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Parallels of Radiation- and Financial-Risk Management on Public Acceptance

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Abstract - The financial collapse of 2007 provides an opportunity for a cross-discipline comparison of risk assessments. Flaws in financial risk assessments bear part of the blame for the financial collapse. There may be a potential for similar flaws to be made in radiological risk assessments. Risk assessments in finance and health physics are discussed in the context of a broader view of the risk management environment. Flawed risk assessments can adversely influence public acceptance of radiological technologies, so the importance of quality is magnified.

Key words: risk analysis, regulations, risk communication, radiation risk

INTRODUCTION

A number of shortcomings in financial risk management have been identified as having contributed to the subprime mortgage and related financial collapse (Rajan 2009, Reinhart 2008, Dudley 2009, Fed 2009, Zingales 2009). Similarities in the risk management framework include the regulatory framework, interconnectedness, incentives, competition in risk analysis, and innovation. These are discussed below and listed in Table 1.

Potential parallel shortcomings in the assessment of radiological activities are then discussed and listed in Table 2. These are examined in order to encourage rigorous avoidance of such shortcomings. Potential similarities include an attitude of invulnerability, a low appreciation for the risk and a lack of transparency.

The direct risk of a failure in radiological risk assessments is exposure of workers and the general public to some level of harm. A broader risk of such a failure is the harm to public trust and the public's willingness to accept nuclear technology applications even if direct biological harm is

minimal. A risk assessment can be found at fault in the event of an unanticipated incident or upon a diligent review of an organization's technical bases.

PUBLIC TRUST

Public trust in the financial markets and for nuclear technology applications is dependent, in part, on the credibility of the risk assessments in their respective fields.

The US general public rates risk from radiation higher than scientists do (Jenkins-Smith 2009) and have low trust in radiological technical risk assessments (Thomas 2001, Jones 2004, Florig 2006). Public interest groups have less confidence in technical risk assessments than the general public (Sjöberg 2003, Florig 2006, and Ledwidge 2004). It is imperative for radiological assessors to maintain very high standards, use the best science, use the most applicable data, and present analyses that are comprehensive, informative, and understandable (Jones 2004).

Failure to apply high standards to radiological assessments could have a harmful impact on the viability of nuclear applications. For example, with the current international debate over climate change, there is a potential for a larger role for nuclear energy (Jenkins-Smith 2009), but only with public acceptance.

Failing to understand the risk of an operation or process is often found to be a contributing factor of incidents. For example, investigators found that the responsible parties "failed to adequately evaluate and understand the magnitude of the worker safety risks" in a plutonium exposure (USDOE 2003). In its Analysis of Significant Events, Institute for Nuclear Power Operations found that personnel not having an appreciation of the risks associated with their actions was a factor in 70% of the 20 most significant events since 1974 (INPO 2002).

Siegrist et. al. 2003 notes that after an incident, "public relations campaigns emphasizing competence and good track records may be useless." Slovic 1999 notes, "Trust is fragile. It is typically created rather slowly, but it can be destroyed in an instant - by a single mishap or mistake." One of the most important factors in erosion of public trust is past failures of the risk management system (Florig 2001).

SIMILARITIES IN THE RISK MANAGEMENT FRAMEWORK

Regulatory Framework

Both the financial and nuclear industries operate under regulatory frameworks. While the regulations are quite different in many respects, the salient similarity for the risk management framework is that both have developed over the years in response to discovered risks (Rajan 2009, Jones 2005). Both frameworks are subject to variations over the years in their effectiveness to manage risks. While financial regulations are more fluid and radiation protection regulations more static, oversight to both varies with the perceived need.

A weakening of the regulatory framework was viewed as a contributing factor in the financial collapse (Dudley 2009, Rajan 2009). A perceived failure in radiological assessments would lead to a call for increased oversight for nuclear operators.

Interconnectedness

While the nuclear industry does not have the kind of interconnectedness that was a problem for the financial industries, ("This financial crisis has exposed how important the interconnections are among the banking system, capital markets, and payment and settlement systems." – Dudley 2009), any significant nuclear incident tarnishes the reputation of all nuclear operators. "Much of what the media reports is bad (trust-destroying) news" (Slovic 1999).

Incentives

A major driver for the subprime mortgage crisis was the profit in producing AAA-rated securities. The pressure to produce these securities led to lowering of loan requirements (Rajan 2009). Similarly, pressure to continue operating and meet objectives is a normal and expected feature of the nuclear industry (INPO 2002).

Competition in Risk Analysis

The securities analysts were under pressure to provide AAA-ratings or lose the business to a competitor (CNBC 2009). Similarly, radiological risk assessors could face pressure to provide lower assessments of risk. Personnel responsible for controlling costs and driving production could seek out radiological risk analysts who provide assessments that are more favorable.

Innovation

New financial products, especially collateralized debt obligations and (unregulated) credit default swaps were a major cause of the financial crisis (Blanchard 2009). It is hard to predict what innovation could lead to problems in radiological risk assessments, but nanotechnology has been suggested as a possibility (Walker 2009).

Included in the term, innovation, in the financial markets is business structures or products designed for the avoidance of regulation (Zingales 2009). A potential similarity in the nuclear industry would be any project or business approach designed for the avoidance of timely reviews of designs and operations.

SIMILARITIES IN RISK ASSESSMENT PITFALLS

Attitude of Invulnerability and other Decision Traps

In the financial crisis, securities' soundness began to weaken as loan approval requirements were reduced, but AAA-ratings were still assigned to bundled mortgages. One of the factors contributing to the overly optimistic ratings was the idea that the housing market would continue to rise, thus limiting the risk of defaults. Meanwhile, "internal risk managers, who repeatedly pointed to risks that never materialized during an upswing, ha[d] little credibility and influence—that is, if they still ha[d] jobs" (Rajan 2009).

Decision traps were certainly a contributor. Teach 2004 identifies, among others, optimism, overconfidence and self-serving bias as decision traps to be avoided and it is likely that the high ratings were at least partly due to decision traps.

To avoid decision traps and make quality risk assessments, the analyst must overcome the tendency to focus only on what seems to be common sense. We have to look beyond the obvious, beyond a pattern of apparent safety to the low frequency, high impact risks (Taleb 2007). This is not natural or easy and the analyst will likely face objections from people who do not look beyond the obvious and who may be optimistic, overconfident and invested in the process being reviewed.

On the other hand, "public interest groups question the ability of risk assessors to account for all possible failure modes, and to realistically characterize the failure modes that are identified" (Florig 2006). It is incumbent on the assessor to strive to meet this high standard.

Low Appreciation for the Risk

It was well-established orthodoxy to assume that housing prices would continue to rise (Reinhart 2008), so an analyst would naturally not take a potential down-market in housing very seriously.

Radiological analysts are likely to be skeptical of the biological harm at the levels of most accidental radiation exposures (Jenkins-Smith 2009). Such skepticism could lead to an underanalysis of the risk.

For example, an analyst might believe that 0.01 Sv is a trivial dose and therefore ignore a whole class of radiological incidents that could lead to this dose. (On the other hand, it could possibly lead to a dose orders of magnitude higher, since you do not know without analyzing.)

This is an error to be carefully avoided. For even if the "true" biological risk is low, if the analysis fails to identify a risk of regulatory significance, then public scorn is justified.

Lack of Transparency

A lack of transparency contributed to a loss of confidence in the financial crisis (Dudley 2009). The lack of openness in radiological assessments is frequently cited as a cause of distrust (Jones 2004, Thomas 2001, Florig 2006, and Ledwidge 2004).

CONCLUSION

Radiological risk assessments and financial risk assessments share some of the same pressures and potential pitfalls. Both are performed in a framework of influences that can affect their quality.

Quality radiological assessments require careful avoidance of mental traps and an active imagination to consider a wide range of potential incidents.

Public acceptance of nuclear technology is dependent on radiological analysts earning the public trust by performing objective, thorough and transparent analyses.

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Table 1: Parallels in Risk Management Environments

Parallel	**Financial Industry – Financial Crisis of 2007**	**Nuclear Industry – Similarities, Pitfalls to Avoid**
Regulatory Framework	Developed over time to limit risk of economy-threatening financial collapse. Application and enforcement varies over time.	Developed over time to protect workers and the public from radiation exposure. Regulations are slow to change but oversight does vary over time.
Interconnectedness	The banking system, capital markets and settlement systems are interconnected. Weaknesses in one country or large company threaten the financial health of others.	The nuclear industry is susceptible to a loss of public trust when an accident occurs anywhere in the world.
Incentives	Providers of financial products benefit from ratings of low risk.	The nuclear industry can benefit from lower design and operation cost if lower risk is assessed for a process.
Competition in Risk Analysis	Rating agencies were under pressure to give low risk estimates to collateralized debt obligations.	Analysts could face competition from project and operations managers seeking to keep costs low and production high.
Innovation	Regulations failed to keep up with new products.	Potentially, new activities could exceed the regulatory framework.

Table 2: Contributors to Potential Weaknesses in Financial and Radiological Risk Assessments

Parallel	**Financial Industry – Financial Crisis of 2007**	**Nuclear Industry – Similarities, Pitfalls to Avoid**
Attitude of Invulnerability	Some thought the risk of acute financial crises was a thing of the past or relegated to emerging markets.	As time grows between incidents, there could be a tendency to assume risk of radiological events is merely an academic exercise.
Low Appreciation For The Risk	Housing prices were assumed to continue to rise, therefore, subprime mortgage risk was deemed very low.	The widespread belief in the nuclear industry that radiation risks are exaggerated could lead to assuming that the impact of radiological incidents is low.
Lack of Transparency	Lack of transparency contributed to a loss of confidence, particularly over-the-counter securities and their associated derivatives.	Lack of transparency in radiological assessments weakens their credibility.

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