Designing Communication for the Day-to-Day Safety Oversight of Nuclear Power Plants

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Abstract

Inspectors of nuclear power plants manage information to make plants safer and to monitor and evaluate adherence to regulatory requirements. Integrating grounded practical theory and communication as design, we investigated the collective design of and practice of status meetings—a pair of daily meetings meant to manage information about the day-to-day safety oversight of nuclear power plants. Our analysis focused on (1) the problems these status meetings were meant to address, (2) the techniques participants used or proposed to address them, and (3) the situated ideals reflected in the designs for and practice of these meetings. Clustering the techniques illuminated designable features of status meetings (e.g., what, how much, and how to communicate, turn-taking, timing, pacing, and audience). We extend work on communication as design by conceptualizing and investigating collective design work, focusing on the fit, function, and fragmentation of approaches to status meetings. We also contribute to the theory and practice of organizing for safety and reliability by making recommendations for coping when communication processes informed by best practices nonetheless produce persistent, irresolvable tensions that complicate the enactment of safety.

Keywords: Communication as design, grounded practical theory, regulatory communication, nuclear power plants, safety and reliability

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> The rumbling of the steam driven turbines vibrates through our shoes. After walking through a maze of pipes, steel beams, and concrete, we stand on the roof of the enormous building that houses the turbines, next to the pipes that feed them. Wearing what seems to be the agency uniform of chinos, a button down, and comfortable shoes, our guide gestures at them without looking. He explains the intense heat and steam below us: The reactor generates heat. That heat raises the temperature of water kept under pressure to prevent boiling. Pipes transfer that heat to tanks allowed to boil, releasing the constrained energy. The magnitude of forces under our feet are told in the vibration—the echo of pressure, heat, and energy harnessed by the system we navigated through to stand atop.

Keeping powerful and complex industrial systems safe requires the careful monitoring and managing of intricate interactions between technical and human systems (Perin, 2005). Theories of organizational safety and reliability disagree about the inevitability of failure in such systems (Leveson, Dulac, Marais, & Carroll, 2009). Normal accident theory, for example, predicts that such systems are destined to fail (Perrow, 1999), but high reliability theory (HRT) argues that the safe operation of such systems is possible through mindful organizational processes like heedful interrelating (Weick & Roberts, 1993). Research on organizing for safety and reliability underscores communication processes as essential, because in the such complex systems, safety is a collective accomplishment (Gherardi & Nicolini, 2000; Leveson et al., 2009).

The key problem in these systems then is understanding and improving how collectives actually communicate to enact safety (Gherardi & Nicolini, 2000). Work on organizing for reliability and safety tends to forward ideal models of communication without sufficiently acknowledging or accounting for the challenges of practice (Scott & Trethewey, 2008). Recognizing the need for heedful interrelating is not the same as actually enacting it. The processes recommended in HRT such as heedful interrelating and mindfulness "are often highlighted…as self-evident solutions" (p. 311), but "increases in the clarity of communication or amount of information flow do not automatically translate into cultural or behavioral change, so the management of ambiguity through interaction is likely more complex than these high reliability organizing constructs currently allow" (Scott & Trethewey, 2008, p. 311). Meanwhile,

work on information behavior tends to focus on improving communication to enhance accuracy, placing less concern on meaning making practices (Mokros & Aakhus, 2002; Perin, 1995). This study contributes an analysis of communication processes—status meetings—enacted by inspectors and regulators to manage information for the day-to-day safety oversight of nuclear power plants. We investigate how organizational processes meant to ensure safety actually enacted it (Gherardi & Nicolini, 2000), and how that enactment spurred inherent, irresolvable tensions that complicated its accomplishment (Trethewey & Ashcraft, 2004).

To do so, we turned to work conceptualizing communication as design. Communication as design (CAD, Aakhus, 2007; Aakhus & Jackson, 2005) can elucidate of how systems manage information and meaning making (Mokros & Aakhus, 2002) by focusing concern not only on information management practices but also on the processes from which those practices emerge. This article contributes to the theory and practice of organizing for safety as well as communication as design by investigating how participants collectively designed communication processes to oversee the safety of nuclear power plants. Integrating grounded practical theory (GPT, Craig & Tracy, 1995) and design methods (Aakhus & Jackson, 2005), we studied communication problems experienced by nuclear regulatory inspectors, surfaced their solutions to those problems, and explored the situated ideals reflected in their accounts. Consistent with our grounded approach, we now frame the analysis with a description of the site.

Information Management for Safety Oversight and the Resident Inspector Program

Our study took place over a roughly 8-month span of time in a single region of the U.S. Nuclear Regulatory Commission (NRC). During the course of our study, the NRC relied on teams of inspectors to monitor 104 nuclear power plants (Nuclear Regulatory Commission, 2012; Perin, 2005). To do this, the NRC divided plant oversight into four regions, with each region overseeing between 20-30 plants. In the region where we collected our data, the plants

were sorted into branches that were supervised by branch personnel at the regional office and monitored by resident inspectors who worked at the individual plants. Each branch was headed by a branch chief (BC) and was supported by a senior project engineer (SPE) and one or two project engineers (PEs). Each plant office had a senior resident inspector (SRI), one or two resident inspectors (RIs), and a part-time administrative assistant. A typical branch reflected a team of approximately 14 staff. All told, the branches, regional leadership, and regional administrative personnel formed what we are calling the Reactor Safety Unit (RSU), which was responsible for overseeing the operation of the plants including the plants' own safety processes.

As the watchers and regulators of complex systems, the RSU was mainly focused on controlled information processing (Weick & Roberts, 1993). The RSU gathered information about plant operations from multiple sources, made sense of it, and took action when needed. To this end, the role of resident inspectors was to "provide first-hand, independent assessment of plant conditions and performance" (Nuclear Regulatory Commission, 2012, ¶ 6). The participants in our study confirmed that S/RIs gathered and managed information about day-to-day plant conditions and "independently verified" information provided by plant operators.

To do this, the S/RIs observed and asked questions of the operators in the sterile, quiet control room and observed and spot-checked the work of the electricians, technicians, and others at the plant. Gathering information went significantly beyond asking questions and spot-checking, however. Outfitted with cameras, notebooks, and personal safety gear, the S/RIs navigated the noisy machinery of the cavernous physical plants. Along with these tools, they carried with them technical engineering knowledge, mental models of inspection work, rules and regulations, networks of relationships, and the stories that comprised their sense of local plant history and nuclear power generation. The S/RIs managed an ever expanding body of information about each plant, where information was clustered around "issues," their label for

ongoing, plant-specific happenings (e.g., scheduled maintenance, operational problems). They made and modified technologies of varied complexity to monitor, communicate, and make sense of issues as they arose (e.g., issue tracking spreadsheets, white boards, email updates, report "boilerplates," and so forth).

On a typical day, the S/RIs arrived at the plant, reviewed the plants' logs, "walked down" (i.e., toured) the plant and control room, and prepared for a daily, early-morning conference call. The *branch status call* included S/RIs at each plant in the branch and the branch regional personnel (i.e., S/PEs and BCs). Typically during branch status calls, S/RIs would "report up" information about their plant, and the branch chiefs would "report down" any information that the S/RIs needed. After this call, S/RIs continued to monitor emergent issues, performed "planned surveillances" of various aspects of plant operations, and generated reports describing the operation of the plants. A short time later each day, the personnel from each branch at the regional office would gather for a meeting that occurred mid-morning. The *regional status meeting* involved most of the RSU personnel who were physically present in the region, other personnel from within the region (e.g., RSU leadership, personnel with special knowledge), and other representatives via conference call (e.g., national headquarters). The S/RIs would typically not call in for the regional status meeting.

According to formal documents, the prescribed purpose of these *status meetings* was sharing information about the technical and regulatory condition of the plants. Although information was continuously passed among RSU personnel, these meetings comprised the bulk of communicating what participants called "status," and we focused our analysis on these meetings. Although information management also occurred in reports or ad hoc and formalized conversations and briefings, the daily accomplishment of information gathering and sharing for safety oversight was purposively and consistently performed in status meetings. As such, they

merit study because they were exemplary of the problems of managing information for day-to-day safety oversight generally and the various ways that RSU tried to solve those problems. They were routine, always occurring in a similar fashion, and day-to-day issues were most often surfaced and discussed for the first time in status meetings. Ideas for how the meetings *should* work circulated in formal documents, emails, and on centrally-located posters. They also merit study because they exemplify processes that are typical in other organizations concerned with safety and reliability (e.g., "Monday notes," Tompkins, 2005).

Communication as Design and Grounded Practical Theory

Taking a CAD approach to understanding the status meetings focused our attention on how the RSU managed information for safety oversight and made decisions about *how* to communicate to manage information. That is, we focused on how the status meetings worked *and* the collective negotiation of how they should and would work. This nuance is especially valuable in the study of organizing for safety and reliability, because it not only surfaces communicative safety processes but also examines the collective crafting of such processes (Goodman et al., 2011). The study of both enables the interrogation of the robustness of the systems meant to manage information in organizing for safety.

The study of communication as design focuses attention on the creation and evaluation messages; however, it also focuses attention on the creation and evaluation of communication processes (Aakhus, 2007; Aakhus & Jackson, 2005). All humans are, in a sense, communication designers. O'Keefe's (1988) theory of message design logics conceptualizes how individuals create and evaluate messages using different logics to accomplish communicative goals. In this sense, organizational members design messages as they convey information, ask questions, or make arguments (Barbour, Jacocks, & Wesner, 2013). CAD also encompasses the emergent and the disciplined crafting of interaction. As Aakhus and Rumsey (2010) argued, "communication

design happens as participants jointly coordinate their interaction in making contributions and, intentionally or not, craft a particular kind of communication (and avoid other kinds) with each other," to co-create meaning, to accomplish communication action, and to "coherently coordinate meaning and action" (p. 68).

Taking a communication as design stance, then, we treated status meetings as designed processes, or "intervention[s] into ongoing activity (e.g., a device, a service, an interactional format)" (Aakhus & Jackson, 2005, p. 412), and we examined "designs for" status meetings and the RSU's "design work" (Aakhus, 2007, p. 116). By investigating "designs for" status meetings, our analysis attends to "the affordances and constraints of designs for communication and then reconstructs what the design presupposes about communication" (p. 116). "Designs for" communication embody design hypotheses about how communication works. By examining the RSU's "design work," or "what people in a position to shape communication do to shape it" (Aakhus, 2007, p. 117), we consider their application of a practical theory of status meetings to enable the day-to-day safety over oversight of nuclear power plants. Participants' accounts of the designable features of their interaction and their designability toward some end embody design hypotheses and evidence their design theory for how the interaction should manage the situation and create some result rather than another (Aakhus & Jackson, 2005).

We began our engagement with RSU taking a GPT approach focused on the situated communication problems and the techniques that participants used to address them (Craig & Tracy, 1995). Early during our fieldwork, it became clear status meetings were negotiated in a sort of collective design work. The inspectors' communication processes were essential in the accomplishment of day-to-day safety oversight. Participants saw safety as a collective accomplishment, and they argued about how their communication processes should work. We turned to CAD in the analysis, because a concern for "designs for" and "design work" focused it

on those communication processes *and* the participants' crafting of those processes. GPT and CAD share a focus on the empirical description of practical problems addressed by communication activity and the application and interrogation of normative theory (Barge & Craig, 2009). GPT focuses on reconstituting practice at multiple, interrelated theoretical levels (i.e., problem, technical, and philosophical levels), analogous and compatible with design methodology (Aakhus & Jackson, 2005). GPT contributed theoretical guidance for generating insight about the problems of practice, the techniques meant to address those problems, and the situated ideals that guided attempts at problem solving. CAD enabled our examination of the collective negotiation of their communication processes and the techniques applied and proposed therein, and thus, CAD enabled a theoretical focus on the (re)design of their practice.

We begin our analysis as Craig and Tracy (1995) recommended, by seeking to understand "those aspects of situations that characteristically become problematic and require reflective thinking, for which theory can provide relevant resources at both the technical and the philosophical levels" (p. 253). Akin to the empirical examination of discourse practices within design methodology (Aakhus & Jackson, 2005), the analysis of the problem level "is aimed at developing conjectures about participant goals and about the obstacles participants face in accomplishing these goals" (Jackson, 2002, p. 110). We therefore first asked, *what were the problems status meetings were meant to address? (RQ1)* Answering this question framed and enabled the following analysis of how participants tried to structure and enact their communication to address those problems.

The bulk of the analysis concerned the "technical level," or the "repertory of specific communicative strategies and techniques that are routinely available to be employed within the practice" (p. 253), "…that reflect their possible orientation to, and attempts to cope with, the interactional dilemma" (Craig & Tracy, 1995, p. 259). A focus on techniques can make apparent

"designable features" (Aakhus & Jackson, 2005, p. 423)—aspects of communication that reflect choices made by participants or choices that might be made (Jackson, 2002). Applications of GPT have focused on techniques individual people devise to resolve problems in particular sorts of interaction (Barge & Craig, 2009), such as facilitating in group decision support systems (Aakhus, 2001) or conducting intellectual discussions (Tracy, 1997). The structuring of status meetings represents a collective response to trying to accomplish safety oversight, analogous to the individual techniques identified in GPT research. CAD turned our focus on a repeatable design (the status meeting), the specific features of which had developed over time to address the problems of status meetings guided by an ongoing negotiation of situated ideals. Our analysis thus attended to the question, *what techniques surfaced to address the problems of status meetings? (RQ2),* and in answering, we were able to bring attention to their designable features.

A reading of problems and techniques should reveal "the philosophical level," the situated ideals that communicators use to "derive reasons for resolving the problem in one way or another, accepting certain trade-offs among competing goals, and thus choosing to use certain communicative strategies and techniques rather than others" (Craig & Tracy, 1995, p. 253). Understanding the philosophical level (akin to considering an "ideal model" in design methodology, Jackson, 2002), prompted us to ask *what situated ideals were reflected in efforts to solve those problems? (RQ3)* Our focus on the evaluations of and arguments about problems and techniques revealed situated ideals that were negotiated in participants' collective design work.

Methods

From 2011 to 2012, we collected data about communication between and among S/RIs and their affiliated RSU personnel. We crafted a qualitative approach focused on how participants shared stories, created meaning(s), and oversaw safety on a day-to-day basis. Although not a traditional ethnography, we conceived of our project as adopting engaged,

ethnographic methods (Barge & Shockley-Zalabak, 2008; Tracy, 2003), comprised of a blend of shadowing, field interviewing, document collection, open-ended surveying, and a workshop through which we facilitated discussion of preliminary results among participants.

Procedures

Shadowing and field interviewing. We adopted shadowing as a distinct method that involves following participants throughout their workday (Czarniawska, 2007; Gill, 2011). For three to four days per plant, we engaged in simultaneous shadowing, where one of us would shadow the S/RIs while the other shadowed in the region. This allowed us a dual view. To the extent possible, we observed the goings on in each location and the communication between the locations. We visited six nuclear power plants and shadowed in five. Together, we conducted approximately 380 hours of fieldwork. As part of our shadowing, we also conducted 29 field interviews with a mix of S/RIs, BCs, S/PEs, senior regional management, and others.

Interpretive principles guided our approach to shadowing and interviewing. We sought to understand communication processes from the participants' point of view. Because of this, we did not strive to be an invisible "fly on the wall," but engaged and asked (Barge & Shockley-Zalabak, 2008). Not wanting to disrupt their work, we sought opportune moments for questioning (Authors, 2013). We also conducted semi-structured field interviews that reflected the guidance of GPT, comprised of open-ended questions to encourage conversation about communication problems, techniques, and participants' accounts of why a technique worked.

To capture our shadowing observations and interviews, we jotted our impressions in notebooks or took "headnotes" (Emerson, Fretz, & Shaw, 1995). We also drew diagrams, generated additional questions, and wrote early analysis memos. We kept in touch with each other throughout, processing preliminary observations over email or phone. We also reflected on the shared research process to encourage reflexivity. Once we completed our shadowing, we

organized and typed our notes. The first author's fieldnotes focused on recording discrete key moments and phrases and the second author's fieldnotes were more in the style of thick description (Geertz, 1973), seeking to capture the context of communication. Our notes provided a well-rounded understanding of communication at the research sites, and we generated approximately 315 of pages of typed fieldnotes and interview notes, combined.

Additional data sources. We collected three additional sources of data to enrich our shadowing and field interviews (Barge & Shockley-Zalabak, 2008). First, we collected documents related to our ongoing research (e.g., press releases and publicly available documents). Second, we fielded an online questionnaire that provided space for participants to comment anonymously. Third, we facilitated a workshop at the completion of the bulk of our shadowing. We presented tentative findings and organized participants into small groups wherein we facilitated conversations that invited participants to amplify, modify, and challenge the findings. The workshop not only brought participants into the research process, but it also encouraged explicit conversations about problems and techniques. We took notes throughout including during follow up conversations after the workshop. Overall, we incorporated these data into our fieldnotes, compiling them into a single dataset.

Data Analysis

During our time in the field, we generated tentative and preliminary understandings related to information management, driven by the first author's interest in this area. At the conclusion of data collection, we uploaded the dataset to Dedoose, an online, cross-platform analysis tool and established preliminary codes for sorting the data around key communicative moments. Guided by the research questions, we each independently read all the notes, excerpting examples. From here, we exported our examples to a text table that comprised a little over 200 pages, sorted by the kinds of meetings or conversations we observed (e.g., status meetings, ad

hoc meetings, and conversations around reports). Although we focused our analysis on the status meetings, it was informed by these other moments as well.

The bulk of the analysis occurred through a series of iterative rounds of coding and discussion. The first author developed a rubric for organizing the excerpts guided by CAD, challenged and developed in discussion with the second author. Taking a CAD stance in the analysis prompted us to look at the collective design work focused on status meetings. Participants at all levels gave accounts and argued about how status meetings could or should work during RSU-wide meetings, during status meetings themselves, and during interviews with participants. We highlighted moments where participants endorsed a particular aspect of how status meetings worked, made suggestions for changing status meetings (i.e., "we could do it this way instead…"), or just engaged in an alternative practice. We explored possibilities not initially articulated by participants through our own questioning (i.e., "what if it worked this way…").

Each of us independently read through the excerpts, and we checked and challenged our application of the rubric in iterative conversations through which we consolidated our interpretations. We surfaced the problems that status meetings were meant to address by reflecting on the multiple functions ascribed to them. We clustered the techniques discussed by participants around designable features of status meetings. That is, the techniques in the data reflected ideas about how status meetings should work, and those techniques were focused on similar aspects of status meetings (e.g., techniques for negotiating how much information to communicate). We then reviewed the data to articulate the situated ideals evidenced in participants' accounts and our own observations. Throughout, we preserved and reported discordant accounts to reflect the fragmented and negotiated character of their design work.

The Problems of Status Meetings (RQ1)

The official purpose of status meetings was formalized in RSU's articulation of how their

communication should serve the NRC mission: "Maintain public health and safety, identify and pursue safety issues vigorously and promptly, and optimize strategic performance goals while maintaining safety." Addressing it meant answering *are we in danger?* and, *how do we know?* Yet, although managing information for safety was the principal, organizational goal, participants argued that safety is abstract, complex, and difficult to measure. In an early conversation, one participant noted, "Safety is our product," but then explained that safety was so difficult to "produce" because it is ephemeral. Another argued that the RSU produced safety through the *absence* of problems, errors, or accidents, defining safety as a "dynamic nonevent."

Participants also described additional functions that status meetings served, arguing that these were intermediate to safety, such as information management, enabling regulatory action, organizational learning, and demonstrating the value of the RSU. For example, the operation and monitoring of the plants generated so much information that *managing information* was necessary and appropriate for good inspection work. A participant joked that the plants' "main product is paperwork, and electricity is a by-product." Thus, the RSU *managed* information through status meetings, where solving the problem of too much information meant answering, *what does this information mean for safety?* Their management of information reflected decisions about what information to share and processes that gave meaning to information based on professional, expert judgments about what information about an issue meant.

Participants argued that status meetings also had to address a problem of *regulation*. The RSU had to assign fault for certain problems and enforce sanctions when necessary. Participants argued that this meant that status meetings had to emphasize safety outcomes *and* fairness and consistency with formal policy and regulations. Addressing this meant answering, *what should the regulatory action be, based on this information?* In status meetings, discussions focused on the regulatory meaning of information about an issue as well as the technical meaning.

They argued the work, including how status meetings should work, also needed to be taught. In this, participants made explicit that the meetings also served a *learning* function for those relatively new to the organization or when practices were changing. Addressing this problem meant answering, *do we agree about what we are doing and do we all know how we are doing it?* For example, a participant explained that PEs attended and (when ready and with support) led their branch's status meeting call to assist professional development. As another example, during our investigation, the inspectors were fielding a new inspection protocol. Although conversations about that protocol happened in other meetings as well, the participants talked about the protocol and highlighted information as relevant for it during status meetings.

Finally, they demonstrated that status meetings had to make explicit and concrete the *value* of inspection work. Demonstrating contributions to the agency, the plants, and the public good was all the more difficult because of safety's ephemeral and amorphous character. Thus, the question asked here was, *is it clear that our inspection work helps make the plants safer?* For example, one plant experienced an emergency for which RSU had recently required that plant to improve their level of preparation. As the RSU worked through the issue, the usefulness of the improvements prompted by their past inspection work was a common refrain. The RSU observed how they made the emergency easier to manage and that without the RSU, the emergency might have been much worse. Comments during status meetings also referred explicitly to the incident as providing them a rare concrete case for their contributions to safety. Thus, inspection reports, findings, and the daily conduct of status meetings documented the value of their work.

According to participants, solving these problems (absence, managing, regulating, learning, and valuing) in status meetings comprised in part the accomplishment of safety oversight. That is, participants tried to address them in their designs for status meeting as well as in the conduct of status meetings. The emergent character of the meetings reflected RSUs design

work. However, as should be clear in the analysis that follows, (1) not all participants were aware of all of these problems as they thought and argued about status meetings, and (2) not all of these problems were explicit or salient during status meetings at the same time. In fact, it was in part the operation and interaction of multiple, complex problems and the competing demands presented by trying to solve them that made status meetings challenging. We now turn to a critical description of techniques—used, proposed, and possible, clustering the techniques around designable features of status meetings. That is, the techniques that we surfaced in the analysis clustered around designable features of status meetings (i.e., aspects of status meetings, features, that participants might change in particular ways reflecting a particular techniques). The analysis focused on formal and informal guidance and alternative proposals for what to communicate; how much to communicate; and how to communicate, including expectations for turn-taking and timing; and for audience. We move briefly through each of these designable features and provide representative examples where appropriate.

Techniques and the Designable Features of Status Meetings (RQ2)

What to Communicate

Participants managed the problems of status meetings in part by deciding *what, as well as how much, to communicate*. A predictable set of information was shared about each plant, each day, which meant that each S/RI or BC rattled off a repetitive set of details regarding the operation of each plant (e.g., the current risk, planned maintenance for the day). A poster that hung in the RSU conference room listed what should be shared during status meetings, entitled "daily safety oversight meeting discussion topics." However, regardless of this poster (and other similar documents and conversations), participants argued that this list did not (and, could not) encapsulate the information that should be shared in status meetings. Rather, information communicated should include *anything* related to safety, which required, then, that participants

possess an intuitive, experience- and expertise-based sense of note-worthy information—qualities that could not be captured on a poster. An S/RI explained of the poster, "That's management expectations for what will be covered" but, "…you always have to anticipate questions." Leadership echoed this idea that the poster should not limit what was shared. An axiom on the poster itself captured this sentiment: "When it comes to safety, nothing is routine."

Thus, status meetings also involved communicating information not necessarily related to safety but that was "interesting." Interesting-ness served as a fuzzy category for including information that otherwise might not have been, where what counted as interesting depended on the professional judgment of those managing the information. Information might be interesting because it was unusual or perhaps relevant for safety, but the safety relevance of information was not always clear as issues unfolded. Participants explained, "The key is separating routine from what looks routine but is not," and that issues that were "somewhat abnormal" were good to mention so that the RSU could take the right actions and "get eyes on it." Another participant described his intention to share an issue at a status meeting as not even really about safety, saying, "while it's not about regulatory oversight, it might be interesting to certain people…" Another noted, "Always send pictures if you have them, because the region likes show and tell."

At the same time, participants reported needing to balance sharing enough with not too much. To be sure, it would be impossible to observe or communicate all information because plant operations comprised so much activity. S/RIs "sampled" observations guided by emergent issues and by the Reactor Oversight Process (ROP), a risk-informed framework of the sorts of inspections that needed to be completed on various timetables (Nuclear Regulatory Commission, 2013). Sharing information about one issue meant that attention could not be spent on another. Further complicating this was that deciding how much to communicate was affected by the fact that as issues unfolded, they were not (and could not be) completely known. That is, inspectors

worked under conditions of uncertainty and ambiguity. In one case, a participant explained that he could report an issue, but it was still "early information" and it was not a "big safety issue at this point." Accordingly, one participant explained that he might give more or less information to limit "inspecting from the region." He rationalized, "I mean, give me some time, let me do my job before you start bombarding me with questions. I mean, you put me out here. You must have some faith in me." Another participant argued, "… we sometimes limit information to limit the questions we will receive…but maybe they needed to hear that [information]." Ultimately, however, participants tended to lean toward sharing *more* information. Senior leadership and BCs talked about setting a "low threshold" for information sharing, and many participants argued it was better to over-communicate than fail to share something that was later important.

How to Communicate

Ideas about how to communicate information reflected an additional designable feature of status meetings. For example, an initial goal of our engagement with the RSU was to make explicit how they marked safety-significance in language. We expected phrases such as "that's safety significant because…" but in fact, we rarely saw anything of the kind. Instead, the sharing of information relied on shared understanding. Status meetings might include laughter or joking about shared experience or ribbing a colleague, but typically, the briefers related issues calmly and concisely, without undue comment, emotion, or reflection. A participant, thus, likened the RSU exchanges to the black box recordings of pilots. Any remarkableness, as such, might be only signaled to an outsider by a chuckle or headshake from another person in the room.

In precisely and accurately conveying information, participants were careful with the language they used and relied on engineering terms and references to formal documents such as: "Plant X Unit 1 is yellow…the alpha diesel is inoperable and they're in an LCO for a couple of hours." This precision was evident, too, when they corrected misstatements. During a regional

status meeting, participants were looking at projected photos of a site. A senior leader asked, "so these are Styrofoam blocks…" and several people immediately corrected, "…Styrofoam *forms*."

Participants seemed relatively unreflective of how they communicated information, and as such, their proposals for changes to status meetings did not include issues such as making safety more explicit. Participants argued that the safety significance of issues would be apparent to fellow inspectors, and so meta-communicative comments about the meaning of information were unnecessary. Moreover, the degree to which participants assumed that precision and accuracy in information sharing were attainable and necessary signals an important part of how they thought about information. During the workshop, we reflected to the group that they did little to make safety significance explicit. Participants responded that this was as it should be, because understanding should rely on shared expertise. On the other hand, concerns about the use of emails to communicate information discussed in status meetings reflected that they were seen as for more than just a reporting of the facts. Plants varied in their use of a summary email after a status meeting (e.g., no email, email only for complicated issues, a daily email that kept a record of issues as they unfolded). A leader expressed concern that emailed updates about plant conditions could replace conversation about issues, noting that he had too often seen someone brief from an email instead of notes. He worried that the use of email might miss the nuanced understanding of an issue gained during status meetings.

Turn-taking. Status meetings also involved a fairly structured assumption of turn-taking where, for instance, plants and branches reported in the same order almost all of the time, and in two rounds. A first round covered the routinized information for each plant, and a second round covered "seconds," which included updates from other meetings, items of interest not related to plant operations per se (e.g., a visitor at a plant), and so forth. Individuals facilitated this two-round structure when sharing information; during the first round they would reference an item to

be discussed later by saying, “I’ll come back to that at the end,” or “I’ll talk about that during seconds.” Deviations from this structure were corrected in the moment (e.g., by requesting firsts or seconds from someone who had been skipped).

We did not find this two-round structure formally articulated, and yet status meetings rarely deviated from it. Notably, such turn-taking persisted even when we thought it might not. During an emergent event that put the region on twenty-four hour alert, the discussion of the unfolding event still came after the routinized reporting of plant conditions. Thus, turn-taking was unchanged even during a time of emergency. And in fact, participants saw little value in changing the order of reporting. We suggested intentionally varying the order as a way to challenge the routinization of information sharing. A senior leader explained that although he was willing to try the change, he did not believe it would improve their process. Other participants’ proposals for changes did not call out these structures; although, a few explained that the content conveyed during firsts might be skipped unless something was out of normal.

Timing and pacing. Status meetings were also structured in the sense that they occurred at the same time each day. The branch status calls occurred at the same time as determined by each branch to come ahead of the regional status meeting. This meant, however, that some plants in different time zones had less time to get information about plant conditions and emergent issues. An S/RI explained, “You adjust to it…it limits time for information seeking between when you find out something and the [status meeting].” Yet, the time-shifted sites found themselves caught between two days, gathering information for the last meeting as they prepared for the next. The S/RIs’ schedules also reflected the timing of the meetings. The mornings were typically the period of the most intense activity unless a new issue emerged later in the day.

Status meetings were meant to have an expeditious but not rushed pacing. Participants argued that status meetings should take as much time as it needed, but they also needed to return

to other work. When asked about when he would stop a line of questioning to save time, one RSU leader explained, "We don't want to appear to be stifling conversation about a possible safety related topic. Overall though, that's not a big deal most of the time, as I think the [regional status] meetings are very valuable, and any meeting will have some inefficiencies, so it's a small price." However, the meetings were by no means leisurely. They would end abruptly as soon as it became clear that the conversation was complete. Quick goodbyes would end the meeting, and the room would empty as the conference line disconnects bleeped in rapid succession.

Participants' alternative proposals for status meetings spoke to pacing and the routine scheduling of meetings. Inspectors—especially those who worked in different time zones far from the regional office—wished that the meetings might be scheduled at a different time, but just adjusted, in the end. Although participants agreed that status meetings should take as much time as needed, they disagreed about what deserved time (as noted above). Participants argued that the quick pace should be more uniformly enforced. Viewing it as mostly routine, some participants also argued that status meetings should occur less frequently (e.g., three times instead of five times per week) or be replaced with a web form. Others explained that they were inefficient on purpose, because pacing needed to allow plenty of time for shared sense making.

Audience

Designable features of status meetings also included concern for audience: who should attend, how status meetings should orient to particular audiences, and differing roles for attendees. Management was the principal audience of the status meetings. They functioned to pass information up the hierarchy (e.g., a participant explained that S/RIs "filter up to [the] branch at status [meetings]"). The senior leaders of the RSU led the regional status meeting and BCs led branch status calls. They called the meetings to order, they directed the flow of the conversation, and they were typically the only person taking notes. Accordingly, BCs briefed

during the regional status meeting, S/RIs briefed during the branch status calls, and briefers typically directed their comments to the leaders of these status meetings. Attendance was expected, however. It was typical for participants to attend status meetings unless they could not. Thus, if a senior leader or BC was to be absent, they would appoint another person, in accordance with the formal guidance for doing so, which also reflected the RSU hierarchy (i.e., BCs stood in for senior leadership, SPEs for BCs, etc.).

This hierarchical flow of information was also reflected by who actively paid attention, and when. At times, the status meetings seemed more a series of conversations between the person sharing information and the leader, and those not directly involved did not seem to be listening with the same intensity (e.g., taking notes). In regional status meetings, the layout of the room facilitated this flow of information. A large table was positioned in the center of the room, and senior leadership, BCs, and other regional leaders typically sat in the same seats at the table. Lining the walls were chairs used by S/PEs and other inspectors. And, although questions might come from anyone, RSU leadership, BCs, or other leaders asked the majority of questions, and interruptions of these individuals were rare. During our observations at the plants, the S/RIs would alternate between listening to the other plants and having conversations amongst themselves (e.g., about the call, issues at their own plant, or other topics not related to the call). The routinized structure of the status meetings allowed for this kind of participation without rapt attention. During one branch status call, the S/RIs were conversing, and then without seeming aware, the SRI switched his attention from the conversation to the call at just the appropriate moment. The routinized order meant the participants had a practiced sense of their turn.

Alternative views of audience offered contended, however, that the entirety of RSU was the audience, and not only the senior leadership. A participant articulated the regional status meeting as having three purposes: “to brief management, for experienced engineers to provide

their insight, and for new inspectors to learn….” Echoing this, formal documents stipulated that the status meetings were to brief all of RSU, and senior leadership agreed. Participants described status meetings as putting everyone—with their myriad knowledge and experience—in a room at once. To be sure, experienced inspectors did ask questions and refer to past issues. It was not always the case that communication was vertical, but could be horizontal and diagonal as well.

Status meetings reflected RSU’s collective design work. Emergent “designs for” status meetings made clear sense participants’ hypotheses or guesses about what would work in a particular context for a particular problem (Aakhus & Jackson, 2005). The particular form of status meetings reflected efforts to solve the problems of managing information for day-to-day safety oversight by routinizing and structuring the information management required. As reflected in the preceding discussion, techniques varied in the degree to which they were contested, explicitly sanctioned by leadership, and captured in formal artifacts (e.g., policy guides, posted guidance, emailed expectations). Participants endorsed aspects of status meetings as they were and supported alternatives by making arguments based on safety (e.g., “we will be safer if we…”) and the other problems of status meetings. Arguments also drew on experience and expertise (e.g., “in my practice or in our branch, this process works”).

Situated Ideals: Multiple, Competing, and Tensional (RQ3)

Their enactment of and arguments about status meetings also reflected the operation of multiple, competing, and tensional situated ideals—the philosophical level. These situated ideals offered differing rationales for why a particular technique was better or worse, and they were negotiated as RSU conducted status meetings in ways that reflected a particular set of decisions about the meetings’ designable features. According to participants, (1) status meetings needed to accurately and precisely transmit information, but they also needed to provide space for collective sense making; (2) they needed to draw on measurable, concrete evidence in making

claims but also tolerate the ambiguity and uncertainty in inspection work; (3) they needed to be repetitive without being too interesting or too boring; and (4) they needed to focus on what was actually happening in the plants at present without ignoring important backstory. In sum, across these tensional, situated ideals, status meetings had to balance standardization and consistency against fit and flexibility.

Transmit Information and Make Meaning

Communication may be conceived of as a process of co-creating meaning, and, just as usefully, as transmitting information (Mokros & Aakhus, 2002). RSU participants' principal model for communication was that it was about transmitting data, clearly, precisely, and accurately. They described it as like a game of "telephone." They took care asking questions like, "Let me make sure I understand," and their language emphasized engineering precision and measurable, concrete "facts." To this end, leadership reminded inspectors to first "get the facts." And because status meetings emphasized accuracy and precision, S/RIs *needed* to get and share the facts. However, the reality was that S/RIs did not always have the facts or that the facts were ambiguous. Participants also used status meetings to check and test out their interpretations.

Participants argued that transmitting information could and should be standardized, but others argued that meaning making required flexibility. Reducing the number of meetings, replacing them with a web form, and pushing quickly through status meetings made sense if the ideal was the transmission of information, but it made less sense when a participant recognized that the status meetings also allowed the inspectors to think together. Holding status meetings everyday and including all of the RSU made sense when read as protecting space for flexibility needed for meaning making.

Deal with Ambiguity Concretely

The ideals of transmission and constitution were also related to what counted as "good

information" in their meetings. In our observations and their accounts, good information was to be measurable and straightforwardly categorized into engineering and regulatory frameworks. Given their regulatory mission, the idea that they were making meaning or interpreting was problematic, because as a regulatory agency, they had to make concrete determinations. During the status meetings, participants referenced the formal documents (e.g., physically looking up the regulations that sat in thick binders on their shelves) that described the regulatory framework and the intended operation of plants (e.g., technical specifications, regulations, inspection manuals). Treating information as uniform meant that the interpretation of the "hard facts" was about finding *the* right answer per these documents, not merely *an* answer.

This tension surfaced during a bi-annual meeting of all of the RSU. When discussing the interpretation of information as part of a learning exercise, a BC offered, "Not everything is black and white. We can't treat it as black and white." The conversation returned to the interpretation of how the issue fit the relevant formal documents. The senior leaders made explicit their choice to leave the issue undecided, arguing that the RSU as a collective would have deal with the challenges of interpretation, but many in the room pushed back. They wanted *an* answer even as others argued that *an* answer was not possible or most appropriate. For those participants, leadership should be able to direct *the* way status meetings worked.

Make Status Meetings Boring and Interesting

In general, status meetings were boring. Meetings repeated the same information, and photos and interesting puzzles were rare. Members of RSU voiced reminders during status meetings of not losing what they called a "questioning attitude," a continuous, focused interrogation of information, even when it seemed just the same as it always had. Their experience and expertise made the challenge more difficult as seasoned inspectors became more and more effective at predicting how an issue would go. A participant argued, therefore, that

routines could be hazardous, noting that although status meetings were repetitive, they should not be routine. Participants argued that flexibility in status meetings and elsewhere allowed the inspectors to craft their work processes to serve their own plants—to keep it interesting.

At the same time, they argued status meetings *needed* to be boring, standardized. In other words, they were concerned that if they became too interesting, the RSU might be distracted. During an emergent event, senior leaders reminded the team to keep focused on day-to-day safety oversight—the issues emerging at their own plants, in their own branches. The standardization of status meetings (e.g., turn-taking, timing, what to share, management as audience) helped keep focus when they became "too interesting." During an emergent event, the SRI dealing with it nonetheless reminded the leader of the call that a plant had been skipped during the routinized rounds in their hurry to get to the emergency. Turn-taking was useful, according to participants, because no plant or branch should be overlooked.

Focus on the Past and Present

Participants argued that status meetings also had to balance an interest in the history of the plants with an awareness of what was actually happening. They argued that good inspection work needed to be informed by history without being blinded by it. That depended on an awareness of the history of plants, but, in the interests of being fair, participants argued they could not treat plants that had performed well differently from plants that had performed badly. (The RSU did categorize plants for different levels of scrutiny, but only based on current problems.) "Plant profiling," participants argued, would be unethical, unfair, and unsafe, supplanting "hard facts" with a sense of what was likely. They argued that standardizing status meetings would help maintain a focus on the current "hard facts" of the plant.

They also argued that including the entirety of RSU allowed them to maintain a focus on the current conditions of the plants but also draw on their collective wisdom regarding past

issues. Per this rationale, regional status meetings, therefore, could not just take place between the branch chiefs and management or through a web form. Participants argued that status meetings had to be expeditious, but they could not rush past questions that might contribute. Still, leaders limited time for reminiscing or discussing too much of the history of issues especially in the regional status meetings, and briefers were to translate the story into the "facts."

The preceding analysis has argued that the practice of status meetings reflected a complex negotiation of how they should work. Their negotiation of techniques reflected multiple, competing, tensional situated ideals that gave at times contradictory rationales for addressing the problems of status meetings. How the participants negotiated techniques reflected designable features of status meetings (e.g., what and how much to communicate, how to communicate, and audience). Those negotiations were important because the status meeting format afforded and constrained their enactment of safety. The analysis demonstrated too that the RSU's design work was collective, contested, and negotiated. Exploring the nature of collective design work constitutes a principal contribution of this study to CAD.

Status Meetings—Collectively Designed Communication Processes

The conduct of status meetings and the circulation of ideas about how status meetings should work revealed the RSU design for (Aakhus, 2007) status meetings. However, it was not uniform; it reflected a multiplicity of contested ideas about how status meetings should work. That is, there was not a singular design hypothesis (Aakhus, 2007) at work but many, and a principal output of our application of CAD and GPT was the surfacing of the multiplicity of design hypotheses (i.e., proposals for how to run a status meeting). Likewise, their design work (Aakhus, 2007) did not reflect a singular, cohesive practical theory or designer, but rather a multiplicity of voices. Not all participants were aware of all of the problems status meetings as they thought and argued about them, and not all of these problems were explicit or salient during

status meetings at the same time. We categorized the examples of particular techniques per designable features they reflected, but the negotiation of a technique might have ramifications for multiple designable features of status meetings. Techniques used and proposed reflected multiple at times contradictory situated ideals. We conceptualize the entirety of RSU as operating as a diffused, messy, collective designer of status meetings. The negotiation of status meetings constituted RSU's design work, and we build on CAD by exploring that collective design work—what RSU team members at all levels did to shape their communication and the knowledge and practices cultivated in the day-to-day safety oversight of nuclear power plants.

For example, hierarchical power influenced, but did not determine, the outcome of their design work. Managers produced formal communication plans. Their expectations were explicit in, for example, the poster that hung in the RSU conference room. They had formal authority to change how status meetings worked, and team members oriented advocacy for changes toward managers. Hierarchy had a powerful influence, but participants also drew on their expertise and experience to make arguments about how status meetings should be. Participants also made problem-based arguments appealing to the sanctioned functions of status meetings, the mission of the RSU, and formal documents. They learned about and considered techniques for status meetings from other regions and other fields. Accepting senior management as *the* designer of status meetings misses more complex and useful explanations.

The integration of CAD and GPT in the methods and analysis is a second contribution. GPT and CAD proved not only compatible, but the integration also served here as a way to analyze and assess what people were attempting to do with a specific communication process, to notice not only what the structure of status meetings accomplished but also what new difficulties this structure created for participants. The analytical focus on differences of opinion and perspective participants had about the problems status meetings were meant to address and the

practiced and proposed techniques for addressing those problems enables a practitioner or researcher to attend to the ways the participants themselves pay attention to the designability of status meetings and to the implications of a format's design. Clustering the techniques surfaced around the designable features of status meetings offers points for reflection and intervention in the organization's enactment of safety and an imagining of new techniques.

The findings also contribute to the study and practice of CAD and organizing for safety and reliability by articulating resources for treating communication processes as collectively designed. The status meeting was used to do something within the flow of organizational work including determining what safety matters required attention and what needed to be conveyed to serve various purposes for various audiences. The format was consequential for what safety and high reliability could be. Interrogating designs for such communication processes means focusing in collective design work on questions about the effectiveness of particular techniques and how they addresses the designable features of those processes. Our study demonstrated that the effectiveness of different techniques in status meetings rested in the sophistication with which they addressed the problems of status meetings and managed multiple, competing, and tensional situated ideals (e.g., fit and flexibility versus standardization and consistency).

Taking the status meetings and communicative moments like them as a site for intervention in the accomplishment of day-to-day oversight should raise concerns about the fit, function, and fragmentation of techniques. A technique may fail because it does not *fit* the requirements of the problems faced by communicators. For example, the pacing of status meetings required ongoing negotiation because of the fluidity of time needed to handle the repetitive and novel aspects of safety oversight. A technique may not *function* because the collective in part or in whole cannot or will not enact it. For example, even those participants who expressed the need for status meetings a space for constituting meeting found themselves

falling back on a model of communication as transmission. Related to this pattern, we observed RSU participants were more careful and reflexive with their communication with those they regulated (i.e., the plant operators) than with each other, choosing to "tell it like it is" when communicating with other RSU colleagues. A technique may fail, because the *fragmented* circulation of competing alternatives and voices prevents the effective operation of any technique. We observed the same turn-taking structures in all status meetings, but other techniques varied from branch to branch and in a few cases from inspector to inspector (e.g., the practice of summary emails after status meetings).

A focus on collective design work in organizing for safety and reliability including considering questions of fit, function, and fragmentation is especially promising, because it enables conversations about designs for communication that may produce better outcomes *even when* what those outcomes are or should be is emergent. Whereas organizational safety literatures have tended to emphasize the development of best practices such as heedful interrelating and mindfulness (Scott & Trethewey, 2008), our data reflected that inspection work must address the ongoing, persistent tensions created by doing inspection work even when—or because—it includes such practices. As Weick and Roberts (1993) argued, "A smart system does the right thing regardless of its structure and regardless of whether the environment is stable or turbulent," (p. 377) and yet what makes the system "smart" may also inherently produce tensions. "Smart systems" need to transmit information and make meaning, which inherently creates needs for standardization and flexibility. This was no less true when the inspection work was done very well. CAD orients those organizing for safety to the systemic evaluation of the communication processes that enact safety and the design work in which those processes are negotiated. To illustrate, we turn now to practical recommendations for status meetings generated through our application and extension CAD and GPT.

First, we recommend that those involved in day-do-day safety oversight make explicit the competing needs for techniques reflecting communication models of transmission and constitution. Even as RSU expanded their understanding of communication, an almost habitual preference for techniques reflecting a transmission model persisted. Members of the leadership team, for instance, were conversant in the scholarly literatures of safety and communication and recognized the usefulness of thinking of communication as a negotiation. Yet, they struggled with even the term "negotiation" because in putting this into practice because as regulators, they had to "speak with one voice" and apply the regulatory framework objectively.

Second, those involved in day-to-day safety oversight should create space for storytelling when needed by making issue complexity and safety significance explicit. Although participants in our study saw the value of storytelling, status meetings tended to preference brevity and technical detail. We were surprised, for instance, that briefers rarely explicitly stated (that is, provided backstory or additional context) why an issue was more or less complex or why an issue mattered. Making this explicit might create signals for the need to engage with an issue in more detail (i.e., to engage in storytelling) that might otherwise be missed.

Third, status meetings should make the boring interesting and the interesting boring by systematically changing routines. Repetitive activities facilitated the status meetings by allowing participants to anticipate the flow of meetings and the questions that might arise, and, RSU was careful to remain focused in status meetings. Yet, it is the very preoccupation with mindfulness that can "encourage simplification and exploitation of existing performance routines, adherence to institutionalized categories, and compliance with inherited job descriptions, all of which represent acts that are largely mindless" (Weick, Sutcliffe, & Obstfeld, 1999, p. 38). In other words, the degree to which repetitive activities might encourage anticipation without reflection is a reason for concern. Changing routines might mean formally rotating who gives information or

who takes notes, randomly changing the order of reporting, shifting the timing of status meetings fifteen minutes earlier or later, and so forth. The intentional, reflexive *experimentation* may be useful in making conversations persistently new and uncomfortable while retaining the benefits and comfort of repetition.

In conclusion, we are reminded of a comment made by one of the participants, that "status is not safety." That is, merely providing, collecting, and deciding information does not produce safety. The RSU worked every day to remember that their conversations were a representation in this sense. Achieving an always ephemeral understanding of safety depended on the degree to which their designs for status meetings negotiated in their design work allowed them to manage the inherent challenges of inspection work.

Barbour, J. B., & Gill, R. (in press). Designing communication for the day-to-day safety oversight of nuclear power plants. *Journal of Applied Communication Research.*

References

Aakhus, M. (2001). Technocratic and design stances toward communication expertise: How GDSS facilitators understand their work. *Journal of Applied Communication Research, 29*, 341-371.

Aakhus, M. (2007). Communication as design. *Communication Monographs, 74*, 112-117.

Aakhus, M., & Jackson, S. (2005). Technology, interaction, and design. In K. Fitch & R. Sanders (Eds.), *Handbook of language and social interaction* (pp. 411-436). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Aakhus, M., & Rumsey, E. (2010). Crafting supportive communication online: A communication design analayis of conflict in an online support group. *Journal of Applied Communication Research, 38*, 65-84.

Barbour, J. B., Jacocks, C. A., & Wesner, K. (2013). Message design logics of organizational change. *Communication Monographs, iFirst*, 1-25.

Barge, J. K., & Craig, R. T. (2009). Practical theory in applied communication scholarship. In L. R. Frey & K. N. Cissna (Eds.), *Routledge handbook of applied communication research* (pp. 55-78). New York, NY: Routledge.

Barge, J. K., & Shockley-Zalabak, P. (2008). Engaged scholarship and the creation of useful organizational knowledge. *Journal of Applied Communication Research, 36*, 251-265.

Craig, R. T., & Tracy, K. (1995). Grounded practical theory: The case of intellectual discussion. *Communication Theory, 5*, 248-272.

Czarniawska, B. (2007). *Shadowing and other techniques for doing fieldwork in modern societies*. Liber, Sweden: Copenhagen Business School Press.

Emerson, R. M., Fretz, R. I., & Shaw, L. L. (1995). *Writing ethnographic fieldnotes*. Chicago, IL: University of Chicago Press.

Geertz, C. (1973). *The interpretation of cultures*. New York, NY: Basic Books.

Gherardi, S., & Nicolini, D. (2000). The organizational learning of safety in communities of practice. *Journal of Management Inquiry, 9*, 7-18.

Gill, R. (2011). The shadow in organizational ethnography: moving beyond shadowing to spect-acting. *Qualitative Research in Organizations and Management, 6*, 115-133.

Goodman, P. S., Ramanujam, R., Carroll, J. S., Edmondson, A. C., Hofmann, D. A., & Sutcliffe, K. M. (2011). Organizational errors: Directions for future research. In B. M. Staw & A. P. Brief (Eds.), *Research in Organizational Behavior: An Annual Series of Analytical Essays and Critical Reviews* (Vol. 31, pp. 151-176).

Jackson, S. (2002). Designing argumentation protocols for the classroom. In F. H. van Eemeren (Ed.), *Advances in pragma-dialectics* (pp. 105-120). Amsterdam: SICSAT.

Leveson, N., Dulac, N., Marais, K., & Carroll, J. (2009). Moving beyond normal accidents and high reliability organizations: A systems approach to safety in complex systems. *Organization Studies, 30*, 227-249.

Mokros, H. B., & Aakhus, M. (2002). From information seeking behavior to meaning engagement practice: Implications for communication theory and research. *Human Communication Research, 28*, 298-312.

Nuclear Regulatory Commission. (2012, October 03). Fact sheet on oversight of nuclear power plants. Retrieved February 25th, 2013, from http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/oversight.html

Nuclear Regulatory Commission. (2013). Reactor oversight process (ROP) Retrieved June 1, 2013, from http://www.nrc.gov/NRR/OVERSIGHT/ASSESS/

O'Keefe, B. J. (1988). The logic of message design: Individual differences in reasoning about communication. *Communication Monographs, 55*, 80-103.

Perin, C. (1995). Organizations as contexts: Implications for safety science and practice. *Organization & Environment, 9*, 152-174.

Perin, C. (2005). *Shouldering risks: The culture of control in the nuclear power industry*. Princeton, NJ: Princeton University Press.

Perrow, C. (1999). *Normal accidents: Living with high risk technologies*. Princeton, NJ: Princeton University Press.

Scott, C. W., & Trethewey, A. (2008). Organizational discourse and the appraisal of occupational hazards: Interpretive repertoires, heedful interrelating, and identity at work. *Journal of Applied Communication Research, 36*, 298-317.

Tompkins, P. K. (2005). *Apollo, challenger, columbia: The decline of the space program*. Los Angeles, CA: Roxbury Publishing Company.

Tracy, K. (1997). *Colloquium: Dilemmas of academic discourse*. Norwood, NJ: Ablex.

Tracy, S. J. (2003). *Qualitative research methods: Collecting evidence, crafting analysis, communicating impact*. Malden, MA: Wiley-Blackwell.

Trethewey, A., & Ashcraft, K. L. (2004). Practicing disorganization: The development of applied perspectives on living with tension. *Journal of Applied Communication Research, 32*, 81-88.

Weick, K. E., & Roberts, K. H. (1993). Collective mind in organizations: Heedful interrelating on flight decks. *Administrative Science Quarterly, 38*, 357-381.

Weick, K. E., Sutcliffe, K. M., & Obstfeld, D. (1999). Organizing for high reliability: Processes of collective mindfulness. In R. I. Sutton & B. M. Staw (Eds.), *Research in Organizational Behavior, Vol. 21, 1999* (Vol. 21, pp. 81-123).