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The Nuclear Accident at Three Mile Island a Practical Lesson in the Fundamental Importance of Effective Communications

John C. DeVine Jr.
Principal
Polestar Applied Technology, Inc.
Los Altos, California

ABSTRACT

The Three Mile Island Unit 2 (TMI-2) accident in March 1979 had a profound effect on the course of commercial nuclear generation in the United States and around the world. And while the central elements of the accident were matters of nuclear engineering, design and operations, its consequences were compounded, and in some respects superseded, by extraordinarily ineffective communications by all parties at all levels. Communications failures during the accident and its aftermath caused misunderstanding, distrust, and incorrect emergency response – and seeded or reinforced public opposition to nuclear power that persists to this day. There are communications lessons from TMI that have not yet been fully learned, and some that once were learned but are now gradually being forgotten.

The more glaring TMI communications problems were in the arena of external interactions and communications among the plant owner, the Nuclear Regulatory Commission (NRC), the media, and the public. Confusing, fragmented, and contradictory public statements early in the accident, regardless of cause, undermined all possibility for reasonable discourse thereafter. And because the TMI accident was playing out on a world stage, the breakdown in public trust had long term and widespread implications. At the plant site, both TMI-2 cleanup and restart of the undamaged TMI-1 unit met with years of public and political criticism, and attendant regulatory pressure. Across the nation, public trust in nuclear power and those who operate it plummeted, unquestionably contributing to the 25+ year hiatus in new plant orders.

There were other, less visible but equally important, consequences of ineffective communications at TMI. The unplanned "precautionary" evacuation urged by the governor two days after the accident – a life changing, traumatic event for thousands of residents – was prompted primarily by misunderstandings and miscommunications regarding the condition of the plant. And today, nearly 30 years after the event, many in our nuclear industry have insufficient knowledge or regard for the underlying nuclear safety vulnerabilities revealed by the accident, in part because these have not been well explained.

From this single, compelling experience, many lessons can be drawn. Some of these were recognized early and taken to heart by those who own and operate nuclear plants – but over time, respect for their importance has given way somewhat to the seemingly more urgent practicalities of plant cost, schedule and production goals. In other cases, the lessons have remained largely obscure.

This paper will describe in greater detail the communications aspects of the TMI accident, lessons that can be drawn from them, and their implications on current and future nuclear facility operation. The paper reflects the author's personal, direct experience as part of the accident response team and subsequent cleanup operations at TMI.

THE ACCIDENT AT THREE MILE ISLAND UNIT 2

At almost exactly 4:00am on March 28, 1979, an apparently minor equipment problem at the Three Mile Island Unit 2 (tmi-2) nuclear plant in Middletown Pennsylvania triggered an automatic reactor shutdown. Automatic shutdown of nuclear reactor – called a reactor "scram" - is a precautionary measure intended to keep the reactor in a safe condition. While not frequent, it is nonetheless a relatively straightforward and inconsequential plant action, usually followed by routine checks, repairs if needed, and restart of the plant often within a day or two.

That was not the case at TMI-2 on March 28, 1979. The reactor scram laws the first step in a spiral of rapid events that included a stuck valve, misunderstanding and misdiagnosis of plant conditions by the plant operators – who consequently prematurely terminated important automated protective actions – and ultimately overheating and major damage to the nuclear plant core, release of massive quantities of radioactive contamination inside the plants containment and much smaller, but still significant amounts to the environment. Although the time line of core damage would not be fully understood for more than a year, it was ultimately determined that the 100 ton nuclear core of the TMI reactor was essentially destroyed by about 6:20 that morning – only two hours and twenty minutes after the initiating event, long before anyone in the public learned of a "TMI Accident" and before even the plant operators had any sense of the magnitude of the event.

The rest, of course, is history. Over the succeeding days and weeks, the Three Mile Island accident and recovery was played out on the world stage. Continuing confusion and miscommunication led to the partial (and unnecessary) evacuation of the surrounding areas (TMI is only a few miles from Harrisburg, the capitol of Pennsylvania). The TMI-2 plant was irreparably damaged and never operated again, and its adjacent sister plant, TMI-1, although undamaged, was not permitted to operate by the Nuclear Regulatory Commission (NRC) for the next six years. The plant owner – the Metropolitan Edison Company (MetEd) and its parent, the General Public Utilities (GPU) Corporation – lost billions of dollars, and for a time was close to bankruptcy. Across the nation and around the world, public confidence in nuclear power plummeted, unquestionably a factor in the subsequent 30 year hiatus in new nuclear construction in the United States.

Although the TMI-2 accident is generally viewed as a matter of nuclear engineering, design and operations, its consequences were compounded, and in some respects superseded, by extraordinarily ineffective communications by all parties at all levels. Communications failures during the accident and its aftermath caused misunderstanding, distrust, and incorrect emergency response – and seeded or reinforced public opposition to nuclear power that persists to this day. There are communications lessons from TMI that have not yet been fully learned, and some that once were learned but are now gradually being forgotten.

What happened – and what did not

Evaluation of the effectiveness of communications at TMI-2 – particularly in light of the misperceptions about that event that still persist – requires as a starting point at least a basic understanding of the physical consequences of the accident. The accident has been examined exhaustively by public and private organization – it is at this point, perhaps the most thoroughly examined industrial accident in history – and the objective conclusions are clear. Debates and misperceptions notwithstanding, it is absolutely clear that no one, on site or off site, was harmed. And the environment was not harmed in any lasting or substantive way.

In a sense, the accident validated the robust design of U.S. nuclear plants and value of their defense-in-depth design philosophy. But at the same time, a broader examination of the event shows that it could have been more severe under moderately different circumstances, so the relatively benign public health and environmental consequences should not be viewed as a guarantee that serious nuclear accidents present no risk.

The short and long term financial consequences to the plant's owner, and to the industry at large, are similarly clear.

Communications failures during and following the accident

It would be difficult to envision a scenario in which there could have been a more complete breakdown in communication. From the very first moments of the accident, and at essentially every subsequent point, there communications failures that aggravated, or masked, or confused the situation and that collectively contributed to the overall outcome.

The more glaring TMI communications problems were in the arena of external interactions and communications among the plant owner, the Nuclear Regulatory Commission (NRC), the media, and the public. Confusing, fragmented, and contradictory public statements by company personnel to the public early in the accident, regardless of cause, undermined all possibility for reasonable discourse thereafter. Miscommunications within the GPU system (both at the plant and between the plant management, corporate management, and company technical resources in company headquarters in New Jersey) not only contributed to poor communications with the public, but they also hampered or delayed diagnosis, support and correction of plant conditions. And miscommunications internally within NRC led directly to the unnecessary – and for many, terrifying – sudden evacuation recommendation from the Governor of Pennsylvania on the morning of March 30th.

The term "ineffective communication" may not convey clearly enough the depth of communications-related breakdowns that contributed to the TMI-2 event. Several

anecdotes add meaning to the issue. All are well documented in the NRC's Rogovin Report[1], the president's Kemeny Commission[2] Report, and others:

- Early on the morning of March 28th, while the accident was still unfolding in the plant, a popular local Harrisburg morning radio disc jockey, monitoring local CB broadcasts for items of potential news interested, picked up a brief police transmission related to an undefined problem at TMI. Sensing a possible story, he contacted the plant and was connected in turn with MetEd's TMI spokesman – who happened to be stationed at MetEd's Reading PA headquarters and whose normal TMI duties consisted of PR events, plant tours and the like. The MetEd spokesman gave the stock response – "no problem, routine, no radioactivity release, not to worry…". This grossly inaccurate report was understandable, in that under normal circumstances it would have been accurate and at that point he had no information to the contrary.

  This broadcaster accepted MetEd's explanation and chose not to make any announcement on the radio about the TMI problem. Later, when the TMI-2 accident became the news event of the decade, he realized that his trust of MetEd had cost him the once-in-a-lifetime opportunity to break a huge news story – and of course he and his media colleagues developed a lasting distrust of MetEd and GPU.

- On the morning of March 29th, the day after the accident, MetEd's president made guest appearances on several nationally broadcast morning television shows. In his interviews he stated that safety systems had performed properly and that the plant would likely be back on line within a few weeks.

  Clearly he was uninformed about the still ongoing events at the plant. At that moment, in fact, plant staff was still struggling to understand and control conditions in the damaged reactor – and a day later, based on the belief that the plant safety was deteriorating, the Governor of Pennsylvania ordered the precautionary evacuation. In fairness to the MedEd president, it must be noted that the full extent of core damage was not determined more than a year after the accident. But by the morning of March 29th, it was clear to all involved that the damage had been very severe and would require very substantial (if yet undefined) analysis and repair.

  Whether caused by misinformation or by misguided attempt to diminish unwarranted public anxiety, this totally incorrect appraisal had the effect of further painting the

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[1] United States. Nuclear Regulatory Commission. Special Inquiry Group. *Three Mile Island : a report to the Commissioners and to the public.* Washington, D.C.: Nuclear Regulatory Commission, Special Inquiry Group, 1980. 2 vols. in 4. [Aka "Rogovin report."] Available at http://www.threemileisland.org/

[2] United States. President's Commission on the Accident at Three Mile Island. *The need for change, the legacy of TMI : report of the President's Commission on the Accident at Three Mile Island.* Washington, D.C. : The Commission, 1979. [Aka "Kemeny Commission report."] Available at http://www.threemileisland.org/

corporate management as uncaring, dishonest and self-serving, and it undermined in advance public confidence in subsequent company statements.

- At the time of the accident, there had been little planning or preparations for media communications like the "Joint Information Centers" set up at plants today for that purpose. The job of leading MetEd communications, both with media and with state officials, in the first days of the accident fell to Mr. John (Jack) Herbein, the TMI Site Vice President. This was problematic because Mr. Herbein's primary responsibility was management of the plant, which in those chaotic days was a consuming task. Furthermore, he had no experience and training for that sometimes contentious public communications role.

  During a media briefing on March 30th, facing a skeptical and unruly group of reporters and asked by one to explain a fragment of hearsay information about the plant, Mr. Herbein uttered the now-famous response "Do I have to tell you people *everything*?" His frustration was evident because he had in fact been trying very hard to provide clear and complete information about the very fluid ongoing events – but his words, replayed on TV broadcasts everywhere, conveyed a very different impression. From that point, MetEd was never again an effective spokesman and soon afterwards the company abrogated its media communications role to the NRC – a move that satisfied the immediate demand for "credible" information, but aggravated the longer term situation by creating the incorrect perception that NRC had taken over management of the plant from the licensee, MetEd.

- No one who was involved in or affected by (including members of the nearby public) the uncertain days after March 28th can forget the frightening reports regarding the "hydrogen bubble" in the reactor vessel or the evacuation on March 30th prompted by concern that it could trigger an explosive failure of the vessel and massive off-site release of radioactivity. This entire string of events was rooted in technical misunderstanding, miscommunication and unfortunate coincidence, as well documented by the Kemeny and Rogovin reports.

  The related episodes of hydrogen bubble concern and evacuation recommendation are complex and merit more full explanation than possible in this brief paper. But the bottom lines – the nearby public was first traumatized by concern about an event (detonation of the "bubble") that was either physically impossible or extraordinarily unlikely, and then asked to leave their homes (some feared forever) based on on that concern in combination with misinterpretation and miscommunication of in-plant conditions. That sequence is, in itself, a textbook example of both the difficulty and importance of correctly communicating technically complex information under stressful conditions.

Why??

There is a very legitimate set of questions regarding the above communications failures at TMI-2 that deserves consideration: What is the root cause of these failures? Are they

anomalous or unique to the TMI-2 event – or would it be reasonable to expect similar breakdowns for technically comparable events at other stations? And have the problems been addressed and fixed?

It is the author's view that there are several root causes of the TMI-2 communications failures; that these are now well understood; that they are not unique to TMI-2 in 1979 (that is, similar breakdowns would have occurred in similar accident circumstances elsewhere); that effective steps have been taken within the U.S. nuclear industry to improve communications effectiveness; but that some of this positive experience may have been diminished with time and with a new generation of plant managers and executives who did not personally experience the TMI situation.

The primary factors contributing to the severe communications during the TMI-2 accident are as follows:

1. **Mindset**. The Kemeny Commission attributed the accident itself, in large measure, to the plant staff and nuclear industry *mindset* that the design and regulatory requirements for nuclear reactors are so conservative that that the chances of a serious accident are essentially nil. This is, in a sense, a subtle intellectual arrogance that can bias decision making and color interpretation of information. In the TMI-2 event, there was an initial under-reaction (serious industrial accidents often take the form of gradual disintegration of seemingly manageable events) and even as it unfolded, plant operators seemed unable to grasp the possibility of a core-damaging loss of coolant accident. The author believes that this mindset contributed directly to the miscommunications early in the event.

2. **Confusion**. For a variety of reasons, the accident progression looked very different to the plant operators from all the situations they had been trained to deal with. As the situation seemed to deteriorate and the corrective actions taken by operators repeatedly did not yield the expected results, the confusion led to escalating stress and ever more frantic human reactions – a situation ripe for communications breakdown.

3. **Lack of preparation.** Perhaps because of the mindset that serious accidents were simply not going to happen, NRC requirements and utility (including MetEd) practices included minimal systems, facilities, training, rehearsal, etc. for dealing with real events. As an example, because of phone line overload, telephone communications among plant personnel, support organizations, NRC, state officials and other players were severely constrained, and in numerous cases (communications leading up to the March 30th evacuation) this contributed directly to flowed decision making.

4. **Controversy.** The late 1970s was a period of rapidly expanding nuclear power plant construction and corresponding rapidly escalating anti-nuclear sentiment and organized opposition to the expanding nuclear fleet. (As a matter of eerie coincidence, the popular anti-nuclear film "The China Syndrome", starring Jack Lemon and Jane Fonda, had been released only a few weeks before the TMI-2

Of primary importance to nuclear plant managers and emergency planners is that, to some extent at least, three of these factors are quite likely, and the fourth (effective preparation) while very important, cannot compensate for the other three. Rather, plant operators must learn to deal realistically with the challenges of effective communications under emergency conditions.

Actions taken to improve communications effectiveness since TMI-2

The long and painful recovery of the GPU System – the company came close to bankruptcy on several occasions after the accident – included a period of deep introspection and fundamental changes in all aspects of its operation. Changes related to communications included:

- Corporate philosophy that recognized and elevated the visibility and stature of the communications function.
- Establishment of world class communications facilities with full staff of trained professionals, many of whom had experience in print and electronic communications media.
- Full compliance with new NRC requirements regarding emergency preparedness, with particular attention and training in communications, both internal and external.
- Proactive steps to build relationships and to support local media personnel, including such actions as holding technical briefings and providing extensive plant information so that media personnel could develop a solid understanding of plant issues *before* an accident occurred. And very importantly, demonstrating over and over, by its actions under all circumstances, that information released by the company was correct, complete and timely.
- Most importantly, building trust within the surrounding communities. As a key example, GPU management committed to providing personal briefings, by senior management personnel, to visit and host open public meetings in each community within ten miles of the plant, at least once per year. This was a burdensome and unprecedented commitment, and in the early years many of those meetings were difficult and contentious, but over time people got to know the company management and built a level of trust that had never existed before the accident.

To some degree, the industry as a whole has followed suit and all plants have upgraded emergency planning facilities, processes and training to meet NRC requirements.

Will the changes have lasting effect?

This author believes that, unfortunately, there are indications that communications effectiveness in commercial nuclear operations may be declining.

First, the cost of the kinds of aggressive corrective action taken by GPU is quite high, particularly in manpower. Over time, with nuclear safety continuing to be maintained at an extraordinarily high level throughout the industry and with diminishing financial resources in a competitive, deregulated utility marketplace, it is not surprising to see less and less commitment to strong, proactive nuclear communications efforts.

Similarly, the TMI-2 accident happened almost three decades ago – fewer and fewer of today's plant operators were employed in the nuclear industry in 1979 – and the absence of first hand recollection understandably leads to a sense that TMI-2 is "ancient history", an event that certainly will not befall today's better plants and smarter, better operations (that *mindset* again). The near catastrophic degradation of the Davis Besse reactor vessel head a few years ago demonstrates emphatically that constant vigilance is essential, but human nature conspires against such sustained vigilance in the absence of "real" events.

On the other side of the equation, greatly improved emergency planning requirements, improved training, and a generally maturing technology all do in fact provide improved safety and lessen the chance of another accident of TMI-2's severity and its attendant demands for very effective communications

COMPELLING LESSONS

From the TMI-2 accident and all of its consequences, a few key conclusions regarding its communications aspects are clear:

1. **Effective communications are central (not peripheral) to success** of operation of industrial technologies (like nuclear power plants) in the public sector. In the TMI-2 case, the accident had huge economic consequences for an entire industry, it could have been worse, and communications breakdowns played an important part in the overall event.

2. **Trust is key to effective communications** - and once the accident starts, it's too late (way too late) to start building trust. The trust and mutual respect among operators, regulators and public can only be built over time and must be reinforced and demonstrated continually.

3. **Time is of the essence**. First impressions (initial communications) during an unfolding accident set the tone for all that follows. Silence from the plant operators during spawns confusion, distrust, misdirection, fear. Initial misinformation can be debilitating, undermining or discrediting all subsequent messages. Perfect clarity, too late, is rarely helpful.

4. In a complex technical situation, **precise technical detail does not necessarily enhance understanding** – it often has the opposite effect. It is very important to find ways to reduce the message to its central elements, and to convey those truthfully and simply.

5. **Constant training and practice** is the only way to prepare an organization to deal with communications challenges under real life emergency conditions. (In this author's experience, in the critique following every drill, it is inevitable that someone relates communications problems. Bingo.)

IN SUMMARY

The Three Mile Accident was the most severe nuclear accident in U.S. history. It also is perhaps the most studied industrial accident of any kind in U.S. history. Exhaustive examinations of the public health consequences of the accident show convincingly that the effects of radioactivity releases, if any, were imperceptibly low.

It is generally agreed, however, that there have been perceptible health consequences from the TMI-2 accident – those linked to stress. Stress to members of the public, particularly those living near the plant, was unquestionably high. And for some the combination of rumor, confusion, contradictory reports and uncertainty, all leading to an evacuation recommendation from the governor, took a toll.

It could be argued that the ineffective internal and external communications during the course of the event were as influential to the outcome as the equipment and operational breakdowns that are now so well understood. And for that reason alone, this accident points out that communications capabilities – staffing, systems, facilities, training – can be as important to protection of the public, the plant and the environment as are the plant material and technical issues that receive constant attention.