Uncertainty	Sense of not knowing, being able to rely on or being completely sure of the benefits of nuclear technology	0 to 1	'0' indicates an individual perceives or experiences absolutely no uncertainty to the benefits of nuclear technology	'1' indicates an individual perceives or experiences extremely high levels of uncertainty to the benefits of nuclear technology
Personal Trust in Project Implementer to Respond Competently to Problems	Extent to which an individual is willing to rely on the Project Implementer to adequately respond to nuclear technology-related problems to ensure safety and security of public interests	0 to 1	'0' indicates an individual is absolutely not willing to rely on the Project Implementer to adequately respond to nuclear technology-related problems	'1' indicates an individual is extremely willing to rely on the Project Implementer to adequately respond to nuclear technology-related problems
Popular Culture Perception **(i) (c)**	Degree to which themes in popular culture refers to nuclear technology as predominantly positive (especially during the formative years)	-1 to 1	'0' indicates popular culture themes related to nuclear technology are completely negative	'1' indicates popular culture themes related to nuclear technology are completely positive
Probability Negative Message is Trusted	Likelihood an individual believes a negatively-framed message regarding nuclear technology as truth	0 to 1	'0' indicates absolutely no belief in negatively-framed messages regarding nuclear technology as truth	'1' indicates absolutely belief in negatively-framed messages regarding nuclear technology as truth
Probability of Selecting Media Source with Negative Framing	Likelihood that a selected source of information frames nuclear technology negatively	-1 to 1	'-1' indicates zero likelihood that source of information selected frames nuclear technology negatively (e.g., all selected sources frame nuclear technology positively)	'1' indicates absolute likelihood that source of information selected frames nuclear technology negatively (e.g., all selected sources frame nuclear technology negatively)
Probability of Threat Being Viewed as "Man-made"	Likelihood nuclear technology viewed as threat (e.g., due to human incompetence, negligence or failure) only created by mankind	0 to 1	'0' indicates nuclear technology absolutely not seen as a threat only created by mankind	'0' indicates nuclear technology absolutely seen as a threat only created by mankind
Proximity to Nuclear Event **(i)**	Physical or psychological distance between an individual and an event regarding nuclear technology	0 to 1	'0' indicates absolutely no connection to an event regarding nuclear technology	'0' indicates extremely close connection to an event regarding nuclear technology

INDIVIDUAL ACCEPTANCE CLD VARIABLES				
CLD Variable	**Stock/Flow Variable**		**Meaning of Lowest Value**	**Meaning of Highest Value**
	Description	**Range**		
Radiation Attitudes **(c)**	Comprehensive reflection of personal attitudes to radiation or nuclear-related technologies, processes or facilities ['S' Curve @ threshold 'Perceived Personal Risk' value]	-1 t o1	'-1' indicates an extremely negative comprehensive reflection of personal attitudes toward radiation or nuclear technologies	'1' indicates an extremely positive comprehensive reflection of personal attitudes toward radiation or nuclear technologies
Socially Catastrophic Potential	Potential of a nuclear technology-related event to cause a significant number of deaths or injuries over a short period of time	0 to 1	'0' indicates absolutely no potential for nuclear technology to cause a high number of deaths or injuries over a short period of time	'1' indicates extremely high potential for nuclear technology to cause a high number of deaths or injuries over a short period of time
Socio-political Awareness & Involvement **(i)**	Extent of an individual's awareness of surrounding social and political issues, as well as levels of contribution to community affairs	0 to 1	'0' indicates absolutely no awareness of surrounding social and political issues, as well as absolutely no level of contribution to community affairs	'1' indicates extremely high awareness of surrounding social and political issues, as well as extremely high levels of contribution to community affairs

(c) Denotes a variable that connects to another CLD in the model
(i) Denotes 'initializing' variables (e.g., variables with no inputs)
[dependent variable behavior @ threshold 'independent variable' value] Denotes description of assumed non-linear behavior of a variable

Table 7 – Local CLD Variable Definitions

LOCAL CLD VARIABLES				
CLD Variable	**Stock/Flow Variable**		**Meaning of Lowest Value**	**Meaning of Highest Value**
	Description	**Range**		
Cognitive Inclusion of Perceived Threat Frequency	Extent to which low frequency of adverse events at nuclear facilities are included in stakeholder group risk determination of a specific nuclear project ['S' Curve @ threshold 'Perceived Benefit from Project' value]	0 to 1	'0' indicates complete rejection of frequency of threatening events from risk determination specific nuclear project	'1' indicates complete inclusion/use of frequency of threatening events from risk determination specific nuclear project
Credibility of Negative Framing	Extent to which negative framing of specific nuclear project is considered credible or trustworthy	0 to 1	'0' indicates negative framing of specific nuclear project is considered 0% trustworthy	'1' indicates negative framing of specific nuclear project is considered 100% trustworthy
Degree of Implementer Awareness of Stakeholder Values	Extent to which the Project Implementer understands the salient values of stakeholder groups	0 to 1	'0' indicates absolutely no understanding of stakeholder group values	'1' indicates absolutely perfect understanding of stakeholder group values
Degree of Opposition Awareness of Stakeholder Values	Extent to which the specific nuclear project opposition understands the salient values of stakeholder groups	0 to 1	'0' indicates absolutely no understanding of stakeholder group values	'1' indicates absolutely perfect understanding of stakeholder group values
Importance of Publicized Mistake to Stakeholder	Extent to which an additional publicized mistake is considered significant to a stakeholder group [Exponential curve vs. 'Probability First Reporting of Publicized Mistake is from the Project Implementer' value]	0 to 1	'0' indicates absolutely no significance of an additional mistake	'1' indicates extremely high level of significance of an additional mistake
Local Socioeconomic Condition **(i) (c)**	Comparison of local social and economic factors to national averages	0 to 1	'0' indicates local economic stagnation (e.g., high poverty, high unemployment - above national averages)	'1' indicates sustained local economic growth (e.g., low poverty, low unemployment - below national averages)

LOCAL CLD VARIABLES				
CLD Variable	**Stock/Flow Variable**		**Meaning of Lowest Value**	**Meaning of Highest Value**
	Description	**Range**		
Media Favorability **(c)**	Extent to which media reports are positive, neutral or negative	-1 to 1	'-1' indicates prejudicially negative (e.g., demonizing) tone	'1' indicates prejudicially positive (e.g., canonizing) tone
Negative Social Framing **(c)**	Extent to which the dominant perspective of a stakeholder group toward a specific nuclear project is negative ['S' curve vs. threshold 'Social Opportunity/Danger Tradeoff' value]	-1 to 1	'-1' indicates that the dominant perspective of a stakeholders group is 100% positive toward a specific nuclear project	'1' indicates that the dominant perspective of a stakeholders group is 100% negative toward a specific nuclear project
Perceived Benefit from Project	Comparison of new/old local net benefit from specific nuclear project ['S' curve vs. threshold 'Probability Benefit is Received' value]	-1 to 1	'-1' indicates complete loss of net benefit (e.g., decreased property values & tax revenue, increased unemployment) from specific nuclear project	'1' indicates significant gain of net benefit (e.g., increased property values & tax revenue, decreased unemployment) from specific nuclear project
Perceived Frequency of Risk Event	Relative expected time between event occurrences	0 to 1	'0' indicates no time between expected events (e.g., continuously occurring events)	'1' indicates infinite time between expected events (e.g., never occurring events)
Perceived Positive Environmental Effects **(i)**	Extent to which nuclear energy has a net positive impact on the environment	-1 to 1	'-1' indicates belief that nuclear energy only has net negative impact on the environment	'1' indicates belief that nuclear energy only has net positive impact on the environment
Perceived Pride in New Specific Nuclear Project **(i)**	Degree of intrinsic value of the specific nuclear project felt by stakeholder group	0 to 1	'0' indicates no intrinsic value from specific nuclear project	'1' indicates absolute intrinsic value from specific nuclear project
Perceived Probability Nuclear Waste Issue is Resolved***	Extent to which the nuclear waste storage and security issue is resolved to satisfaction of stakeholder groups	0 to 1	'0' indicates nuclear waste issue completely unresolved	'1' indicates nuclear waste issue completely resolved
Perceived Probability of Competent Project Implementation **(c)**	Extent to which stakeholder group desired levels of competent project implementation are achieved by the specific nuclear project	0 to 1	'0' indicates absolutely no level of desired competent implementation reached	'1' indicates level of desired competent implementation perfectly reached

LOCAL CLD VARIABLES				
CLD Variable	**Stock/Flow Variable**		**Meaning of Lowest Value**	**Meaning of Highest Value**
	Description	**Range**		
Perceived Risk from Project	Probability of fatality and/or environmental devastation from the specific nuclear project	0 to 1	'0' indicates 0% perceived likelihood of fatality and/or environmental devastation	'1' indicates 0% perceived likelihood of fatality and/or environmental devastation
Perceived Stakeholder Empowerment **(i) (c)**	Extent to which stakeholder groups can participate in decisions and actions of the specific nuclear project	0 to 1	'0' indicates absolutely no stakeholder group participation	'1' indicates significant levels of stakeholder group participation
Perceived Transparency of Project Implementer	Extent to which stakeholder group desired levels of Project Implementer transparency are achieved	0 to 1	'0' indicates absolutely no level of desired transparency reached	'1' indicates level of desired transparency has been perfectly reached
Probability Benefit is Realized	Extent to which a stakeholder group realizes publicized/expected benefits from the specific nuclear project ['S' Curve @ threshold 'Social Trust in Project Implementer' value]	0 to 1	'0' indicates absolutely no realization of publicized benefits	'1' indicates significant realization of publicized benefits
Probability First Reporting of Publicized Mistake is from the Project Implementer **(i)**	Extent to which the Project Implementer is first to report to stakeholders	0 to 1	'0' indicates Project Implementer is never the first to report its own (publicized) mistakes	'1' indicates Project Implementer is always the first to report its own (publicized) mistakes
Probability Project Stakeholder Safety and Security Concerns are Met **(c)**	Extent to which stakeholder group desired levels of safety and security are achieved by the specific nuclear project	0 to 1	'0' indicates absolutely no level of desired safety/security reached	'1' indicates level of desired safety/security reached perfectly attained
Social Danger (c)	Cumulative measure of objective risks associated with a specific nuclear project	0 to 1	'0' indicates cumulative measure of objectives risks associated with a specific nuclear project is prohibitively low (e.g., minimum value for input variables considered)	'1' indicates cumulative measure of objectives risks associated with a specific nuclear project is significantly high (e.g., maximum value for input variables considered)

LOCAL CLD VARIABLES				
CLD Variable	**Stock/Flow Variable**		**Meaning of Lowest Value**	**Meaning of Highest Value**
	Description	**Range**		
Social Equity/ Injustice Balance **(i)**	Extent to which dangers associated with specific nuclear project are equally shared by public/stakeholder groups	0 to 1	'0' indicates that all dangers are localized and experienced by a small subset of the public/ stakeholder groups	'1' indicates that all dangers are equally shared and experienced by all of the public/stakeholder groups
Social Opportunity	Cumulative measure of objective benefits associated with a specific nuclear project ['S' curve vs. threshold 'Perceived Risk from Project' value]	-1 to 1	'-1' indicates cumulative measure of objectives benefits associated with a specific nuclear project is viewed only as dangers (e.g., maximum value for input variables considered)	'1' indicates cumulative measure of objectives benefits associated with a specific nuclear project is viewed only as opportunity (e.g., maximum value for input variables considered)
Social Opportunity/Danger Tradeoff	Extent to which stakeholder groups consider a specific nuclear project an opportunity, rather than a danger ['S' Curve @ threshold 'Social Opportunity' value]	-1 to 1	'-1' indicates the results of this tradeoff are only dangers (e.g., even opportunities are perceived as dangerous)	'0' indicates the results of this tradeoff are only opportunities (e.g., dangers don't exist)
Social Trust in Project Implementer **(c)**	Extent to which stakeholder groups are willing to rely on the Project Implementer of a specific nuclear project to make decisions in situations where the group lacks the resources to make a decision	0 to 1	'0' indicates absolutely no trust in the Project Implementer to make decisions	'0' indicates absolute trust in the Project Implementer to make decisions
Stakeholder Acceptance **(c)**	Extent to which stakeholder group supports a specific nuclear project	-1 to 1	'-1' indicates active rejection of (e.g., actively protesting against) a specific nuclear project	'0' indicates active acceptance of (e.g., actively advocating for) a specific nuclear project

(c) Denotes a variable that connects to another CLD in the model
(i) Denotes 'initializing' variables (e.g., variables with no inputs)
[dependent variable behavior @ threshold 'independent variable' value] Denotes description of assumed non-linear behavior of a variable

Table 8 - State/National CLD Variable Definitions

STATE/NATIONAL CLD VARIABLES				
CLD Variable	**Stock/Flow Variable**		**Meaning of Lowest Value**	**Meaning of Highest Value**
	Description	**Range**		
Actual Value of the Specific Nuclear Project	Cumulative measure of the objective value to a nation/ state of a specific nuclear projects ['S' Curve @ threshold 'State/Local Economic Benefits of Specific Nuclear Facility Received' value]	-1 to 1	'-1' indicates cumulative measure of objective value is absolutely negative (e.g., only prohibitive costs/risks exist)	'1' indicates cumulative measure of objective value is absolutely positive (e.g., no prohibitive costs/risks exist)
Additional Regulatory Approval Expectations	Level of additional license/permit expectations by the national regulator on the Project Implementer	0 to 1	'0' indicates zero additional expectations form national regulator	'1' indicates prohibitive level of additional expectations from national regulator
Anti-Nuclear NGO Legal & Social Activities **(c)**	Extent to which national anti-nuclear entities are acting against specific nuclear projects	0 to 1	'0' indicates no national anti-nuclear NGO actions to delay a specific nuclear project	'1' indicates no national anti-nuclear NGO actions to prohibitively delay or stop a specific nuclear project
Essential Stakeholder 'Peer Pressure' for Continued Specific Nuclear Project Operations/ Construction	Degree to which other stakeholder groups effected by a specific nuclear project actively support/encourage the Project Implementer to do everything necessary to continue project progress	0 to 1	'0' indicates absolutely no encouragement/support of stakeholder groups effected by a specific nuclear project	'1' indicates significant levels of encouragement/support of stakeholder groups effected by a specific nuclear project (e.g., lending political, reputational or financial resources)
Host State Cong Rep National Political Benefit of Supporting the Specific Nuclear Project	Extent to which national political power or influence is gained by supporting a specific nuclear project ['S' Curve @ threshold 'Political Controversy from Supporting the Specific Nuclear Project' value]	-1 to 1	'-1' indicates national political influence comes from absolute rejection of a specific nuclear project	'1' indicates national political influence comes from absolute acceptance of a specific nuclear project
Host State Constituent Support for the Specific Nuclear Project	Extent to which a decision-makers constituents support a specific nuclear project	0 to 1	'0' indicates no constituent support of a specific nuclear project	'1' indicates complete constituent support of a specific nuclear project

STATE/NATIONAL CLD VARIABLES				
CLD Variable	**Stock/Flow Variable**		**Meaning of Lowest Value**	**Meaning of Highest Value**
	Description	**Range**		
Host State Stakeholder Consensus in Support for the Specific Nuclear Project	Extent to which different stakeholder groups hold a common belief in support for a specific nuclear project	0 to 1	'0' indicates no stakeholder group common belief in support of a specific nuclear project among stakeholder groups	'1' indicates complete stakeholder group common belief in support of a specific nuclear project among stakeholder groups
Improved Project Implementer Capability with One-of-a-Kind Nuclear Project **(c)**	Extent to which a Project Implementer can improve its ability to complete required tasks for progress on a one-of-a-kind nuclear project	0 to 1	'0' indicates Project Implement absolutely unable to improve its ability to make progress on a one-of-a-kind nuclear project	'1' indicates Project Implement perfectly able to improve its ability to make progress on a one-of-a-kind nuclear project
Incentives to Nuclear Facilities for Using Specific Nuclear Project **(i)**	Externally provided financial, reputational or service-based motivation to use the specific nuclear project	0 t o1	'0' indicates absolutely no external motivation is provided to use the specific nuclear project	'1' indicates significant levels of external motivation are provided to use the specific nuclear project
Lessons Learned	Extent to which a Project Implementer makes improvements based on mistakes, mishaps or re-work	0 to 1	'0' indicates absolutely no improvements are made based on mistakes or mishaps	'1' indicates significant improvements are made based on mistakes or mishaps
Mistakes, Mishaps, Re-Work	Events that occur to increase cost or delays schedule of operations at a specific nuclear project	0 t o1	'0' indicates absolutely no events occur that increase cost or delays schedule of operations	'1' indicates events continuously occur that increase cost or delays schedule of operations
National Expected Specific Nuclear Project Cost	Forecast/promised measure of cost to national stakeholder groups for the specific nuclear project	0 to 1	'0' indicates minimally acceptable levels of forecast costs (e.g., political/social capital, subsidies & upfront costs) from specific nuclear project	'1' indicates prohibitive levels of forecast costs (e.g., political/social capital, subsidies & upfront costs) from specific nuclear project
National Need Specific Nuclear Project	Extent to which services provided by the specific nuclear facility are needed for national economic or security purposes	0 to 1	'0' indicates absolutely no national economic or security need for the specific nuclear facility	'1' indicates a significant national economic or security need for the specific nuclear facility
National SNM Perception Benefit***	Extent to which successful operations of a specific nuclear project increase the perception of SNM as nationally beneficial	0 to 1	'0' indicates absolutely no perception of SNM as nationally beneficial	'1' indicates significant perception of SNM as nationally beneficial

STATE/NATIONAL CLD VARIABLES				
CLD Variable	**Stock/Flow Variable**		**Meaning of Lowest Value**	**Meaning of Highest Value**
	Description	**Range**		
National 'Willingness to Pay' for Specific Nuclear Project	Expected value (tangible and intangible) versus expected cost tradeoff for a specific nuclear project	0 to 1	'0' indicates that expected cost is prohibitively greater than expected value resulting in an absolute unwillingness to pay	'1' indicates that expected value is significantly greater than expected cost resulting in an absolute willingness to pay
Negative Specific Nuclear Project Event **(i) (c)**	Any event at a specific nuclear project that adversely effects human or environmental health	0 to 1	'0' indicates absolutely no negative events that adversely effects human or environmental health	'1' indicates negative events that adversely effects human or environmental health occur (or have in the recent past)
One-of-a-Kind Nuclear Project Construction Uncertainty	Extent to which the Project Implementer continues specific nuclear project construction with unknown information/unmade decisions	0 to 1	'0' indicates that all information is known and all decisions are made for the construction of a specific nuclear project	'1' indicates that absolutely no information is known and absolutely no decisions are made for the construction of a specific nuclear project
One-of-a-Kind Nuclear Project Design Uncertainty	Extent to which the Project Implementer continues specific nuclear project design with unknown information/unmade decisions	0 to 1	'0' indicates that all information is known and all decisions are made for the design of a specific nuclear project	'1' indicates that absolutely no information is known and absolutely no decisions are made for the design of a specific nuclear project
Operations Approaching Limits of Capability	Extent to which successful operations of the specific nuclear project accumulates resources close to capacity	0 to 1	'0' indicates that successful operations absolutely do not accumulate resources close to capacity	'0' indicates that successful operations absolutely accumulate resources close to capacity
Oversight Entity Reported Specific Nuclear Project Cost	Extent to which the reported cost of a specific nuclear project is growing	0 to 1	'0' indicates absolutely no cost increase reported	'1' indicates prohibitive levels of cost increase reported
Perceived Project Implementer Regulatory Approvals Application Quality	Extent to which the Project Implementer submits a quality license/permit application	0 to 1	'0' indicates extremely poor quality license/permit submittal	'1' indicates perfect quality license/permit submittal
Political Controversy from Supporting the Specific Nuclear Project **(c)**	Extent to which supporting a specific nuclear project generates a prolonged public debate between stakeholder groups with conflicting opinions	0 to 1	'0' indicates no prolonged public debate between stakeholder groups with conflicting opinions associated with supporting a specific nuclear project	'1' indicates prohibitive levels of prolonged public debate between stakeholder groups with conflicting opinions associated with supporting a specific nuclear project

STATE/NATIONAL CLD VARIABLES				
CLD Variable	**Stock/Flow Variable**		**Meaning of Lowest Value**	**Meaning of Highest Value**
	Description	**Range**		
Politician Support of the Specific Nuclear Project by Host State Cong Reps	Extent to which the host state Congressional representatives publically and legislatively support the specific nuclear project	-1 to 1	'-1' indicates host state Congressional representatives publically and legislatively oppose the specific nuclear project	'1' indicates host state Congressional representatives publically and legislatively advocate for the specific nuclear project
Pressure to Control Specific Nuclear Project Costs	Extent to which internal and external forces influence the Project Implementer to use its budget more efficiently	0 to 1	'0' indicates absolutely no internal or external influences to efficiently use the budget	'1' indicates significant levels of internal or external influences to efficiently use the budget
Pro-Nuclear NGO Legal & Social Activities **(c)**	Extent to which national pro-nuclear entities are acting in support of specific nuclear projects	0 to 1	'0' indicates no national pro-nuclear actions supporting specific nuclear projects	'1' indicates significant levels of national pro-nuclear actions supporting specific nuclear projects
Probability Specific Nuclear Project Commences/Continues Operations **(c)**	Likelihood of the Project Implementer is allowed to continue progress toward specific nuclear project operations	0 to 1	'0' indicates absolutely no likelihood of the Project Implementer is allowed to continue progress toward specific nuclear project operations	'1' indicates extremely high likelihood of the Project Implementer is allowed to continue progress toward specific nuclear project operations
Probability of Adequate Congressional Funding	Likelihood specific nuclear project receives adequate Congressional funds to meet construction/operations deadlines	0 t o1	'0' indicates absolutely no likelihood the specific nuclear project receives adequate Congressional funds to meet pertinent deadlines	'1' indicates extremely high likelihood the specific nuclear project receives adequate Congressional funds to meet pertinent deadlines
Probability of Criticism of National Regulating Entity	Level of criticism lobbied toward the national regulator regarding a specific nuclear project	0 to 1	'0' indicates no criticism of the national regulating entity regarding a specific nuclear project	'1' indicates prohibitive levels of criticism of the national regulating entity regarding a specific nuclear project
Probability of Expanding Specific Nuclear Project Operational Scope	Likelihood that internal or external forces influence the Project Implementer to expand the original scope of the specific nuclear project operations	0 to 1	'0' indicates absolutely no likelihood that internal or external forces influence an expansion of the original scope of the specific nuclear project	'1' indicates a significant likelihood that internal or external forces influence an expansion of the original scope of the specific nuclear project

STATE/NATIONAL CLD VARIABLES				
CLD Variable	**Stock/Flow Variable**		**Meaning of Lowest Value**	**Meaning of Highest Value**
	Description	**Range**		
Probability of Host State Cong Rep Re-Election from Supporting the Specific Nuclear Project	Extent to which supporting a specific nuclear project increases the likelihood of a politician's re-election	-1 to 1	'-1' indicates increase in politician's re-election with complete rejection of a specific nuclear project	'1' indicates increase in politician's re-election with complete support of a specific nuclear project
Probability of Need to (Re)Design Specific Nuclear Project Construction/ Expansion	Likelihood the Project Implementer needs to (re)design the specific nuclear project to consider operational expansion (often due to scope creep)	0 to 1	'0' indicates absolutely no likelihood the Project Implementer would need to (re)design for operational expansion	'1' indicates extremely high likelihood the Project Implementer would need to (re)design for operational expansion
Probability of Success of Specific Nuclear Project Alternative(s)	Likelihood that facilities that perform similar functions as the specific nuclear project successfully operates (actual and/or perceived)	0 to 1	'0' indicates the success of facilities that perform similar functions is much greater than that success of the specific nuclear project	'1' indicates the success of facilities that perform similar functions is much less than that success of the specific nuclear project
Probability the Specific Nuclear Project Receives Regulatory Approvals	Expected probability of a specific nuclear project receiving a license or permit	0 to 1	'0' indicates absolutely no likelihood of a license/permit being received	'1' indicates absolute likelihood of a license/permit being received
Project Implementer Ability to Meet Regulating Entity Expectations	Extent to which the Project Implementer meets national regulating entity expectations regarding the specific nuclear project	0 to 1	'0' indicates complete lack of the Project Implementer meeting national regulator expectations	'1' indicates perfect achievement by the Project Implementer of national regulator expectations
Project Implementer Capability **(c)**	Extent to which a Project Implementer is capable of completing the required tasks for progressing the specific nuclear project ['S' curve @ threshold 'Additional Regulatory Approval Expectations' value]	0 to 1	'0' indicates severely insufficient Project Implementer capacity	'1' indicates overabundance of Project Implementer capacity

STATE/NATIONAL CLD VARIABLES				
CLD Variable	Stock/Flow Variable		Meaning of Lowest Value	Meaning of Highest Value
	Description	Range		
Regulating Entity Confidence in Project Implementer	Extent to which the national regulating entity has confidence in the Project Implementer to successfully operate a specific nuclear project	0 t o1	'0' indicates absolutely zero confidence of the national regulating entity in the Project Implementer to successfully operate a specific nuclear project	'1' indicates absolute confidence of the national regulating entity in the Project Implementer to successfully operate a specific nuclear project
State/Local Economic Benefits of Specific Nuclear Project Received	Extent to which a specific nuclear project economic benefits are received by state and local stakeholder groups	0 to 1	'0' indicates absolutely no economic benefits are received by state and local stakeholder groups	'1' indicates an overabundance of economic benefits are received by state and local stakeholder groups
Specific Nuclear Project Cost Overrun	Extent to which actual costs of completing a specific nuclear project exceed budget projections (actual or estimated)	0 to 1	'0' indicates actual costs of completing a specific nuclear project never exceed budget projections	'1' indicates actual costs of completing a specific nuclear project prohibitively exceed budget projections
Specific Nuclear Project Expected Budget Available	Extent to which the Project Implementer expects sufficient budget to be available to complete the specific nuclear project	0 to 1	'0' indicates that Project Implementer expects extremely limited budget available to complete the specific nuclear project	'1' indicates that Project Implementer expects near limitless budget available to complete the specific nuclear project
Support from Non-Host State Cong Reps with Specific Need for Specific Nuclear Project	Extent to which non-host state Congressional representatives who have a specific need publically and legislatively support the specific nuclear project	0 to 1	'0' indicates absolutely no public and legislative support of the specific nuclear project by non-host state Congressional representatives	'1' indicates unwavering public and legislative support of the specific nuclear project by non-host state Congressional representatives
Support from Non-Host State Cong Reps without Specific Need for Specific Nuclear Project	Extent to which non-host state Congressional representatives who do not have a specific need publically and legislatively support the specific nuclear project	0 to 1	'0' indicates absolutely no public and legislative support of the specific nuclear project by non-host state Congressional representatives with no need for the specific nuclear project	'1' indicates unwavering public and legislative support of the specific nuclear project by non-host state Congressional representatives with no need for the specific nuclear project
Tangible SNM Benefit	Extent to which the state/national SNM benefit is accumulated and countable	0 to 1	'0' indicates absolutely no state/national benefits are accumulated and countable	'1' indicates abundance of state/national benefits are accumulated and countable

STATE/NATIONAL CLD VARIABLES				
CLD Variable	**Stock/Flow Variable**		**Meaning of Lowest Value**	**Meaning of Highest Value**
	Description	**Range**		
Time to Consider Regulatory Approvals Application	Amount of time taken during the license/permit application process (during which the Project Implementer is expected to maintain progress forward on the specific nuclear project) ['S' curve @ threshold 'Anti-Nuclear NGO Legal & Social Actions' value]	0 to 1	'0' indicates no additional time taken during the applications process	'1' indicates prohibitive amount of time taken during the applications process (e.g., long enough time to cause accumulated costs to discontinue the project)

(c) Denotes a variable that connects to another CLD in the model
(i) Denotes 'initializing' variables (e.g., variables with no inputs)
[dependent variable behavior @ threshold 'independent variable' value] Denotes description of assumed non-linear behavior of a variable

APPENDIX B – CAUSAL LOOP DIAGRAM LOOP EXPLANATION

Table 9 - Individual Acceptance CLD Loop Explanation

Radiation Attitudes	CLD Explanation	Conceptual Behavior Explained	Phenomena
R(R.A.)1: Radiation Attitude/Social Trust Loop (c)	Increasing '**radiation attitudes**' increases the '**social trust in project implementer**' **(c)**; increasing '**social trust in project implementer**' **(c)** increases the '**personal trust in project implementer to respond competently to problems**'; increasing '**personal trust in project implementer to respond competently to problems**' decreases the '**perceived personal risk**'; decreasing '**perceived personal risk**' increases '**radiation attitudes**'	• Dynamic relationship between individual beliefs on radiation and stakeholder trust in project implementer	• socio-technical system framework (Sterman 2000; de Weck, et al 2011) • social trust in the project implementer (Siegrist, et al 2000) • trust asymmetry principle (Slovic 1993; Cvetkovich, et al 2002) • credibility of the project implementer (Greenberg 2009; Fornell 2007) • snowball' nature of opinion change (Kasperson et al, 1980, 19) • relationship between supporting nuclear projects as a concept and a specific nuclear facility nearby (Kasperson et al, 1980, 15)
R(R.A.)2: Personal Framing Loop	Increasing '**radiation attitudes**' decreases the '**negative personal framing**'; decreasing '**negative personal framing**' increases the '**personal nuclear context**'; increasing '**personal nuclear context**' increases '**radiation attitudes**'	• Reinforcing influence of misinformation/ negative reporting of nuclear project on risk/ opposition	• credibility of the project implementer (Greenberg 2009; Fornell 2007) • relationship between supporting nuclear projects as a concept and a specific nuclear facility nearby (Kasperson et al, 1980, 15) • perceived vs. objective truth/differences in cognitive connections (e.g., Pachur, et al 2012; Finucane, et al 2000; Slovic & Peters 2006; Kahneman & Tversky 1979, 1982) • popular culture and social perceptions of 'nuclear things' (Weart 1998, 2012; Mahaffy 2014; Zemand & Amundson 2004)
R(R.A.)3: Radiation Attitudes & Social Catastrophe Loop	Increasing '**radiation attitudes**' decreases the '**negative personal framing**'; decreasing '**negative personal framing**' decreases the '**fear of "nuclear winter"**'[or decreases the '**fear of long term effects of radiation**']; decreasing '**fear of "nuclear winter"**' [or decreasing '**fear of long term effects of radiation**'] decreases '**socially catastrophic potential**'; decreasing '**socially catastrophic potential**' increases '**radiation attitudes**'	• Individual fears influence expected social fears and negative outcomes	• rigorous model for individual radiation attitudes (Chandra 2014) • snowball' nature of opinion change (Kasperson et al, 1980, 19) • popular culture and social perceptions of 'nuclear things' (Weart 1998, 2012; Mahaffy 2014; Zemand & Amundson 2004) • probability neglect (Sunstein 2002, 62-63)
R(R.A.)4: Personal Benefit vs. Risk Loop	Increasing '**radiation attitudes**' increases the '**perceived personal benefit**'; increasing '**perceived personal benefit**' decreases the '**perceived personal risk**'; decreasing '**perceived personal risk**' increases '**radiation attitudes**'	• Acceptance varies for individuals with same individual radiation attitude for different nuclear fuel cycle facilities	• relationship between supporting nuclear projects as a concept and a specific nuclear facility nearby (Kasperson et al, 1980, 15) • operational vs. expected (or, speculative) benefits (Venables, et al 2009; Bezdek & Wendling 2006; Greenberg 2009; Flynn, et al 1993)

Radiation Attitudes	CLD Explanation	Conceptual Behavior Explained	Phenomena
R(R.A.)5: Personal Control vs. Uncertainty Loop	Increasing '**radiation attitudes**' increases the '**perceived personal control**'; increasing '**perceived personal control**' increases the '**personal knowledge framing**'; increasing '**personal knowledge framing**' decreases '**personal sense of uncertainty**'; decreasing '**personal sense of uncertainty**' decreases '**perceived personal risk**'; decreasing '**perceived personal risk**' increases '**radiation attitudes**'	• Increasing sense of control can offset increasing levels of uncertainty – recent emphasis on 'consent-based siting'	• perceived vs. objective truth/differences in cognitive connections (e.g., Pachur, et al 2012; Finucane, et al 2000; Slovic & Peters 2006; Kahneman & Tversky 1979, 1982) • nuanced, cognitive conception of risk (Margolis 1996, 1997)
R(R.A.)6: Media vs. Personal Framing Loop	Decreasing '**negative personal framing**' decreases the '**probability of selecting media source with negative framing**'; decreasing '**probability of selecting media source with negative framing**' decreases the '**probability negative message is trusted**'; decreasing '**probability negative message is trusted**' decreases '**negative personal framing**'	• Influence of trusted information sources on how messages regarding risk/benefit are received	• perceived vs. objective truth/differences in cognitive connections (e.g., Pachur, et al 2012; Finucane, et al 2000; Slovic & Peters 2006; Kahneman & Tversky 1979, 1982) • snowball' nature of opinion change (Kasperson et al, 1980, 19) • popular culture and social perceptions of 'nuclear things' (Weart 1998, 2012; Mahaffy 2014; Zemand & Amundson 2004)

Table 10 - Local CLD Loop Explanation

Local CLD	CLD Explanation	Conceptual Behavior Explained	Phenomena
R(L)1: Social Danger & Perceived Risk Loop	Increasing '**stakeholder acceptance**' increases the '**probability stakeholder safety & security concerns are met**'; increasing '**probability stakeholder safety & security concerns are met**' decreases the '**social danger**'; decreasing '**social danger**' increases the '**social opportunity/danger tradeoff**'; increasing '**social opportunity/danger tradeoff** decreases the '**perceived risk from project**'; decreasing '**perceived risk from project**' increases '**stakeholder acceptance**'	• Reinforcing nature of tangible danger on perceived risk	• perceived vs. objective truth/differences in cognitive connections (e.g., Pachur, et al 2012; Finucane, et al 2000; Slovic & Peters 2006; Kahneman & Tversky 1979, 1982) • credibility of the project implementer (Greenberg 2009; Fornell 2007) • nuanced, cognitive conception of risk (Margolis 1996, 1997) • differing perspectives of the nuclear acceptance (e.g., Santa Fe vs. Carlsbad on WIPP (Margolis 1997, 132)
R(L)2: Perceived Benefit vs. Implementation Loop	Increasing '**stakeholder acceptance**' increases the '**perceived probability of competent project implementation**; increasing sense of '**perceived probability of competent project implementation**' increases the '**social trust in project implementer**'; increasing '**social trust in project implementer**' increases '**probability that benefit is received**'; increasing '**probability that benefit is received**' increases '**perceived benefit from project**'; increasing '**perceived benefit from project**' increases '**stakeholder acceptance**'	• Competency and social trust of project implementer reinforces perceived and received benefit	• socio-technical system framework (Sterman 2000; de Weck, et al 2011) • relationship between supporting nuclear projects as a concept and a specific nuclear facility nearby (Kasperson et al, 1980, 15) • operational vs. expected (or, speculative) benefits (Venables, et al 2009; Bezdek & Wendling 2006; Greenberg 2009; Flynn, et al 1993) • credibility of the project implementer (Greenberg 2009; Fornell 2007)
R(L)3: Tradeoff vs. Risk Loop	Increasing '**perceived risk from project**' decreases the sense of '**social opportunity**'; decreasing sense of '**social opportunity**' decreases the '**social opportunity/danger tradeoff**'; decreasing '**social opportunity/danger tradeoff**' increases '**perceived risk from project**'	• Dynamic by which risk is either increasingly seen as an opportunity (and decreasingly as a danger) or vice versa	• nuanced, cognitive conception of risk (Margolis 1996, 1997) • operational vs. expected (or, speculative) benefits (Venables, et al 2009; Bezdek & Wendling 2006; Greenberg 2009; Flynn, et al 1993) • differing perspectives of the nuclear acceptance (e.g., Santa Fe vs. Carlsbad on WIPP (Margolis 1997, 132)
R(L)4: Social Framing vs. Tradeoff Loop	Increasing '**social opportunity/danger tradeoff**' decreases the '**negative social framing**'; decreasing '**negative social framing**' decreases the sense of '**social danger**'; decreasing '**social danger**' increases '**social opportunity/danger tradeoff**'	• Reinforcing effect that perception (influenced by negative framing) can have on tangible danger	• popular culture and social perceptions of 'nuclear things' (Weart 1998, 2012; Mahaffy 2014; Zemand & Amundson 2004) • core stakeholder values (de Groot, et. al. 2013) • 'situational awareness' (P.E.D. #1, #3, #4) • trust asymmetry principle (Slovic 1993; Cvetkovich, et al 2002)

Local CLD	CLD Explanation	Conceptual Behavior Explained	Phenomena
R(L)5: Risk Frequency Inclusion Loop	Increasing '**perceived benefit from project**' increases the '**cognitive inclusion of frequency**'; increasing '**cognitive inclusion of frequency**' decreases the '**perceived frequency**'; decreasing '**perceived frequency**' increases '**perceived benefit from project**'	• As benefits increase, descriptions of associated risks increasingly reference low frequency of occurrence; as benefits decrease, any risk is problematic	• perceived vs. objective truth/differences in cognitive connections (e.g., Pachur, et al 2012; Finucane, et al 2000; Slovic & Peters 2006; Kahneman & Tversky 1979, 1982) • snowball nature of opinion change (Kasperson et al, 1980, 19) • probability neglect (Sunstein 2002, 62-63) • nuanced, cognitive conception of risk (Margolis 1996, 1997)
R(L)6: Personal Knowledge vs. Social Framing Loop (c)	Increasing '**negative social framing**' decreases the '**personal knowledge framing**' **(c)**; decreasing '**personal knowledge framing**' **(c)** increases the '**credibility of negative framing**'; increasing '**credibility of negative framing**' increases '**negative social framing**'	• Facts and 'objective' knowledge can easily be co-opted or overwhelmed by framing of the project	• perceived vs. objective truth/differences in cognitive connections (e.g., Pachur, et al 2012; Finucane, et al 2000; Slovic & Peters 2006; Kahneman & Tversky 1979, 1982) • socio-technical system framework (Sterman 2000; de Weck, et al 2011) • differing perspectives of the nuclear acceptance (e.g., Santa Fe vs. Carlsbad on WIPP (Margolis 1997, 132) • credibility of the project implementer (Greenberg 2009; Fornell 2007)
R(L)7: Social Trust vs. Publicized Mistake Loop	Increasing '**social trust in project implementer**' decreases the '**importance of publicized mistake to stakeholder**'; decreasing '**importance of publicized mistake to stakeholder**' increases '**degree of project implementer awareness of stakeholder values**'; increasing '**degree of project implementer awareness of stakeholder values**' increases '**social trust in project implementer**'	• Illustrates importance of (1) project implementer having a high awareness of what stakeholders consider important and (2) minimizing the potential negative aspects of publicized mistakes	• core stakeholder values (de Groot, et. al. 2013) • 'situational awareness' (P.E.D. #1, #3, #4) • 'no surprises' strategy stakeholder outreach (P.E.D. #1, #2, #3, #4) • rigorous model for individual radiation attitudes (Chandra 2014) • trust asymmetry principle (Slovic 1993; Cvetkovich, et al 2002) • social trust in the project implementer (Siegrist, et al 2000)
R(L)8: Media Opinion vs. Social Opinion Loop	Increasing '**media favorability**' decreases the '**credibility of negative framing**'; decreasing '**credibility of negative framing**' decreases '**negative social framing**'; decreasing '**negative social framing**' decreases '**social danger**'; decreasing '**social danger**' increases '**media favorability**'	• Influence of media opinion on tangible danger and stakeholder acceptance	• popular culture and social perceptions of 'nuclear things' (Weart 1998, 2012; Mahaffy 2014; Zemand & Amundson 2004) • socio-technical system framework (Sterman 2000; de Weck, et al 2011) • snowball nature of opinion change (Kasperson et al, 1980, 19) • core stakeholder values (de Groot, et. al. 2013) • 'situational awareness' (P.E.D. #1, #3, #4) • credibility of the project implementer (Greenberg 2009; Fornell 2007)
R(L)9: Nuclear Waste & Opposition Loop	Increasing '**probability nuclear waste issue is resolved**' decreases the '**negative social framing**'; decreasing '**negative social framing**' decreases the '**degree of opposition awareness of stakeholder values**'; decreasing '**degree of opposition awareness of stakeholder values**' increases '**probability nuclear waste issue is resolved**'	• High level of influence nuclear waste has as the 'crown jewel' of anti-nuclear lobby argument	• snowball nature of opinion change (Kasperson et al, 1980, 19) • trust asymmetry principle (Slovic 1993; Cvetkovich, et al 2002) • social trust in the project implementer (Siegrist, et al 2000) • popular culture and social perceptions of 'nuclear things' (Weart 1998, 2012; Mahaffy 2014; Zemand & Amundson 2004) • socio-technical system framework (Sterman 2000; de Weck, et al 2011)

Local CLD	CLD Explanation	Conceptual Behavior Explained	Phenomena
R(L)10: Social Trust vs. Opposition Loop	Increasing '**social trust in project implementer**' increases the '**probability benefit is received**'; increasing '**probability benefit is received**' increases '**social opportunity**'; increasing '**social opportunity**' increases '**social opportunity/danger tradeoff**'; increasing '**social opportunity/danger tradeoff**' decreases '**negative social framing**'; decreasing '**negative social framing**' decreases '**degree of opposition awareness of stakeholder values**'; decreasing '**degree of opposition awareness of stakeholder values**' increases '**social trust in project implementer**'	• Opposing viewpoints gain salience/merit as stakeholders lose trust in the project implementer	• credibility of the project implementer (Greenberg 2009; Fornell 2007) • core stakeholder values (de Groot, et. al. 2013) • 'situational awareness' (P.E.D. #1, #3, #4) • social trust in the project implementer (Siegrist, et al 2000) • trust asymmetry principle (Slovic 1993; Cvetkovich, et al 2002)
R(L)11: Social Trust vs. Benefit Loop	Increasing '**social trust in project implementer**' increases the '**probability benefit is received**'; increasing '**probability benefit is received**' increases '**perceived benefit from project**'; increasing '**perceived benefit from project**' increases '**stakeholder acceptance**'; increasing '**stakeholder acceptance**' increases '**degree of project implementer awareness of stakeholder values**'; increasing '**degree of project implementer awareness of stakeholder values**' increases '**social trust in project implementer**'	• Trust is easier to initiate, maintain and (if needed) recover as benefits are realized	• credibility of the project implementer (Greenberg 2009; Fornell 2007) • core stakeholder values (de Groot, et. al. 2013) • 'situational awareness' (P.E.D. #1, #3, #4) • trust asymmetry principle (Slovic 1993; Cvetkovich, et al 2002) • perceived vs. objective truth/differences in cognitive connections (e.g., Pachur, et al 2012; Finucane, et al 2000; Slovic & Peters 2006; Kahneman & Tversky 1979, 1982)
R(L)12(a&b): Stakeholder Acceptance vs. Radiation Attitudes Loop(s) (c)	a) Increasing '**stakeholder acceptance**' increases the '**radiation attitudes**'; increasing '**radiation attitudes**' increases '**perceived benefit from project**'; increasing '**perceived benefit from project**' increases '**stakeholder acceptance**' b) Increasing '**stakeholder acceptance**' increases the '**radiation attitudes**'; increasing '**radiation attitudes**' decreases '**perceived risk from project**'; decreasing '**perceived risk from project**' increases '**stakeholder acceptance**'	• Inextricable, dynamic link between individual beliefs and stakeholder acceptance that changes over time (e.g., new 'pro-nuclear' Green movement)	• socio-technical system framework (Sterman 2000; de Weck, et al 2011) • snowball nature of opinion change (Kasperson et al, 1980, 19) • perceived vs. objective truth/differences in cognitive connections (e.g., Pachur, et al 2012; Finucane, et al 2000; Slovic & Peters 2006; Kahneman & Tversky 1979, 1982) • differing perspectives of the nuclear acceptance (e.g., Santa Fe vs. Carlsbad on WIPP (Margolis 1997, 132) • rigorous model for individual radiation attitudes (Chandra 2014) • relationship between supporting nuclear projects as a concept and a specific nuclear facility nearby (Kasperson et al, 1980, 15) • operational vs. expected (or, speculative) benefits (Venables, et al 2009; Bezdek & Wendling 2006; Greenberg 2009; Flynn, et al 1993)

Table 11 - State/Federal CLD Loop Explanation

State/Federal CLD	CLD Explanation	Conceptual Behavior Explained	Phenomena
R(S/N)1: Stakeholder Consensus vs. Political Controversy Loop	Increasing '**host state stakeholder consensus in support for specific nuclear project**' decreases the '**political controversy from supporting the specific nuclear project**'; decreasing '**political controversy supporting the specific nuclear project**' increases the '**host state constituent support for specific nuclear project**'; increasing '**host state constituent support for specific nuclear project**' increases '**host state stakeholder consensus in support for specific nuclear project**'	• Reinforcing influence of social 'controversy' attached to a specific nuclear project on constituent (e.g., local voter) support	• Congressional dynamics (WIPP vs. SONGS case studies) • 'no surprises' strategy stakeholder outreach (P.E.D. #1, #2, #3, #4) • core stakeholder values (de Groot, et. al. 2013) • 'situational awareness' (P.E.D. #1, #3, #4) • differing perspectives of the nuclear acceptance (e.g., Santa Fe vs. Carlsbad on WIPP (Margolis 1997, 132) • popular culture and social perceptions of 'nuclear things' (Weart 1998, 2012; Mahaffy 2014; Zemand & Amundson 2004) • socio-technical system framework (Sterman 2000; de Weck, et al 2011)
R(S/N)2: Stakeholder Consensus vs. Re-Election Loop	Increasing '**host state stakeholder consensus in support for specific nuclear project**' decreases '**political controversy from supporting the specific nuclear project**'; decreasing '**political controversy supporting the specific nuclear project**' increases '**host state constituent support for specific nuclear project**'; increasing '**host state constituent support for specific nuclear project**' increases '**probability of host state Cong Rep re-election from supporting the specific nuclear project**'; increasing '**probability of host state Cong Rep re-election from supporting the specific nuclear project**' increases '**politician support of specific nuclear project by host state Cong Reps**'; increasing '**politician support of specific nuclear project by host state Cong Reps**' increases '**host state stakeholder consensus in support for specific nuclear project**'	• Importance of voters to state government and state-specific representatives in federal government (e.g., those beholden to the cares of the voters) accepting nuclear projects	• Congressional dynamics (WIPP vs. SONGS case studies) • core stakeholder values (de Groot, et. al. 2013) • 'situational awareness' (P.E.D. #1, #3, #4) • differing perspectives of the nuclear acceptance (e.g., Santa Fe vs. Carlsbad on WIPP (Margolis 1997, 132) • relationship between supporting nuclear projects as a concept and a specific nuclear facility nearby (Kasperson et al, 1980, 15)

State/Federal CLD	CLD Explanation	Conceptual Behavior Explained	Phenomena
R(S)3: Political Benefit from Project Support Loop	Increasing '**host state Cong Rep political benefit of supporting specific nuclear project**' increases '**politician support of specific nuclear project by host state Cong Reps**'; increasing '**politician support of specific nuclear project by host state Cong Reps**' increases '**host state stakeholder consensus in support for specific nuclear project**'; increasing '**host state stakeholder consensus in support for specific nuclear project**' decreases '**political controversy from supporting specific nuclear project**'; decreasing '**political controversy from supporting the specific nuclear project**' increases '**host state Cong Rep political benefit of supporting specific nuclear project**'	• Extent to which a new nuclear project is associated with increasing political power, standing or influence	• operational vs. expected (or, speculative) benefits (Venables, et al 2009; Bezdek & Wendling 2006; Greenberg 2009; Flynn, et al 1993) • Congressional dynamics (WIPP vs. SONGS case studies) • core stakeholder values (de Groot, et. al. 2013) • 'situational awareness' (P.E.D. #1, #3, #4) • relationship between supporting nuclear projects as a concept and a specific nuclear facility nearby (Kasperson et al, 1980, 15)
R(S/N)4: Project Implementer Expectations & Approvals Loop	Increasing '**regulating entity confidence in project implementer**' decreases the '**time to consider regulatory approvals**'; decreasing '**time to consider regulatory approvals**' decreases '**additional regulatory approval expectations**'; decreasing '**additional regulatory approval expectations**' increases '**project implementer ability to meet regulating entity expectations**'; increasing '**project implementer ability to meet regulating entity expectations**' increases '**perceived project implementer regulatory approval application quality**'; increasing '**perceived project implementer regulatory approval application quality**' increases '**regulating entity confidence in project implementer**'	• Relationship where lacking confidence in project implementer can generate increasing number of tasks to be completed – possibly becoming prohibitive	• credibility of the project implementer (Greenberg 2009; Fornell 2007) • popular culture and social perceptions of 'nuclear things' (Weart 1998, 2012; Mahaffy 2014; Zemand & Amundson 2004) • 'no surprises' strategy stakeholder outreach (P.E.D. #1, #2, #3, #4) • core stakeholder values (de Groot, et. al. 2013) • 'situational awareness' (P.E.D. #1, #3, #4)
R(S/N)5: One-of-a-Kind Uncertainty vs. Mistakes Loop	Increasing '**one-of-a-kind nuclear project design uncertainty**' increases the '**one-of-a-kind nuclear project construction uncertainty**'; increasing '**one-of-a-kind nuclear project construction uncertainty**' increases '**mistakes, mishaps, re-work**'; increasing '**mistakes, mishaps, re-work**' increases '**one-of-a-kind nuclear project design uncertainty**'	• Extent to which expected growing pains of new technology implementation become unwieldy and problematic (e.g., increasing political pressure to meet next deliverable)	• 'no surprises' strategy stakeholder outreach (P.E.D. #1, #2, #3, #4) • nuanced, cognitive conception of risk (Margolis 1996, 1997) • socio-technical system framework (Sterman 2000; de Weck, et al 2011) • dynamics associated with 'one-of-a-kind' facility cost (WIPP vs. SONGS case studies)

State/Federal CLD	CLD Explanation	Conceptual Behavior Explained	Phenomena
R(S/N)6: Learning vs. Continued Operations Loop	Increasing '**lessons learned**' increases the '**improved project implementer capability with one-of-a-kind nuclear project**'; increasing '**improved project implementer capability with one-of-a-kind nuclear project**' decreases '**mistakes, mishaps, re-work**'; decreasing '**mistakes, mishaps, re-work**' increases '**probability specific nuclear project commences/continues operations**'; increasing '**probability specific nuclear project commences/continues operations**' increases '**lessons learned**'	• Importance of learning from and improving upon mistakes for a new nuclear project to continue operations	• 'no surprises' strategy stakeholder outreach (P.E.D. #1, #2, #3, #4) • nuanced, cognitive conception of risk (Margolis 1996, 1997) • socio-technical system framework (Sterman 2000; de Weck, et al 2011) • dynamics associated with 'one-of-a-kind' facility cost (WIPP vs. SONGS case studies) • credibility of the project implementer (Greenberg 2009; Fornell 2007) • snowball nature of opinion change (Kasperson et al, 1980, 19)
R(S/N)7: Willingness to Pay vs. Overrun Loop	Increasing '**specific nuclear project cost overrun**' increases the '**oversight entity reported specific nuclear facility cost**'; increasing '**oversight entity reported specific nuclear facility cost**' decreases '**national "willingness to pay" for specific nuclear project**'; decreasing '**national "willingness to pay" for specific nuclear project**' increases '**political controversy from supporting the specific nuclear project**'; increasing '**political controversy from supporting the specific nuclear project**' decreases '**probability of adequate Congressional funding**'; decreasing '**probability of adequate Congressional funding**' increases '**specific nuclear project cost overrun**'	• Utility of a new nuclear project continually declines as schedules slip and budgets get adjusted	• Congressional dynamics (WIPP vs. SONGS case studies) • popular culture and social perceptions of 'nuclear things' (Weart 1998, 2012; Mahaffy 2014; Zemand & Amundson 2004) • snowball nature of opinion change (Kasperson et al, 1980, 19) • 'situational awareness' (P.E.D. #1, #3, #4) • 'no surprises' strategy stakeholder outreach (P.E.D. #1, #2, #3, #4) • operational vs. expected (or, speculative) benefits (Venables, et al 2009; Bezdek & Wendling 2006; Greenberg 2009; Flynn, et al 1993)
R(S/N)8: National Willingness to Pay vs. Controversy Loop	Increasing '**national "willingness to pay" for specific nuclear project**'; decreases '**political controversy from supporting the specific nuclear project**'; decreasing '**political controversy from supporting the specific nuclear project**' decreases '**national expected specific nuclear project cost**'; decreasing '**national expected specific nuclear project cost**' increases '**national "willingness to pay" for specific nuclear project**'	• Utility of new nuclear project continually declines as associated political controversy persists	• Congressional dynamics (WIPP vs. SONGS case studies) • popular culture and social perceptions of 'nuclear things' (Weart 1998, 2012; Mahaffy 2014; Zemand & Amundson 2004) • snowball nature of opinion change (Kasperson et al, 1980, 19) • 'situational awareness' (P.E.D. #1, #3, #4) • 'no surprises' strategy stakeholder outreach (P.E.D. #1, #2, #3, #4) • operational vs. expected (or, speculative) benefits (Venables, et al 2009; Bezdek & Wendling 2006; Greenberg 2009; Flynn, et al 1993) • relationship between supporting nuclear projects as a concept and a specific nuclear facility nearby (Kasperson et al, 1980, 15)

State/Federal CLD	CLD Explanation	Conceptual Behavior Explained	Phenomena
R(S/N)9: State/Local Benefits vs. Political Controversy Loop	Increasing '**probability specific nuclear project commences/continues operations**' increases '**state/local economic benefits of specific nuclear project received**'; increasing '**state/local economic benefits of specific nuclear project received**' increases '**actual value of the specific nuclear project**'; increasing '**actual value of the specific nuclear project**' decreases '**political controversy from supporting the specific nuclear project**'; decreasing '**political controversy from supporting the specific nuclear project**' increases '**probability of adequate Congressional funding**'; increasing '**probability of adequate Congressional funding**' decreases '**specific nuclear project cost overrun**'; decreasing '**specific nuclear project cost overrun**' increases '**probability specific nuclear project commences/continues operations**'	• Benefits accrued by some can temper opposition/ controversy of many	• Congressional dynamics (WIPP vs. SONGS case studies) • operational vs. expected (or, speculative) benefits (Venables, et al 2009; Bezdek & Wendling 2006; Greenberg 2009; Flynn, et al 1993) • differing perspectives of the nuclear acceptance (e.g., Santa Fe vs. Carlsbad on WIPP (Margolis 1997, 132) • relationship between supporting nuclear projects as a concept and a specific nuclear facility nearby (Kasperson et al, 1980, 15) • socio-technical system framework (Sterman 2000; de Weck, et al 2011)
R(S/N)10: Cost Overrun vs. Non-Host State Support (with need) Loop	Increasing '**support from non-host state Cong Reps with specific need for specific nuclear project**' increases '**probability of adequate Congressional funding**'; increasing '**probability of adequate Congressional funding**' decreases '**specific nuclear project cost overrun**'; decreasing '**specific nuclear project cost overrun**' increases '**support from non-host state Cong Reps with specific need for specific nuclear project**'	• A state's need for the services of the new nuclear project tends toward higher acceptable cost overrun	• Congressional dynamics (WIPP vs. SONGS case studies) • operational vs. expected (or, speculative) benefits (Venables, et al 2009; Bezdek & Wendling 2006; Greenberg 2009; Flynn, et al 1993) • relationship between supporting nuclear projects as a concept and a specific nuclear facility nearby (Kasperson et al, 1980, 15) • socio-technical system framework (Sterman 2000; de Weck, et al 2011) • popular culture and social perceptions of 'nuclear things' (Weart 1998, 2012; Mahaffy 2014; Zemand & Amundson 2004)
R(S/N)11: Cost Overrun vs. Non-Host State Support (without need) Loop	Increasing '**support from non-host state Cong Reps without specific need for specific nuclear project**' increases '**probability of adequate Congressional funding**'; increasing '**probability of adequate Congressional funding**' decreases '**specific nuclear project cost overrun**'; decreasing '**specific nuclear project cost overrun**' increases '**support from non-host state Cong Reps without specific need for specific nuclear project**'	• A state's lack of need for the services of the new nuclear project tends toward lower acceptable cost overrun	• Congressional dynamics (WIPP vs. SONGS case studies) • operational vs. expected (or, speculative) benefits (Venables, et al 2009; Bezdek & Wendling 2006; Greenberg 2009; Flynn, et al 1993) • relationship between supporting nuclear projects as a concept and a specific nuclear facility nearby (Kasperson et al, 1980, 15) • socio-technical system framework (Sterman 2000; de Weck, et al 2011) • popular culture and social perceptions of 'nuclear things' (Weart 1998, 2012; Mahaffy 2014; Zemand & Amundson 2004)

State/Federal CLD	CLD Explanation	Conceptual Behavior Explained	Phenomena
R(S/N)12: Accumulated Benefit & Expansion Loop	Increasing '**probability specific nuclear project commences/continues operations**' increases '**tangible SNM benefit**'; increasing '**tangible SNM benefit**' increases '**national SNM perception*****'; increasing '**national SNM perception*****' increases '**probability of expanding specific nuclear project operational scope**'; increasing '**probability of expanding specific nuclear project operational scope**' increases '**actual value of the specific nuclear project**'; increasing '**actual value of the specific nuclear project**' decreases '**political controversy from supporting the specific nuclear project**'; decreasing '**political controversy from supporting the specific nuclear project**' increases '**probability of adequate Congressional funding**'; increasing '**probability of adequate Congressional funding**' decreases '**specific nuclear project cost overrun**'; decreasing '**specific nuclear project cost overrun**' increases '**probability specific nuclear project commences/continues operations**'	• Dynamic by which benefits accrued lead to desires for 'more of a good thing' & scope creep	• Congressional dynamics (WIPP vs. SONGS case studies) • operational vs. expected (or, speculative) benefits (Venables, et al 2009; Bezdek & Wendling 2006; Greenberg 2009; Flynn, et al 1993) • relationship between supporting nuclear projects as a concept and a specific nuclear facility nearby (Kasperson et al, 1980, 15) • socio-technical system framework (Sterman 2000; de Weck, et al 2011) • popular culture and social perceptions of 'nuclear things' (Weart 1998, 2012; Mahaffy 2014; Zemand & Amundson 2004) • dynamics associated with 'one-of-a-kind' facility cost (WIPP vs. SONGS case studies) • snowball nature of opinion change (Kasperson et al, 1980, 19)
B(S/N)1: Peer Pressure vs. Cost Overrun Loop	Increasing '**specific nuclear project cost overrun**' increases the '**oversight entity reported specific nuclear project cost**'; increasing '**oversight entity reported specific nuclear project cost**' decreases '**national "willingness to pay" for specific nuclear facility**'; decreasing '**national "willingness to pay" for specific nuclear facility**' increases '**essential stakeholder "peer pressure" for continued specific nuclear project operations/construction**'; increasing '**essential stakeholder "peer pressure" for continued specific nuclear project operations/construction**' increases '**pressure to control specific nuclear project costs**'; increasing '**pressure to control specific nuclear project costs**' decreases '**specific nuclear project cost overrun**'	• Extent to which state/federal stakeholders who need the new nuclear project act to influence the project implementer to do everything necessary to complete or continue the project	• Congressional dynamics (WIPP vs. SONGS case studies) • core stakeholder values (de Groot, et. al. 2013) • 'situational awareness' (P.E.D. #1, #3, #4) • relationship between supporting nuclear projects as a concept and a specific nuclear facility nearby (Kasperson et al, 1980, 15)

State/Federal CLD	CLD Explanation	Conceptual Behavior Explained	Phenomena
B(S/N)2: Accumulated Benefit vs. Operational Limits Loop	Increasing '**probability specific nuclear project commences/continues operations**' increases '**tangible SNM benefit**'; increasing '**tangible SNM benefit**' increases '**operations approaching limits of capability**'; increasing '**operations approaching limits of capability**' increases '**probability of need to (re)design specific nuclear project construction/expansion**'; increasing '**probability of need to (re)design specific nuclear project construction/expansion**' decreases '**probability of expanding specific nuclear project operational scope**'; decreasing '**probability of expanding specific nuclear project operational scope**' decreases '**actual value of the specific nuclear project**'; decreasing '**actual value of the specific nuclear project**' increases '**political controversy from supporting the specific nuclear project**'; increasing '**political controversy from supporting the specific nuclear project**' decreases '**probability of adequate Congressional funding**'; decreasing '**probability of adequate Congressional funding**' increases '**specific nuclear project cost overrun**'; increasing '**specific nuclear project cost overrun**' decreases '**probability specific nuclear project commences/continues operations**'	• Dynamic by which benefits accrued lead to reduced capacity to continue operations	• Congressional dynamics (WIPP vs. SONGS case studies) • operational vs. expected (or, speculative) benefits (Venables, et al 2009; Bezdek & Wendling 2006; Greenberg 2009; Flynn, et al 1993) • relationship between supporting nuclear projects as a concept and a specific nuclear facility nearby (Kasperson et al, 1980, 15) • socio-technical system framework (Sterman 2000; de Weck, et al 2011) • credibility of the project implementer (Greenberg 2009; Fornell 2007)

APPENDIX C – PRE-INTERVIEW INFORMATION SUMMARY

Interviewers: Principle Investigator: Dr. Michael Golay,
Research Assistants: Adam Williams and David Walsh

Purpose: Acquisition Professional research gathering the fulfill thesis requirements of Massachusetts Institute of Technology System Design and Management Program

Interview Candidates: Experienced project managers and potential stakeholders for socially controversial projects.

Overview of Research: This project aims to go beyond effective communication in understanding how to design nuclear enterprise propositions that will gain stakeholder acceptability. Acceptability is more than effective communication; it also requires varying degrees of engagement with a disparate number of stakeholder groups. In the nuclear enterprise, previous attempts have been well designed physically (i.e., technologically sound), but have floundered by being tone-deaf concerning acceptance. Though effective communication is a necessary, but insufficient, condition for such success, there is a lack of scholarship regarding how to gain stakeholder acceptance for new nuclear projects. The proposed work will build a model for use in assessing the performance of a project in the area of acceptability.

Time Required: Approximately 1 hour per interview.

Interview Method: Qualitative Interviewing.

Recognizing the sensitivity of individuals when it comes to issues related to nuclear technology and radiation, an unconventional approach was necessary for gathering relevant data. Surveys or questionnaires as a means of understanding formation of attitudes were ruled out, since data from such surveys rarely shed light on the root causes of a particular phenomenon. Such quantitative studies pay a price for their standardized precision. Because they ask the same questions in the same order of every respondent, they do not obtain the full picture. Instead, the information that they obtain from any one person is fragmented, made up of bits and pieces of attitudes, observations and appraisals (Weiss 1994).

In order to determine the origins of Radiation Attitudes among the public, we needed more from respondents than a choice among categories. The interview questions were dynamically refined based on their responses during the interview. A set of reference questions was used as a guideline, but the interviews were conducted in a conversational manner. This method for conducting interviews has been termed as "qualitative interviewing". The analysis of these interviews relies less on counting and correlating, and more on interpretation, summary and integration. This method enables one to gain in the coherence, depth and density of the material which each respondent provides (Weiss 1994).

All interviews were governed by the MIT protocols for use of human subjects, among which is assurance of confidentiality for all interviewees.

This list of questions was originally developed by Aditi Chandra in support of interviews conducted in support of earlier project research (Chandra 2012).

Interview Questions for Stakeholder Acceptance at a Local Level

- What is your view of the XYZ facility?
- If you had to choose, would you consider the facility a 'danger' or an 'opportunity'?
- Why do you feel this way?
- What do you think are the benefits of XYZ facility? How widespread are these benefits?
- What according to you are the negative aspects of the facility?
- Do you see potential benefits from such a project?
- Do you think you will (continue) to receive these benefits? Why?
- What are your sources of information about nuclear technology?
- Do you think the media are favorable? Why?
- Do you think the media are acceptably credible? Why?
- Do you think that media reports that negatively frame the nuclear facility are credible?
- Do you trust the project implementer? Why?
- Do you think the project implementer is acceptably transparent? Why?
- Do you think the project implementer is competently building/operating/managing the nuclear facility?
- If not, do you think external (e.g., resources provided) or internal (e.g., project implementer capability) issues are at fault? Why?
- Do you feel that the project implementer has good awareness of local community values? Why?
- Have there been any events of concern to yourself at the facility?

- How often do these concerning events occur?
- How did you learn about mistakes at the nuclear facility?
- Do you feel that the nuclear facility learns lessons from such mistakes? Why?
- How did these events change your views of the facility?
- Are you proud of having XYZ facility in your surroundings? Why?
- Do you think there are any environmental benefits associated with XYZ facility? Why?
- Do you perceive an immediate danger from the facility? Why?
- If so, how widely do such dangers reach?
- Do you feel well informed about nuclear matters? Why?
- Do you consider yourself familiar with nuclear science and technology? Why?
- Is nuclear waste an issue of concern to you? Why?
- Do you think your safety and security concerns are being met by the project implementer?
- What is your view of opposition groups? Why?
- Do you perceive them as credible?
- Do you feel that the opposition groups have good awareness of local community values? Why?
- Do you perceive any political controversy related to the nuclear facility? Why?

Interview Questions for Stakeholder Acceptance at the State and Federal Level

- What is your view of the XYZ facility?
- Why do you feel this way?
- What do you think are the national socio-economic benefits of XYZ facility?

- What do you think are the state socio-economic benefits of XYZ facility?
- What according to you are the national costs of the facility?
- What do you think is the likelihood of the project receiving a permit/license? Why?
- What are your views of national anti-nuclear NGO's and their activities? Why?
- Do you see a link between national anti-nuclear NGO's and local opposition groups?
- What are your views of national pro-nuclear NGO's and their activities? Why?
- Do you perceive a political benefit for (nuclear facility host state) politicians from supporting the project? Why?
- Do you perceive a political benefit for (non-nuclear facility host state) politicians from supporting the project? Why?
- Would opinion poll data showing public support of nuclear facilities influence your views? Why?
- Does your constituency support the project?
- Is there consensus among stakeholder groups in support/opposition for the project?
- Do you think the NRC has confidence in the project implementer? Why?
- Do you think the project implementer is capable of meeting NRC expectations? Why?
- What do you think would be the quality of the project implementer's license application? Why?
- What do you think will be the approximate time required by NRC to consider the license application? Why?
- Do you perceive any 'peer pressure' from other essential/relevant stakeholders for the nuclear facility to continue its construction/operations? Why?
- What incentives exist for the nuclear facility's services to be used?

- What are you views on the national need for the nuclear facility? Why?
- What are (if any) pressures do you see on the project implementer to control costs?
- How well is this one-of-a-kind facility being managed/constructed/operated?
- Do you believe that project will receive adequate funding (e.g., from Congress or investors)?
- What effect does supporting the nuclear facility have on the (re)electability of local (nuclear facility host state) politicians?
- What effect does supporting the nuclear facility have on the (re)electability of state (nuclear facility host state) politicians?
- What effect does supporting the nuclear facility have on the (re)electability of national (nuclear facility host state) politicians?
- What effect does supporting the nuclear facility have on the (re)electability of state (non-nuclear facility host state) politicians?
- What effect does supporting the nuclear facility have on the (re)electability of federal (non-nuclear facility host state) politicians?
- How successful are alternatives to the nuclear facility? Why?
- Do you perceive gaps between reported nuclear facility costs from the project implementer and the expected costs of the nuclear facility? Why?

Interview Questions for Determining Radiation Attitudes

- How would you characterize nuclear technology?
- If you were advising someone else about nuclear technology, what would you suggest to them?
- How would you characterize the benefits of nuclear technology?

- What do you think are some of the solutions for global climate change? Do you believe that nuclear energy can help us to alleviate global warming? Should its use be encouraged? If yes, how; if not, what else should be done?
- How confident are you that serious global warming will be prevented? Why?
- Do you believe nuclear energy is safe enough? Why?
- Do you think there are negative aspects of nuclear technology?
- How would you characterize these negative aspects?
- What uncertainties related to nuclear technology are of concern to you?
- What are your major concerns about nuclear facilities? How are they different for those used to treat diseases, provide better industrial materials and provide energy?
- Do you trust the nuclear enterprise? Why?
- Do you think the nuclear enterprise is acceptably transparent in its practices? Why?
- Do you trust government agencies to protect the public?
- Do you trust anti-nuclear activists and other environmental groups? Why?
- Do you think the nuclear enterprise is competent in its execution of projects? Why?
- Have you ever encountered lack of competence or dishonesty in the nuclear enterprise? A lack of politeness?
- Do you think there is a lack of scientific agreement when it comes to information about nuclear technology?
- Does this affect your views of nuclear technology?
- Are you uncertain about the benefits or costs of nuclear technology? Why?
- Does the lack of detectability of radiation affect your views? Why?
- Were you or your acquaintances ever affected by a nuclear accident?

- Has this affected your views? Why?
- How did you learn about radiation?
- What are your views about radiation?
- Do you fear radiation more than other things in life? Why?
- Are you familiar with nuclear science and technology?
- Are you confident with your level of knowledge? Why?
- Have you been exposed to expert communication regarding nuclear technology?
- Has this affected your views about nuclear technology?
- Do you think your education has affected your views about nuclear technology? Why?
- Do you think your socio-economic background has affected your views about nuclear technology? Why?
- Do you think nuclear technology has a socially catastrophic potential? Why?
- Do you think there are adverse long term effects of nuclear technology?
- Does this affect your views of nuclear technology? Why?
- Did the Fukushima/ Three Mile Island/ Chernobyl accidents change your views about nuclear technology? Why?
- Do you consider these disasters to be "man-made"? Why?
- Do you associate nuclear technology with nuclear weapons? Why?
- Did you read any books or watch any movies which related to nuclear technology?
- Did this impact your opinion? Why?
- Do you believe that a nuclear disaster could potentially lead to a "nuclear winter"?
- Are there any historical factors which have shaped your opinion of nuclear technology? What are these factors?

- Why did they affect your opinion?
- Who do you believe is the most credible source of information about nuclear matters? About other matters concerning energy and society?
- Do you think the media are adequately credible? Why?

Do you think the media are favorable? Why?

APPENDIX D - TAKEAWAYS FROM KEY INTERVIEWS

Interview A

Interview A Summary Notes - 10/21/2014
Background: Professor Golay, Adam Williams and David Walsh conducted a telephone interview with a senior project manager from Westinghouse Electric Company.

Key lessons learned and takeaways from the project so far:

- The interview started with the interviewee admitting that much of the advice he has to offer will be new information as much of it should be just common sense.
- In his experience the issue is not necessarily an issue of knowing what to do but more how to implement those ideas.
- In any project, there is a need for clear division of responsibilities. Everyone needs to understand the relationships and responsibilities (roles and accountabilities) associated with the project.
- Project needs to be clearly defined upfront and plans should have flexibility build in to allow for adjustments as the project moves from phase to phase.
- Communication is important – real communication that leads to understanding and intent. Long meetings do not necessarily equal communication
- Need to put effective tools in place that will allow project members to look ahead and identify problems. Teams should be set up to identify possible roadblocks ahead.
- Need to be able to assess the project as a whole. The designer, constructor, owner, regulator etc. have to have an understanding of what the other groups do and how they do it to allow the long term success of the project.
- Manage disrupters early
- Incentivize the stakeholders - It is important to help all stakeholders identify the benefits each stakeholder's individual benefits. Understand other stakeholders may not weight benefits and risk for that matter the same way your project does.
- Be upfront with interested stakeholders. Provide site tours, project progress information, and economic benefits. There needs to be at least the perception of transparency.
- Poorly written contracts and agreements, while sometimes inevitable, will lead to problems down the road. Have a process to be able to renegotiate and clearly define milestones.
- Internally visualize to the organization (your company and partner companies) the impact of departures from the expected. This helps to reveal the amplified affect serious issues have on the project as a system
- Put in a place a system to anticipate division of responsibility issues early. Do not let them fester and break down the team.
- Define terms and conditions early to help establish and maintain harmonious relationships
- When several organizations are working together on a project, consider establishment of one project management team that consists of the individuals from all the various

organizations. This team will be better able to understand the underlying issues of problems as they arise and may be able to identify potential issues earlier than if the organizations were working sequentially.

Interview B

Interview B Summary Notes -11/3/2014
Background: The interview subject is a Co-director of government and community relations for a private college in the Boston area. The discussion focused on issues surrounding a project that has been in the works on for the last 4 years to expand campus infrastructure.

Identification of stakeholders
The interviewee pointed out that identifying stakeholders is often easier said than done. Often there are surprises in learning hose stakeholders actually feel about a project.
Internal stakeholders include: Internal investment management groups, Faculty, Students, Staff, School's leadership team, internal communication groups.
The project was surprised by the position of a small but very vocal group of internal stakeholders that opposed the expansion of the campus
External Stakeholders include: City council – elected officials, City planning board – appointed, 4 nearby neighborhoods (includes 6 separate associations), local community association, Chamber of commerce, Competing developers, City wide groups (residents)
Engagement Strategies:

- First engagement with stakeholders is simply to try and start a conversation. The first questions asked of possible stakeholders is "do you think there is any merit to their plans? Is the project worth talking about further?" The goals are to make stakeholders feel like they are part of the decision making process and to ease the idea of the project into the minds of stakeholders. Introducing the project early and in little chunks helps to make the project a non-issue when larger project information is release as people have already heard about the project and feel like they were part of early decision process.
- Identify who are your real partners in the project. Many interested parties will pledge support in stakeholder meetings but have other ideas once they leave the meeting.
- Identify who really matters
- Make the various groups belong to the project and give them the appearance that they have say in the project. People want to be heard

More often than not, people that were against the project were not against it because the project was not in the best interest of the public, but rather they wanted to get concessions out of letting the project move forward.

Interviewee was able to turn around the project by tracking the **values, resentments and history** (whether it was true or not) for each of the stakeholders and focusing efforts toward improving these areas. Often this was done by linking groups in favor of the project with those that were either indifferent or against the project. For example cross connecting the faculty that was in favor of the project with residents that were indifferent about the project. As more people that

were indifferent get onboard with the project there is more incentive for those against the project to play along.

There are no short cuts to building stakeholder acceptance. It is something that has to be developed over time and with a soft touch.

Interview C

Interview C Summary Notes - 11/5/2014
Background: The interview was conducted by Dr. Golay, Adam Williams and David Walsh. The interviewee is in his late 40's old and is a high school social studies teacher.

When asked to identify facilities or activities near you that may be hazardous, the interviewee responded with:

- Nuclear – Zion plant in the teardown
- Fracking
- Rail transport of oil and gas
- Biohazard facilities

In the case of Fracking:

- Reads about fracking coming to the state, but not in his immediate area.
- Locally, fracking has only been in the news for the last couple months
- Biggest worry is the impact on the local water supply
- Notes that there is a lack of firm decision on fracking within his community and the state as a whole.
- Believes fear in the general population is driven by a general lack of knowledge and no history to speak of.
- Feels he is better educated on many of these projects and as such is less afraid than many of his peers.
- Sees fracking as being sensationalized in the news. Focus is on selling newspapers not necessarily informing the public.
- Worried that local leadership (local and state) tends to act too late. Policy only happens after an accident occurs.
- Has a weariness that comes from smaller companies polluting water tables in the past dumping toxic waste into environment.

Biohazard facilities:

- (this comes in the wake of the Ebola outbreak)
- Understands that there are definite risks associated with these types of facilities, but there is a greater social benefit to learning more about preventing outbreaks.
- Interviewee balances out his fear with social benefits, job creation, and tax breaks

Railways:

- Railways do not communicate with the public. He sees oil/gas tankers on the railways, but has no way of knowing what the railways are actually moving or if it is hazardous to him or not.

- Acknowledges that nothing bad has happened in the area, but has heard of issues in Canada

Nuclear Facilities:

- Sees local nuclear facilities as doing a good job of communicating with the public
- The interviewee sees France as a gold standard with significant government involvement. Feels this leads to a strong nuclear culture as there is less concern with maximizing profits.
- Subject remembers Three Mile Island and saw the movie *The China Syndrome.*
- He has read through declassified US Army documents to learn more about the nuclear tests they conducted.
- He views Three Mile Island in a very different light than Chernobyl. Three Mile Island resulted in a much smaller release of radiation and the Chernobyl incident was a result of reckless action by operators. He also admits that he does view Chernobyl through the lens of the cold war.
- He views Fukushima in a different light than both Three Mile Island and Chernobyl. He understands that the earthquake followed by the tsunami was an abnormal event. He was impressed by the plant's ability to withstand an event that was significantly more devastating than what the plant was designed to handle, but questions the decision to build on the cost.

Radiation:

- Identifies radiation exposure worthwhile for X-rays, cancer, airport screening
- Radiation is unacceptable if it is due to the recklessness of companies, politics, polluting the water table
- Feels that companies have a responsibility to customers to provide safe products for example, Apple's products should not expose users to radiation and should have appropriate checkpoints in place.
- The government has the responsibility to ensure the safety of consumers and should have appropriate checkpoints in place.
- Feels that the hazards of radiation are not well understood.

Internet Bias

- When discussing current events with his students he sees that internet biases have a significant impact on the view of his students. They seem to have a hard time discerning the bias in some articles/websites.
- It is easy to find internet opinions in line with his own views or those of his students.
- Feels that the internet has not freed up knowledge as much of the information available is biased one way or the other and individuals choose to follow outlets that are in line with their views.

Interview D

Interview D Summary Notes - 11/12/2014

Background: The interview was conducted by Dr. Golay, Adam Williams and David Walsh. The interviewee is 48 years old and is a high school physics teacher.

When asked to identify facilities or activities near you that may be hazardous, the interviewee responded with:

- Fracking (because it is in the news)
- Commuter rail line used to transport coal and oil past his house
- Nuclear – Zion plant in the teardown

In the case of Fracking:

- Biggest worry is the secondary effects on the water supply.
- Notes that there is a lack of firm decisions on the safety of fracking.
- The subject fracking safety is important but not urgent to him as most activity is happening south of subject's location
- Sees fracking as being sensationalized in the news.
- The biases in the news is very concerning to the subject.
- Locally, fracking has only been in the news for the last couple months
- As far as the interviewee's involvement in the fracking debate, he would vote someone out of office, but would not join any active groups

Subject's recommendations to improve stakeholder relations

- Spend money on public education programs
- Hold public hearings
- Is happy with the current state of the fracking debate in the local area. People are discussing concerns publically. Interviewee believes the topic is at a tipping point and decisions will be made soon
- Need to define the benefits associated with local fracking and educate public about the benefits. Defining the benefits upfront should help keep corporations honest.
- There should be proven emergency plans in place to prevent ground water pollution.
- The company should make use of TV and mailing campaigns.
- The company needs to show they are willing to listen and are not just moving ahead with the project without informing the population.

Perception of information sources

- He generally trusts newspapers
- Does not trust network TV
- Radio is trustworthy
- Mail communications are better than email. Spending the extra money to send real mail shows they are more serious about what they are sending.
- Cheap sources of communication raise concerns and suspicion

Pressure group messages

- Should be a discussion with care given to how the message is presented.
- Needs to be in the right quantity. Too much will have a negative impact on his opinion, and too little may not get the point across.
- Door to door activists raise suspicion for the interviewee.

Political

- He wants to know a workable policy is being worked on by leadership.
- Fearful that policy might not be in the best interest of the people and will be in favor of drillers.
- Wants insurance from the government that they are monitoring the situations and will take action if needed.

- Wants to know the government can enforce the policy. Leaving supervision to the company is not enough.

If subject lived near a fracking site

- Continuous checking of the project from an outside source or government should be mandatory.
- Expects continuous communications from government oversight.
- Must have an economic benefit:
    - If on interviewee's land then he wants a direct cut of profits
    - Benefits given to the local community.
    - Tax benefits for the community.
- He likes the mailer the water company sends out a couple times a year describing the quality of the water.

Rail transport benefits

- He would not have chosen to live there if there was no benefits to being so close to the rail line.
- Bought stock in the company to increase the benefit.
- Additional benefits come from being able to utilize the commuter aspects of the rail line.
- There is inconvenience, noise and traffic.
- Lives in an economically well off area and can live in the suburban area and travel to the city because of the rail line
- Recognizes the hazard of the rail line but the benefits outweigh the hazard.

Fracking benefit

- Benefit is not clear yet.
- Tax? Gas prices? Will the gas be used in the local area, state, country or will it be shipped overseas instead?
- The train line has been around and subject moved there knowing it was there and what the risks were, but fracking came to them and the benefits are not clear

Breaking trust

- To break the trust with the rail line there would have to be an accident and a condition would have to exist such that the accident could potentially happen again.

Nuclear

- Does not live near any nuclear sites. Not close to Zion but there are many plants in the state
- Needs further review of storage issues and Madrid fault line

Knowledge of radiation

- 48 years old so grew up with Three Mile Island and Chernobyl.
- Watched movies (Godzilla).
- Knew about different types of radiation and different sources of radiation.
- Believes there is general fear and misunderstanding based on global events.
- Fukushima made him rethink his faith in how nuclear power is implemented.
- Is pro-nuclear power but needs to be convinced that sites are operating in the safest way possible.
- Sees Japanese response to accident somewhat prudent.
- Wants to see new plants far away from population centers.
- Expects future plants to require gravitational cooling capabilities.

- Wants nuclear plants that don't require power to ensure the safety of the plant.
- The local populations see the lake as holy. Nothing can impact the lake.
- Would rather have a gas plant than a nuclear plant near him regardless of the pollution implications.
- New plants must be pretty and aesthetically pleasing.

What should a utility that wants to build a nuclear plant be doing?

- Interviewee would rather see the government propose the need for the plant and not the utility.
- Government involvement will help to show the economic benefit and perception that the need of the plant is true and not just an attempt to increase profits.
- Seems to have a trust issue with large corporations putting profits over the needs of the people but has more faith in the government to act in his best interest.

Interview H

Interview H Summary Notes - 12/10/2014
Background: The interview was conducted by Dr. Golay and David Walsh. The interviewees were two high school students. Both are taking advanced placement courses and are expected to one day be in some kind of decision making or leadership role.

Fracking

- Both students would consider fracking a dangerous activity because there is evidence that it has poisoned ground water in the past.
- Students pointed out that many people in their area rely on private wells and as such are dependent on clean ground water.
- Neither students know of any fracking in their immediate area but both are aware of it occurring in nearby states.
- Students believe many of the stories they are hearing are sensationalized to increase viewership, but neither knows to determine they have been sensationalized.
- Both students have seen videos of tap water being set on fire with the understanding that this is the result of fracking and subsequent pollution of ground water.
- Both are concerned about the impact that fracking is having on the larger ecosystem as wild life and food supplies will be impacted.
- Both students acknowledge that the impact on the environment, as they see it, is hypothesized because they have not seen any real evidence as incidents are too recent to fully understand the impact.
- It is believed that the inherent dangers of fracking are tied to both the fracking process and management of the operation.
- They suspect that pollution resulting from fracking is not common, but when it does happen it can/will have a large impact and will be problematic.
- Controls that would make them more comfortable with fracking include strict regulations with the ability to be enforced and to ensure that all fracking activities happen at a safe distance away from local communities.

- Both will be uncomfortable with fracking until there is more history and statistics to review.
- Before making a decision they want to know how often accidents occur and the impact each accident had.
- It is important to them that they know how far the activities are occurring from their day-to-day lives.
- They want to know who is providing oversight and how the oversight is done.
- Both students would be more comfortable with government oversight as they feel the companies cannot be trusted to police themselves. Profits would bias decisions.
- Government oversight would ensure that more information about the activities will be provided to stakeholders.
- Both agree that fracking should be allowed as the efficiency of fracking is better than alternative drilling methods.

Other activates identified as Hazardous

- Both see the rail transport of oil and gas in their communities as a potential hazard that could pollute the environment.
- Both point out that oil spills such as the BP Deepwater oil spill had a huge impact on wildlife and people such as fishermen.
- One of the students read an article that the government can only provide oversight of 1% of the transportation cases. They see this as the companies essentially policing themselves.
- Both students would like to see more oversight and swift action when problems or questions arise.

What aspects of an accident are the biggest concern that make these activities hazardous?

- Loss of human life is the biggest concern.
- Pollution to the environment. One student pointed out that there have been train accidents that did not have any human casualties, but the fact that the accident polluted the environment still makes it hazardous.

What can be done to make hazardous activities more beneficial?

- Lower cost for people. For example, if using the rail lines to transport oil or gas then it is expected that train ticket prices and the price of oil and gas should be lower for that population.
- Creating economic growth in the area.
- Shift the focus to "local oil" reducing the need to transport long distances. Local refineries would be an additional economic benefit.
- The community should have the ability to make changes to regulations or policies to make the activity safer or to bring more economic benefit.

Nuclear

- Both see nuclear power as very important to helping meet our energy needs.
- Nuclear can help bring energy independence and is better for the environment than current alternatives.
- The students do not see nuclear as hazardous if the plants are maintained properly. The risk is high, but the benefit is high. The likelihood of an accident is seen as being low provided the proper precautions are taken.

- Both have heard of Chernobyl and recognize the contamination issue and that there were lives lost as a result.
- Identified other sources of radiation to be microwaves, cell phones and the sun.
- Students identified the problem with nuclear plants is that the radiation is so concentrated if the core melts
- See x-rays as a positive use of radiation.
- Neither student knew of any nuclear facilities in their state.
- Students were not able identify the magnitude of the deaths caused by the earthquake, the tsunami and the nuclear accident at Fukushima nuclear plant.

Interview I

Interview I Summary Notes -12/12/2014
Background: Is a Co-director of government and community relations for a private college in the Boston area.
The focus of this interview was to discuss the interviewee's experiences dealing with stakeholders in regards to the school's nuclear test reactor.

Research reactor

- For the most part, the reactor is operated without much objection as most people are not even aware that it is here.
- There were four occasions where the reactor became a hot topic:
    - Talks of decommissioning in 1998
    - The events of 9/11/2001
    - After an ABC 20/20 special that aired in 2005
    - Following the accident at Fukushima in 2010
- Interviewee saw each of these events as opportunistic times for various stakeholders (political, anti-nuclear groups etc.) to raise a concern and be heard.
- Usually there are only a handful of people that are constantly rocking the boat. Termed the "dirty dozen" (not necessarily a dozen people and they change with time) consisting of mainly retired individuals or people that are fairly well to do financially that want to be in the spotlight.
- Interviewee saw a significant advantage to taking senior people associated with the project to stakeholder meeting to show respect and general caring of stakeholder group concerns. This accessibility to project leadership goes a long way in building relationships.
- It is important to prep the team for project hearing. Everything down to what to wear, coaching on what to say and how you plan on communicating with each other while the cameras are one you. Often knowledgeable individuals (in this case engineers) do not know how to handle themselves in these situations.
- It was beneficial to lead off every meeting with what the reactor is being used for currently (i.e. cancer research). This helps to anchor the benefits of the test reactor right from the start.

- It is important to know the people you bring to meetings and how they react in various situations. This could be an important area for coaching for some individuals.
- Need to understand how news related to your project will be publicized by various organizations. In the case of this project, the larger media outlets tend to have a certain demeaned that all of the journalists associated with that outlet will be aligned to with while local media outlets are much less predictable and will depend on the reporter assigned to the story.
- The university has an office that follows the various media outlets.
- It is important to help educate people (journalists and people in general) about the reactor. The school offers tours of the facilities.
- Responsiveness and reacting immediately to situations is important. Take the offensive to minimize the likelihood the story will be blown out of proportion.
- For many politicians, it is not a matter of how he or she personally feels about the project it is more a matter of how the project is viewed politically.
- In the case of the reactor, the media and the City Council are the two main ways that information and questions are raised. Both are constantly monitored.
- It is important to understand the generational differences of the various stakeholders. Stakeholders respond very differently depending on age and experience.
- Success is generally achieved through a steady approach of interactions and retooling the approach used as required.
- Identify stakeholders early and determine ways to calculate the benefit/interest to each group.
- Maintain a strong coalition of supporters.
- It takes time to build trust with stakeholders but it is essential.
- Feedback processes (feedback loops) are happening all the time.
- When things are calm with the project, it is important to build trust among stakeholders and to foster a coalition of supporters. If you wait for the headline you are too late.
- Be everywhere and in a community minded way. People should associate your organizations with many aspects of their life (friends or family that work there, volunteer in the community, sponsor little league teams etc.) be "scratches on the mind" of community members.

APPENDIX E –INDIVIDUAL ACCEPTANCE MODEL LOOP INTERROGATION

Table 12 - Individual Acceptance Model Loops of Interest

Individual Acceptance Model Loops of Interest		
Specific Model Loop	**Loop Variables**	**Desired change to the variable (increase or decrease)**
R(R.A.)1:Radiation Attitude/Social Trust Loop	'radiation attitudes'	Increase
	'social trust in project implementer'	Increase
	'personal trust in project implementer to respond competently to problems'	Increase
	'perceived personal risk'	Decrease
R(R.A.)2: Personal Framing Loop	'radiation attitudes'	Increase
	'negative personal framing'	Decrease
	'personal nuclear context'	Increase
R(R.A.)3: Radiation Attitudes & Social Catastrophe Loop	'radiation attitudes'	Increase
	'negative personal framing'	Decrease
	'fear of "nuclear winter"	Decrease
	'socially catastrophic potential'	Decrease
R(R.A.)4: Personal Benefit vs. Risk Loop	'radiation attitudes'	Increase
	'perceived personal benefit'	Increase
	'perceived personal risk'	Decrease
R(R.A.)5: Personal Control vs. Uncertainty Loop	'radiation attitudes'	Increase
	'perceived personal control'	Increase
	'personal knowledge framing'	Increase
	'personal sense of uncertainty'	Decrease
	'perceived personal risk'	Decrease

Individual Acceptance Model Loops of Interest (continued)		
Specific Model Loop	**Loop Variables**	**Desired change to the variable (increase or decrease)**
R(R.A.)6: Media vs. Personal Framing Loop	'negative personal framing'	Decrease
	'probability of selecting media source with negative framing'	Decrease
	'probability negative message is trusted'	Decrease

APPENDIX F –LOCAL MODEL LOOP INTERROGATION

Table 13 - Local Model Loops of Interest

Local Model Loops of Interest		
Specific Model Loop	**Loop Variables**	**Desired change to the variable (increase or decrease)**
R(L)2: Perceived Benefit vs. Implementation Loop	'stakeholder acceptance'	Increase
	'perceived probability of competent project implementation'	Increase
	'social trust in project implementer'	Increase
	'probability that benefit is received'	Increase
	'perceived benefit from project'	Increase
R(L)4: Social Framing vs. Tradeoff Loop	'social opportunity/danger tradeoff'	Increase
	'negative social framing'	Decrease
	'social danger'	Increase
R(L)5: Risk Frequency Inclusion Loop	'perceived benefit from project'	Increase
	'cognitive inclusion of frequency'	Increase
	'perceived frequency'	Decrease
R(L)6: Personal Knowledge vs. Social Framing Loop	'negative social framing'	Decrease
	'personal knowledge framing'	Increase
	'credibility of negative framing'	Decrease

Local Model Loops of Interest (continued)		
Specific Model Loop	**Loop Variables**	**Desired change to the variable (increase or decrease)**
R(L)7: Social Trust vs. Publicized Mistake Loop	'social trust in project implementer'	Increase
	'importance of publicized mistake to stakeholder'	Decrease
	'degree of project implementer awareness of stakeholder values'	Increase
R(L)8: Media Opinion vs. Social Opinion Loop	'media favorability'	Increase
	'credibility of negative framing'	Decrease
	'negative social framing'	Decrease
	'social danger'	Decrease
R(L)10: Social Trust vs. Opposition Loop	'social trust in project implementer'	Increase
	'probability benefit is received'	Increase
	'social opportunity'	Increase
	'social opportunity/danger tradeoff'	Increase
	'negative social framing'	Decrease
	'degree of opposition awareness of stakeholder values'	Increase

Local Model Loops of Interest (continued)		
Specific Model Loop	**Loop Variables**	**Desired change to the variable (increase or decrease)**
R(L)11: Social Trust vs. Benefit Loop	'social trust in project implementer'	Increase
	'probability benefit is received'	Increase
	'perceived benefit from project'	Increase
	'stakeholder acceptance'	Increase
	'degree of project implementer awareness of stakeholder values'	Increase

APPENDIX G - INDIVIDUAL ACCEPTANCE MODEL VARIABLE INTERROGATION

Table 14 - Individual Acceptance Model Variable Interrogation

Consolidated List of Variables to Improve Individual Acceptance		
Loop Variables	**Desired change to the variable (increase or decrease)**	**Suggested actions**
'fear of "nuclear winter"'	Decrease	• Provide educational tours, professional training and genuinely reach out to potential stakeholders • Make stakeholders part of the decision making process to create shared visions and goals • Encourage employees to volunteer and take part in the community through local charities, schools & non-profit organizations • Develop and implement multiple feedback mechanisms (focus groups, town hall meetings etc.) and act on them • Agree to, and help maintain an independent, third party review group • Provide stakeholder access to senior level project decision makers (CEO, VPs etc.) • Provide access to experts capable of presenting technical information at the appropriate level for the audience • Be upfront with stakeholders and provide information about the project risk and include safety measures • When mistakes do happen, report them before outside sources do and take ownership for them • Develop realistic plans to recover the project when needed

'negative personal framing'	Decrease	• Provide educational tours, professional training and genuinely reach out to potential stakeholders • Make stakeholders part of the decision making process to create shared visions and goals • Donate time and resource to the community and take credit for it • Encourage employees to volunteer and take part in the community through local charities, schools & non-profit organizations • Develop and implement multiple feedback mechanisms (focus groups, town hall meetings etc.) and act on them • Integrate with the community at both a company level (donations, sponsorships education etc.) and also individual employee levels (volunteering, sports, networking etc.) • Make an effort to understand the values of each stakeholder groups • Align project values with social values • Agree to, and help maintain an independent, third party review group • Provide stakeholder access to senior level project decision makers (CEO, VPs etc.) • Develop mechanisms to be as transparent as possible to stakeholders • Be upfront with stakeholders and provide information about the project risk and include safety measures • Provide updates on both direct benefits (jobs created, reduced electricity prices etc.) and indirect benefits (state and federal funding for infrastructure etc.) related to the project. • Develop a working relationships with media outlets to include predefined channels to provide accurate and timely updates to the media and stakeholders • Provide expert input to help ensure the correctness of information provided by media out lets • Celebrate and publicize important project milestones, give credit to the appropriate stakeholders for each success • When mistakes do happen, report them before outside sources do and take ownership for them • Develop realistic plans to recover the project when needed

Consolidated List of Variables to Improve Individual Acceptance		
Loop Variables	**Desired change to the variable (increase or decrease)**	**Suggested actions**
		• Identify and track the progress of benefits for each stakeholder • Identify and track values, resentments and relationship history with each stakeholder • Develop designs and procedures that maximize safety • Be able to clearly articulate the benefits associated with the project • Follow up promptly and accurately and with integrity to stakeholder concerns • When possible meet in person •

Consolidated List of Variables to Improve Individual Acceptance		
Loop Variables	**Desired change to the variable (increase or decrease)**	**Suggested actions**
'perceived personal benefit'	Increase	• Provide educational tours, professional training and genuinely reach out to potential stakeholders • Make stakeholders part of the decision making process to create shared visions and goals • Donate time and resource to the community and take credit for it • Encourage employees to volunteer and take part in the community through local charities, schools & non-profit organizations • Develop and implement multiple feedback mechanisms (focus groups, town hall meetings etc.) and act on them • Integrate with the community at both a company level (donations, sponsorships education etc.) and also individual employee levels (volunteering, sports, networking etc.) • Make an effort to understand the values of each stakeholder groups • Align project values with social values • Agree to, and help maintain an independent, third party review group • Provide updates on both direct benefits (jobs created, reduced electricity prices etc.) and indirect benefits (state and federal funding for infrastructure etc.) related to the project. • Celebrate and publicize important project milestones, give credit to the appropriate stakeholders for each success • Identify and track the progress of benefits for each stakeholder • Identify and track values, resentments and relationship history with each stakeholder • Be able to clearly articulate the benefits associated with the project

Consolidated List of Variables to Improve Individual Acceptance		
Loop Variables	**Desired change to the variable (increase or decrease)**	**Suggested actions**
'perceived personal control'	Increase	• Make stakeholders part of the decision making process to create shared visions and goals • Develop and implement multiple feedback mechanisms (focus groups, town hall meetings etc.) and act on them • Agree to, and help maintain an independent, third party review group • Provide stakeholder access to senior level project decision makers (CEO, VPs etc.) • Develop mechanisms to be as transparent as possible to stakeholders • Provide access to problem response procedures • Develop a plan to disseminate information ahead of time including social media options • Be upfront with stakeholders and provide information about the project risk and include safety measures • When mistakes do happen, report them before outside sources do and take ownership for them • Develop realistic plans to recover the project when needed • Work to define stakeholder roles and responsibilities

Consolidated List of Variables to Improve Individual Acceptance		
Loop Variables	**Desired change to the variable (increase or decrease)**	**Suggested actions**
'perceived personal risk'	Decrease	• Provide educational tours, professional training and genuinely reach out to potential stakeholders • Make stakeholders part of the decision making process to create shared visions and goals • Develop and implement multiple feedback mechanisms (focus groups, town hall meetings etc.) and act on them • Align project values with social values • Agree to, and help maintain an independent, third party review group • Provide stakeholder access to senior level project decision makers (CEO, VPs etc.) • Provide access to problem response procedures • Be upfront with stakeholders and provide information about the project risk and include safety measures • When mistakes do happen, report them before outside sources do and take ownership for them • Develop realistic plans to recover the project when needed • Develop designs and procedures that maximize safety • Establish and disseminate emergency plans and procedures including accident notification plans • Follow up promptly and accurately and with integrity to stakeholder concerns • Work to define stakeholder roles and responsibilities

Consolidated List of Variables to Improve Individual Acceptance		
Loop Variables	**Desired change to the variable (increase or decrease)**	**Suggested actions**
'personal knowledge framing'	Increase	• Provide educational tours, professional training and genuinely reach out to potential stakeholders • Make stakeholders part of the decision making process to create shared visions and goals • Donate time and resource to the community and take credit for it • Encourage employees to volunteer and take part in the community through local charities, schools & non-profit organizations • Develop and implement multiple feedback mechanisms (focus groups, town hall meetings etc.) and act on them • Integrate with the community at both a company level (donations, sponsorships education etc.) and also individual employee levels (volunteering, sports, networking etc.) • Make an effort to understand the values of each stakeholder groups • Align project values with social values • Agree to, and help maintain an independent, third party review group • Provide updates on both direct benefits (jobs created, reduced electricity prices etc.) and indirect benefits (state and federal funding for infrastructure etc.) related to the project. • Celebrate and publicize important project milestones, give credit to the appropriate stakeholders for each success • Identify and track the progress of benefits for each stakeholder • Identify and track values, resentments and relationship history with each stakeholder • Be able to clearly articulate the benefits associated with the project

Consolidated List of Variables to Improve Individual Acceptance		
Loop Variables	**Desired change to the variable (increase or decrease)**	**Suggested actions**
'personal nuclear context'	Increase	• Provide educational tours, professional training and genuinely reach out to potential stakeholders • Encourage employees to volunteer and take part in the community through local charities, schools & non-profit organizations • Integrate with the community at both a company level (donations, sponsorships education etc.) and also individual employee levels (volunteering, sports, networking etc.) • Make an effort to understand the values of each stakeholder groups • Align project values with social values • Provide stakeholder access to senior level project decision makers (CEO, VPs etc.) • Provide access to experts capable of presenting technical information at the appropriate level for the audience • Be upfront with stakeholders and provide information about the project risk and include safety measures • Provide updates on both direct benefits (jobs created, reduced electricity prices etc.) and indirect benefits (state and federal funding for infrastructure etc.) related to the project. • Identify and track the progress of benefits for each stakeholder • Identify and track values, resentments and relationship history with each stakeholder • Be able to clearly articulate the benefits associated with the project

Consolidated List of Variables to Improve Individual Acceptance		
Loop Variables	**Desired change to the variable (increase or decrease)**	**Suggested actions**
'personal sense of uncertainty'	Decrease	• Provide educational tours, professional training and genuinely reach out to potential stakeholders • Encourage employees to volunteer and take part in the community through local charities, schools & non-profit organizations • Integrate with the community at both a company level (donations, sponsorships education etc.) and also individual employee levels (volunteering, sports, networking etc.) • Make an effort to understand the values of each stakeholder groups • Align project values with social values • Provide stakeholder access to senior level project decision makers (CEO, VPs etc.) • Provide access to experts capable of presenting technical information at the appropriate level for the audience • Be upfront with stakeholders and provide information about the project risk and include safety measures • Provide updates on both direct benefits (jobs created, reduced electricity prices etc.) and indirect benefits (state and federal funding for infrastructure etc.) related to the project. • Identify and track the progress of benefits for each stakeholder • Identify and track values, resentments and relationship history with each stakeholder • Be able to clearly articulate the benefits associated with the project

Consolidated List of Variables to Improve Individual Acceptance		
Loop Variables	**Desired change to the variable (increase or decrease)**	**Suggested actions**
'personal trust in project implementer to respond competently to problems'	Increase	• Provide educational tours, professional training and genuinely reach out to potential stakeholders • Make stakeholders part of the decision making process to create shared visions and goals • Develop and implement multiple feedback mechanisms (focus groups, town hall meetings etc.) and act on them • Align project values with social values • Agree to, and help maintain an independent, third party review group • Develop mechanisms to be as transparent as possible to stakeholders • Provide access to problem response procedures • Develop a plan to disseminate information ahead of time including social media options • Provide access to experts capable of presenting technical information at the appropriate level for the audience • Be upfront with stakeholders and provide information about the project risk and include safety measures • Provide expert input to help ensure the correctness of information provided by media out lets • Provide realistic project schedules and budgets • When mistakes do happen, report them before outside sources do and take ownership for them • Develop realistic plans to recover the project when needed • Develop designs and procedures that maximize safety • Establish and disseminate emergency plans and procedures including accident notification plans

Consolidated List of Variables to Improve Individual Acceptance		
Loop Variables	**Desired change to the variable (increase or decrease)**	**Suggested actions**
'probability negative message is trusted'	Decrease	• Provide educational tours, professional training and genuinely reach out to potential stakeholders • Encourage employees to volunteer and take part in the community through local charities, schools & non-profit organizations • Integrate with the community at both a company level (donations, sponsorships education etc.) and also individual employee levels (volunteering, sports, networking etc.) • Make an effort to understand the values of each stakeholder groups • Align project values with social values • Provide stakeholder access to senior level project decision makers (CEO, VPs etc.) • Provide access to experts capable of presenting technical information at the appropriate level for the audience • Be upfront with stakeholders and provide information about the project risk and include safety measures • Provide updates on both direct benefits (jobs created, reduced electricity prices etc.) and indirect benefits (state and federal funding for infrastructure etc.) related to the project. • Identify and track the progress of benefits for each stakeholder • Identify and track values, resentments and relationship history with each stakeholder • Be able to clearly articulate the benefits associated with the project

Consolidated List of Variables to Improve Individual Acceptance		
Loop Variables	**Desired change to the variable (increase or decrease)**	**Suggested actions**
'social trust in project implementer'	Increase	• Provide educational tours, professional training and genuinely reach out to potential stakeholders • Make stakeholders part of the decision making process to create shared visions and goals • Donate time and resource to the community and take credit for it • Encourage employees to volunteer and take part in the community through local charities, schools & non-profit organizations • Develop and implement multiple feedback mechanisms (focus groups, town hall meetings etc.) and act on them • Integrate with the community at both a company level (donations, sponsorships education etc.) and also individual employee levels (volunteering, sports, networking etc.) • Make an effort to understand the values of each stakeholder groups • Align project values with social values • Agree to, and help maintain an independent, third party review group • When possible meet in person • Provide stakeholder access to senior level project decision makers (CEO, VPs etc.) • Develop mechanisms to be as transparent as possible to stakeholders • Provide access to problem response procedures • Develop a plan to disseminate information ahead of time including social media options • Provide access to experts capable of presenting technical information at the appropriate level for the audience • Be upfront with stakeholders and provide information about the project risk and include safety measures

Consolidated List of Variables to Improve Individual Acceptance		
Loop Variables	**Desired change to the variable (increase or decrease)**	**Suggested actions**
'socially catastrophic potential'	Decrease	• Provide educational tours, professional training and genuinely reach out to potential stakeholders • Encourage employees to volunteer and take part in the community through local charities, schools & non-profit organizations • Integrate with the community at both a company level (donations, sponsorships education etc.) and also individual employee levels (volunteering, sports, networking etc.) • Make an effort to understand the values of each stakeholder groups • Align project values with social values • Provide stakeholder access to senior level project decision makers (CEO, VPs etc.) • Provide access to experts capable of presenting technical information at the appropriate level for the audience • Be upfront with stakeholders and provide information about the project risk and include safety measures • Provide updates on both direct benefits (jobs created, reduced electricity prices etc.) and indirect benefits (state and federal funding for infrastructure etc.) related to the project. • Identify and track the progress of benefits for each stakeholder • Identify and track values, resentments and relationship history with each stakeholder • Be able to clearly articulate the benefits associated with the project

APPENDIX H - STAKEHOLDER ACCEPTANCE MODEL VARIABLE INTERROGATION

Table 15 - Local Model Variable Interrogation

Consolidated List of Variables to Improve Stakeholder Acceptance		
Loop Variables	**Desired change to the variable (increase or decrease)**	**Suggested actions**
'cognitive inclusion of frequency'	Increase	• Provide educational tours, professional training and genuinely reach out to potential stakeholders • Encourage employees to volunteer and take part in the community through local charities, schools & non-profit organizations • Integrate with the community at both a company level (donations, sponsorships education etc.) and also individual employee levels (volunteering, sports, networking etc.) • Make an effort to understand the values of each stakeholder groups • Align project values with social values • Provide stakeholder access to senior level project decision makers (CEO, VPs etc.) • Provide access to experts capable of presenting technical information at the appropriate level for the audience • Be upfront with stakeholders and provide information about the project risk and include safety measures • Provide updates on both direct benefits (jobs created, reduced electricity prices etc.) and indirect benefits (state and federal funding for infrastructure etc.) related to the project. • Identify and track the progress of benefits for each stakeholder • Identify and track values, resentments and relationship history with each stakeholder • Be able to clearly articulate the benefits associated with the project

Consolidated List of Variables to Improve Stakeholder Acceptance		
Loop Variables	**Desired change to the variable (increase or decrease)**	**Suggested actions**
'credibility of negative framing'	Decrease	• Provide educational tours, professional training and genuinely reach out to potential stakeholders • Make stakeholders part of the decision making process to create shared visions and goals • Donate time and resource to the community and take credit for it • Encourage employees to volunteer and take part in the community through local charities, schools & non-profit organizations • Develop and implement multiple feedback mechanisms (focus groups, town hall meetings etc.) and act on them • Integrate with the community at both a company level (donations, sponsorships education etc.) and also individual employee levels (volunteering, sports, networking etc.) • Make an effort to understand the values of each stakeholder groups • Align project values with social values • Agree to, and help maintain an independent, third party review group • When possible meet in person • Provide stakeholder access to senior level project decision makers (CEO, VPs etc.) • Develop mechanisms to be as transparent as possible to stakeholders • Provide access to problem response procedures • Develop a plan to disseminate information ahead of time including social media options • Provide access to experts capable of presenting technical information at the appropriate level for the audience • Be upfront with stakeholders and provide information about the project risk and include safety measures

Consolidated List of Variables to Improve Stakeholder Acceptance		
Loop Variables	**Desired change to the variable (increase or decrease)**	**Suggested actions**
'degree of opposition awareness of stakeholder values'	Increase	• Be as transparent as possible • Provide educational tours, professional training, community out reach • Provide access to experts capable of presenting technical information at the appropriate level for the audience • Develop relationships with media outlets and provide correct information to media out lets • Develop and implement multiple feedback mechanisms (focus groups, town hall meetings etc.)
'degree of project implementer awareness of stakeholder values'	Increase	• Make stakeholders part of the decision making process to create shared visions and goals • Develop and implement multiple feedback mechanisms (focus groups, town hall meetings etc.) and act on them • Integrate with the community at both a company level (donations, sponsorships education etc.) and also individual employee levels (volunteering, sports, networking etc.) • Make an effort to understand the values of each stakeholder groups • Align project values with social values • When possible meet in person • Provide stakeholder access to senior level project decision makers (CEO, VPs etc.) • Develop mechanisms to be as transparent as possible to stakeholders • Identify and track the progress of benefits for each stakeholder • Identify and track values, resentments and relationship history with each stakeholder • Follow up promptly and accurately and with integrity to stakeholder concerns

Consolidated List of Variables to Improve Stakeholder Acceptance		
Loop Variables	**Desired change to the variable (increase or decrease)**	**Suggested actions**
'importance of publicized mistake to stakeholder'	Decrease	• Provide stakeholder access to senior level project decision makers (CEO, VPs etc.) • Develop mechanisms to be as transparent as possible to stakeholders • Develop a plan to disseminate information ahead of time including social media options • Develop a working relationships with media outlets to include predefined channels to provide accurate and timely updates to the media and stakeholders • Provide expert input to help ensure the correctness of information provided by media out lets
'media favorability'	Increase	• Provide stakeholder access to senior level project decision makers (CEO, VPs etc.) • Develop mechanisms to be as transparent as possible to stakeholders • Develop a plan to disseminate information ahead of time including social media options • Develop a working relationships with media outlets to include predefined channels to provide accurate and timely updates to the media and stakeholders • Provide expert input to help ensure the correctness of information provided by media out lets • Follow up promptly and accurately and with integrity to stakeholder concerns • Work to define stakeholder roles and responsibilities

Consolidated List of Variables to Improve Stakeholder Acceptance		
Loop Variables	**Desired change to the variable (increase or decrease)**	**Suggested actions**
'negative social framing'	Decrease	• Provide educational tours, professional training and genuinely reach out to potential stakeholders • Make stakeholders part of the decision making process to create shared visions and goals • Develop and implement multiple feedback mechanisms (focus groups, town hall meetings etc.) and act on them • Align project values with social values • Agree to, and help maintain an independent, third party review group • Develop mechanisms to be as transparent as possible to stakeholders • Provide access to problem response procedures • Develop a plan to disseminate information ahead of time including social media options • Provide access to experts capable of presenting technical information at the appropriate level for the audience • Be upfront with stakeholders and provide information about the project risk and include safety measures • Provide expert input to help ensure the correctness of information provided by media out lets • Provide realistic project schedules and budgets • When mistakes do happen, report them before outside sources do and take ownership for them • Develop realistic plans to recover the project when needed • Develop designs and procedures that maximize safety • Establish and disseminate emergency plans and procedures including accident notification plans

Consolidated List of Variables to Improve Stakeholder Acceptance		
Loop Variables	**Desired change to the variable (increase or decrease)**	**Suggested actions**
'perceived benefit from project'	Increase	• Provide educational tours, professional training and genuinely reach out to potential stakeholders • Make stakeholders part of the decision making process to create shared visions and goals • Donate time and resource to the community and take credit for it • Encourage employees to volunteer and take part in the community through local charities, schools & non-profit organizations • Develop and implement multiple feedback mechanisms (focus groups, town hall meetings etc.) and act on them • Integrate with the community at both a company level (donations, sponsorships education etc.) and also individual employee levels (volunteering, sports, networking etc.) • Make an effort to understand the values of each stakeholder groups • Align project values with social values • Agree to, and help maintain an independent, third party review group • Provide updates on both direct benefits (jobs created, reduced electricity prices etc.) and indirect benefits (state and federal funding for infrastructure etc.) related to the project. • Celebrate and publicize important project milestones, give credit to the appropriate stakeholders for each success • Identify and track the progress of benefits for each stakeholder • Identify and track values, resentments and relationship history with each stakeholder • Be able to clearly articulate the benefits associated with the project

Consolidated List of Variables to Improve Stakeholder Acceptance		
Loop Variables	**Desired change to the variable (increase or decrease)**	**Suggested actions**
'perceived probability of competent project implementation'	Increase	• Provide educational tours, professional training and genuinely reach out to potential stakeholders • Make stakeholders part of the decision making process to create shared visions and goals • Donate time and resource to the community and take credit for it • Encourage employees to volunteer and take part in the community through local charities, schools & non-profit organizations • Develop and implement multiple feedback mechanisms (focus groups, town hall meetings etc.) and act on them • Integrate with the community at both a company level (donations, sponsorships education etc.) and also individual employee levels (volunteering, sports, networking etc.) • Make an effort to understand the values of each stakeholder groups • Align project values with social values • Agree to, and help maintain an independent, third party review group • When possible meet in person • Provide stakeholder access to senior level project decision makers (CEO, VPs etc.) • Develop mechanisms to be as transparent as possible to stakeholders • Provide access to problem response procedures • Develop a plan to disseminate information ahead of time including social media options • Provide access to experts capable of presenting technical information at the appropriate level for the audience • Be upfront with stakeholders and provide information about the project risk and include safety measures

Consolidated List of Variables to Improve Stakeholder Acceptance		
Loop Variables	**Desired change to the variable (increase or decrease)**	**Suggested actions**
'personal knowledge framing'	Increase	• Provide educational tours, professional training and genuinely reach out to potential stakeholders • Make stakeholders part of the decision making process to create shared visions and goals • Donate time and resource to the community and take credit for it • Encourage employees to volunteer and take part in the community through local charities, schools & non-profit organizations • Develop and implement multiple feedback mechanisms (focus groups, town hall meetings etc.) and act on them • Integrate with the community at both a company level (donations, sponsorships education etc.) and also individual employee levels (volunteering, sports, networking etc.) • Make an effort to understand the values of each stakeholder groups • Align project values with social values • Agree to, and help maintain an independent, third party review group • Provide updates on both direct benefits (jobs created, reduced electricity prices etc.) and indirect benefits (state and federal funding for infrastructure etc.) related to the project. • Celebrate and publicize important project milestones, give credit to the appropriate stakeholders for each success • Identify and track the progress of benefits for each stakeholder • Identify and track values, resentments and relationship history with each stakeholder • Be able to clearly articulate the benefits associated with the project

Consolidated List of Variables to Improve Stakeholder Acceptance		
Loop Variables	**Desired change to the variable (increase or decrease)**	**Suggested actions**
'probability that benefit is received'	Increase	• Make stakeholders part of the decision making process to create shared visions and goals • Make an effort to understand the values of each stakeholder groups • Align project values with social values • Provide realistic project schedules and budgets • Develop realistic plans to recover the project when needed • Identify and track the progress of benefits for each stakeholder • Identify and track values, resentments and relationship history with each stakeholder • Be able to clearly articulate the benefits associated with the project • Follow up promptly and accurately and with integrity to stakeholder concerns • Work to define stakeholder roles and responsibilities
'social danger'	Decrease	• Make stakeholders part of the decision making process to create shared visions and goals • Agree to, and help maintain an independent, third party review group • Be upfront with stakeholders and provide information about the project risk and include safety measures • Develop a working relationships with media outlets to include predefined channels to provide accurate and timely updates to the media and stakeholders • Provide realistic project schedules and budgets • When mistakes do happen, report them before outside sources do and take ownership for them • Develop realistic plans to recover the project when needed • Develop designs and procedures that maximize safety

Consolidated List of Variables to Improve Stakeholder Acceptance		
Loop Variables	**Desired change to the variable (increase or decrease)**	**Suggested actions**
'social opportunity/danger tradeoff'	Increase	• Make stakeholders part of the decision making process to create shared visions and goals • Donate time and resource to the community and take credit for it • Encourage employees to volunteer and take part in the community through local charities, schools & non-profit organizations • Integrate with the community at both a company level (donations, sponsorships education etc.) and also individual employee levels (volunteering, sports, networking etc.) • Make an effort to understand the values of each stakeholder groups • Align project values with social values • Agree to, and help maintain an independent, third party review group • Provide updates on both direct benefits (jobs created, reduced electricity prices etc.) and indirect benefits (state and federal funding for infrastructure etc.) related to the project. • Identify and track the progress of benefits for each stakeholder

Consolidated List of Variables to Improve Stakeholder Acceptance		
Loop Variables	**Desired change to the variable (increase or decrease)**	**Suggested actions**
'social opportunity'	Increase	• Make stakeholders part of the decision making process to create shared visions and goals • Donate time and resource to the community and take credit for it • Encourage employees to volunteer and take part in the community through local charities, schools & non-profit organizations • Integrate with the community at both a company level (donations, sponsorships education etc.) and also individual employee levels (volunteering, sports, networking etc.) • Make an effort to understand the values of each stakeholder groups • Align project values with social values • Agree to, and help maintain an independent, third party review group • Provide updates on both direct benefits (jobs created, reduced electricity prices etc.) and indirect benefits (state and federal funding for infrastructure etc.) related to the project. • Identify and track the progress of benefits for each stakeholder

Consolidated List of Variables to Improve Stakeholder Acceptance		
Loop Variables	**Desired change to the variable (increase or decrease)**	**Suggested actions**
'social trust in project implementer'	Increase	• Provide educational tours, professional training and genuinely reach out to potential stakeholders • Make stakeholders part of the decision making process to create shared visions and goals • Donate time and resource to the community and take credit for it • Encourage employees to volunteer and take part in the community through local charities, schools & non-profit organizations • Develop and implement multiple feedback mechanisms (focus groups, town hall meetings etc.) and act on them • Integrate with the community at both a company level (donations, sponsorships education etc.) and also individual employee levels (volunteering, sports, networking etc.) • Make an effort to understand the values of each stakeholder groups • Align project values with social values • Agree to, and help maintain an independent, third party review group • When possible meet in person • Provide stakeholder access to senior level project decision makers (CEO, VPs etc.) • Develop mechanisms to be as transparent as possible to stakeholders • Provide access to problem response procedures • Develop a plan to disseminate information ahead of time including social media options • Provide access to experts capable of presenting technical information at the appropriate level for the audience • Be upfront with stakeholders and provide information about the project risk and include safety measures

APPENDIX I – CONSOLIDATION OF SUGGESTED ACTIONS

Suggested Action	Number of occurrences
Provide educational tours, professional training and genuinely reach out to potential stakeholders	
Make stakeholders part of the decision making process to create shared visions and goals	
Donate time and resource to the community and take credit for it	
Encourage employees to volunteer and take part in the community through local charities, schools & non-profit organizations	
Develop and implement multiple feedback mechanisms (focus groups, town hall meetings etc.) and act on them	
Integrate with the community at both a company level (donations, sponsorships education etc.) and also individual employee levels (volunteering, sports, networking etc.)	
Make an effort to understand the values of each stakeholder groups	
Align project values with social values	
Agree to, and help maintain an independent, third party review group	
When possible meet in person	
Provide stakeholder access to senior level project decision makers (CEO, VPs etc.)	
Develop mechanisms to be as transparent as possible to stakeholders	
Provide access to problem response procedures	
Develop a plan to disseminate information ahead of time including social media options	
Provide access to experts capable of presenting technical information at the appropriate level for the audience	

Suggested Action	Number of occurrences
Be upfront with stakeholders and provide information about the project risk and include safety measures	
Provide updates on both direct benefits (jobs created, reduced electricity prices etc.) and indirect benefits (state and federal funding for infrastructure etc.) related to the project	
Develop a working relationships with media outlets to include predefined channels to provide accurate and timely updates to the media and stakeholders	
Provide expert input to help ensure the correctness of information provided by media out lets	
Reduce construction, maintenance and operation delays	
Celebrate and publicize important project milestones, give credit to the appropriate stakeholders for each success	
Provide realistic project schedules and budgets	
When mistakes do happen, report them before outside sources do and take ownership for them	
Develop realistic plans to recover the project when needed	
Identify and track the progress of benefits for each stakeholder	
Identify and track values, resentments and relationship history with each stakeholder	
Develop designs and procedures that maximize safety	
Establish and disseminate emergency plans and procedures including accident notification plans	
Be able to clearly articulate the benefits associated with the project	
Follow up promptly and accurately and with integrity to stakeholder concerns	
Work to define stakeholder roles and responsibilities	