"Three Mile Island – Looking Back On Thirty Years of Lessons Learned"

Testimony
by
Dick Thornburgh
Former Governor of Pennsylvania
Counsel, K&L Gates LLP

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It is not easy for me to forget that date nearly 30 years ago – March 28, 1979 – when we were called upon to deal with something that had never occurred on the face of the earth, the threat of a nuclear meltdown at the Three Mile Island nuclear plant, not far from the state capital in Harrisburg, Pennsylvania.. You have asked that I share with you some of the lessons learned from that event which occurred shortly after I had taken office as governor of Pennsylvania and I am pleased to join you this morning for that purpose.

Let's begin at the beginning. Only one thing was on my mind at 7:50 that morning. As a governor in office only 72 days, I was vitally interested in securing passage of my first budget – one that would reflect my administration's priorities for the Commonwealth of Pennsylvania – and I was hosting a breakfast meeting at the Governor's Home for freshmen Democratic legislators to seek bipartisan support for my fiscal plan.

At 7:50 a.m., however, a telephone call from the state director of emergency management interrupted our meeting. Hew told me that there had been an accident at the Three Mile Island nuclear power plant, located just ten miles downstream of us, in the middle of the Susquehanna River.

I knew immediately that our ambitious agenda for leadership was about to be rudely amended.

What happened in the next five days is history.

I.

DAY ONE

The problem had actually begun at 4 o'clock in the morning, when vital cooling water started to escape through an open valve in the newer of two nuclear reactors at the plant.

For the next two-and-a-quarter hours, plant operators failed to read these symptoms correctly, failed to close that valve, and mistakenly shut off an emergency cooling system that otherwise would have operated automatically.

The reactor core overheated, and the worst accident in the history of commercial nuclear power in the United States was well underway by sunup.

We know now that while some of the reactor fuel heated to the point of melting, a disastrous "meltdown," as suggested in the popular movie "China Syndrome," would be avoided.

We know now that while detectable amounts of radiation escaped into our air and water, and even into our milk, during the days of tension that were to follow – the amounts were limited and their impact on public health, if any, remains debatable.

And we now know that a massive evacuation of the up to 200,000 people residing in the area, and its potential for panic, injury and even loss of life, would have been far more dangerous and damaging than was the accident itself.

But when I answered the phone at 7:50 on that March morning in 1979, we knew none of this.

Nuclear power was still the technological marvel of our time – to some the ultimate answer to our growing energy problems, a source of electricity once described as "too cheap to meter" – and an industry whose safety record had been, or at least was thought to have been, second to none.

I had neither reason nor inclination to challenge these assumptions – except, perhaps, the one about my light bill being too cheap to meter. Nuclear jargon was a foreign language to me, and my exposure to emergency management at a nuclear power plant was limited to a perfunctory briefing just after taking office.

I knew enough, however, that the thought of issuing a general evacuation order first entered my mind at 7:50 that morning and never left me through the unprecedented days of decision that followed.

On the first day, it was not yet clear that the governor would have to personally manage the civilian side of this crisis, but it was very clear that a new administration, with ultimate responsibility for public health and safety, had better start asking questions, analyzing answers, and preparing for the worst.

Because we were so unfamiliar with the existing state bureaucracy, and because there simply was no state bureau of nuclear crisis management, as such, let alone a precedent to study, we did something at the outset which was to serve us very well.

In lieu of the existing bureaucracy, I assembled what might be called an "ad hocracy" – a team of close associates whose judgment and competence I had come to trust and a support group of relevant state specialists whose judgment and competence were about to be tested under pressures none of them ever had known before.

The ad hocracy reported to me only periodically at first, and those reports were sandwiched between other pressing, but somewhat normal, affairs of state.

At the outset, I believed it was important to try to conduct business as usual in the governor's office, and perhaps even more important to appear to be doing so.

As the implications of the accident became more apparent, however, I began to cancel other appointments, and the ad hocracy virtually moved into my office for an extended, and unforgettable, stay.

Our first task was to find out exactly what was happening at the site of the accident. My training as an engineer and a lawyer had given me a well-developed respect for the integrity of

facts which was to serve me well throughout this experience. As I had in those professional endeavors, I was to instinctively demand much more of my sources than mere opinion, conjecture, guesswork or contradictory allegations. I wanted the facts as best as they could be determined and as quickly as they could be assembled.

In the case of TMI, this could prove to be far more difficult than any of us imagined.

The utility, its regulators and other groups and institutions appeared to be contradicting each other, or telling the public either less than they knew or more than they knew. Self-appointed experts began to exaggerate either the danger or the safety of the situation.

The credibility of the utility, in particular, did not fare well. It first seemed to speak with many voices, and then with none at all.

On that first day, it made its debut by seeking to minimize the accident – assuring us that "everything is under control" when we later learned that it wasn't, and that "all safety equipment functioned properly" when we later learned that it didn't.

And even when company technicians found that radiation levels in the area surrounding the island had climbed above normal, the company itself neglected to include that information in its statement to the public.

The company had also vented radioactive steam into our air for two-and-a-half hours at midday, without informing the public.

It fell to us then, to tell the people of central Pennsylvania, as my lieutenant governor did at a 4:30 p.m. press conference, that "this situation is more complex than the company first led us to believe," that there had indeed been a release of radioactivity into the environment, that the company might make further discharges, that we were "concerned" about all of this, but that off-

site radioactivity levels had been decreasing during the afternoon and there was no evidence, as yet, that they ever had reached the danger point.

Although we continued, throughout the crisis, to monitor what utility officials were saying, we began to look elsewhere for sources of information that would be more credible to the public, as well as helpful to us. Among others, we turned inevitably to federal engineers and inspectors who had spent most of the first day inside the plant.

Three of these on-site government experts briefed us at the Governor's Residence that night and joined the lieutenant governor in a 10 p.m. press conference that was to put a long Day One to bed for most members of the ad hocracy.

I was to prove an exception. My past reading habits would delay what otherwise might have been a deep, comfortable and much-needed sleep, because I recalled reading a book, reassuring entitled "We Almost Lost Detroit," an account by John G. Fuller of problems at the Enrico Fermi nuclear power plant in Michigan. I remembered Fuller's discussion of the consequences of core damage at the Michigan plant and realized that our federal experts had not raised this issue with respect to TMI during our evening briefing.

It is well to remember that, in 1979, few people realized there really was no danger of an actual nuclear explosion – mushroom cloud and all – from a nuclear power plant. That isn't physically possible.

The real catastrophe – as outlined by Fuller – would be the overheating of the reactor core to the point where it actually melts down and burns through its concrete and steel containment, thereby releasing massive amounts of radioactive material which, silently, but lethally, could contaminate the environment for miles around, and for centuries to come.

The term "China Syndrome" was derived, in fact, from the theory that such a core would be so hot it actually could burn its way through to the other side of the earth.

Ironically, the movie of that name was running in Harrisburg area theaters that week and its script incredibly described a meltdown as having the potential to contaminate an area "the size of the state of Pennsylvania"!

I did manage to get to sleep that night, but I began Day Two with my new skepticism toward the experts and the industry fully intact.

II.

DAY TWO

As the authors of a specially commissioned report were to write much later, the second day of the crisis was an "Interlude, a day for the drawing of deep breaths . . . a good time for Members of Congress to put in an appearance," which, of course, they did.

Chairman Joseph Hendrie of the NRC, meanwhile, was telling a congressional committee in Washington that we had been "nowhere near" a meltdown, although he had no way of really knowing this at the time. The company was holding its first full-fledged press conference since the accident and telling reporters that the plant was "stable" and that the controlled release of limited amounts of radioactivity into our atmosphere soon should be terminated. There seemed to be a feeling among those in charge that the worst of the accident had been passed. I wanted to believe that, of course, but I was not so sure.

The effort to get a true "fix" on the situation was hampered by self-appointed experts and eyewitnesses of dubious distinction who continued to feed us unsubstantiated stories about dead animals, along with exaggerated warnings, various evacuation schemes, and a ridiculous tale – prompted by a poorly-worded NRC press release in Washington – of radiation so powerful that it

was penetrating four feet of concrete and spreading across the countryside up to 16 miles from the plant. There also were signs popping up in grocery store windows proclaiming, "we don't sell Pennsylvania milk."

At the same time, we were aware that utility company efforts to cool down the reactor were not working as well as expected and that a certain air of apprehension was beginning to affect all those monitoring the process of recovery.

Public faith in the experts and institutions was beginning to erode and it was clear that the credibility of the governor's office was to become much more than simply a political asset for its occupant. That credibility was to become, perhaps, the last check against a possible breakdown in civil authority, and the chaos and panic such a breakdown surely would ignite. Obviously, we were determined to preserve that check.

The time had come, I felt, for the state to become more visibly active and to use whatever credibility we had maintained to put things back into perspective – to establish, in other words, that the situation was not as bad as some would have us fear, nor as good as others would have us believe. We all agreed it was time for me to become publicly involved in the effort.

In my briefing to the press that day I noted that while there was no cause for alarm, we would remain alert. I stated that "I have spent virtually all of the past thirty-six hours trying to separate fact from fiction about this situation. I feel that we have succeeded on the more important questions . . .", although I privately suspected that the latter was a bit of an exaggeration. I was followed by one of the experts from the NRC – a staff member who declared, to my astonishment, that "the danger is over," a comment definitely not in the script.

I learned later that night that another on-site expert privately disagreed with this assessment, and that water samples indicated that "core damage is very bad."

Thus, Thursday ended on this somewhat edgy note, but it was a mere prelude to a Friday I will never forget.

III.

DAY THREE

That was to become known as the day of the great evacuation scare – the day that illustrated not only the folly, but the very real danger, of trying to manage this kind of an emergency by long distance.

It began, once again, in the early morning hours, when the shift operators at TMI were alarmed by a buildup of steam pressure in a valve. Without approval from anybody, they simply opened the valve and allowed the steam, along with a substantial amount of radioactive material, to escape into the atmosphere.

It so happened that, at that precise moment, a helicopter was taking radiation readings directly above the plant's exhaust stack. Not surprisingly, they indicated a very high radiation exposure rate – 1200 millirems per hour – a rate certainly high enough to warrant an evacuation, if the readings had been taken in nearby Middletown, in Harrisburg – or anywhere off the plant site itself.

But coming directly out of the stack, where the materials immediately were dispersed, such a reading was no more significant than those taken on the previous two days of the crisis.

Unfortunately, in a classic manifestation of what I later was to call the "garble gap" between Harrisburg and Washington, the NRC's Washington-based Executive Management Team thought that the readings had, indeed, been taken in an off-site area and decided to recommend that we evacuate all residents within a five-mile radius of the plant.

Also, unfortunately, this Washington group forwarded its recommendations up to us through our Emergency Management Director instead of our radiation protection director – the latter of whom could have corrected the error and spared central Pennsylvania from reaching the very brink of panic which was to ensue.

And even more unfortunately, the emergency management director called a local civil defense director, who called a local radio station with the news that an evacuation order from me might well be imminent. I had yet to be so informed.

When the word finally did get to me that a "Doc Collins" from Washington was saying we should evacuate, I was dumbfounded. I had no idea who "Doc Collins" was or by what authority or for what reason he was making such a recommendation – and I certainly did not intend to evacuate thousands of people on such incomplete information.

For no matter how well planned, massive evacuations had the potential to kill or injure people – especially the aged and infirm, infants in incubators, other hospital patients, and even the able-bodied bystander who, like the usher in a burning theater, happens to be in the wrong place at the wrong time.

I finally connected with the NRC chairman, and by the time I reached him, his staff had discovered what my own radiation experts were telling me: that the evacuation advisory was a mistake. The NRC group withdrew that advisory, and I immediately went on the radio to assure our people that the alarm was a false one and that there was to be no general evacuation. My difficulty in getting answers was compounded by the jamming of the switchboard – thanks not only to the premature disclosure of an erroneous evacuation advisory, but by the mysterious tripping as well of an emergency siren that soon had hearts pounding and eyes widening all over the city.

People were throwing their belongings into trucks and cars, locking up their shops and homes and packing to get out of town. If ever we were close to a general panic, this was the moment.

For the moment, however, the evacuation question was not entirely settled. While relieved that a general evacuation was unnecessary, the confusion which that episode exposed in Washington as well as in the plant and the uncertainty over what might happen next, troubled us deeply.

We began to wonder on our own if pregnant women and small children, those residents most vulnerable to the effects of radiation, yet relatively easy to move, should be encouraged to leave the area nearest the plant. We decided to put that question directly to Chairman Hendrie, who answered, "If my wife were pregnant and had small children in the area, I would get them out, because we don't know what's going to happen."

Shortly after noon on Day Three of the crisis, therefore, I recommended that pregnant women and preschoolers leave the area within five miles of the plant until further notice, and that all schools within that zone be closed as well.

I also ordered the opening of evacuation centers at various sites outside the area to shelter those who had no place to go.

"Current readings," I told the people, "are no higher than they were yesterday [but] the continued presence of radioactivity in the area and the possibility of further emissions lead me to exercise the utmost of caution."

Shortly after that, I was on the phone with President Carter at the White House. It was time to go to the top. Our two staffs had put aside partisan interests in dealing with this crisis

from the beginning, and rightly so. They had developed the kind of "friendship under fire" such incidents frequently promote.

My first conversation with the president was therefore honest, open, direct and above all, productive.

I asked for, and the President agreed to send us, a high-ranking professional who could go to Three Mile Island as his personal representative, merge solid technical and management expertise with an on-site perspective, and report accurately and directly to the White House, to me, and to the people on what was going on out there, what was not going on, and why.

His choice for this task, Harold Denton, the NRC's director of nuclear reactor regulation, turned out to be a near-perfect one, and his arrival later in the day would represent a turning point in the crisis.

Harold Denton arrived at the plant that afternoon. A three-way hotline was installed there to connect him with me and with the President. Later that night, Harold and I met for the first time and spent an hour-and-a-half reviewing the situation.

It was quite clear that his slow and relaxed North Carolina drawl, his way of smiling naturally as he spoke, his ease and apparent candor with the press, his ability to speak plain English as well as nuclear jargon – all of these factors soon were to make him the world's most believable expert on the technical situation at TMI. And it wasn't to be long before his value would be put to the test.

While he was on his way up to Pennsylvania, his colleagues in Washington finally referred publicly to the theoretical possibility of a meltdown, an accurate but poorly handled statement which caused even that most credible of all Americans, Walter Cronkite, to lead the CBS Evening News by saying, "we are faced with the remote but very real possibility of a

nuclear meltdown at the Three Mile Island atomic power plant." One could almost feel the collective shudder going through central Pennsylvania at this pronouncement.

Harold Denton joined me in a press conference at 10 that night, put the facts in perspective, lowered the level of concern and earned his spurs with the press – and with me.

While we did continue to crosscheck his observations against those of my own team, we quickly became convinced that he was as credible as he appeared to be.

As Day Three wound down, I felt we finally were equipped to handle the misstatements, second-guessing and false alarms that were certain to continue.

IV.

DAY FOUR

Harold Denton's long series of regular press briefings in Middletown, near the plant site, began on Day Four, Saturday, March 31.

A brief visit to those young mothers and mothers-to-be who had been evacuated to the Hershey Sports Arena that day preceded yet one more scare to the people of central Pennsylvania.

Based on information given to it by an anonymous NRC source in Washington, a wire service ran a news bulletin that evening that read:

> "U-R-G-E-N-T . . . The NRC now says the gas bubble atop the nuclear reactor at Three Mile Island show(s) signs of becoming potentially explosive . . ."

This fear was totally groundless. The hydrogen bubble never would explode in the reactor vessel. As one review of the crisis later recalled: "It would blow up, instead, in the media."

The bulletin, in its most cryptic and chilling form, moved like a hurricane advisory across the bottoms of prime-time television screens everywhere that Saturday night. In Harrisburg, people streamed out of downtown bars and restaurants. Our switchboard jammed again, and a herd of reporters stampeded into my press office, not for the story itself, but demanding to know if they should get out of town. Obviously, we had to move fast.

We called Harold Denton at the plant and learned that there was no danger of imminent explosion and no cause for alarm. My press secretary, skipping our normal clearance procedures, banged out a three-paragraph statement to that effect and literally ran it down to the capitol newsroom.

Concurrently, we asked Denton, who was on his way to my office, to go directly to the newsroom instead – which he did.

Within minutes, stories quoting our statement, and then Harold's impromptu news conference, began to move on the wires, and another potential panic seemed to have been avoided.

In the course of this "bubble" drill, we had been in touch with the White House and discussed the possibility of a visit to the area by the President himself. Press Secretary Jody Powell authorized me to say that the President would, indeed, be joining us in the near future, and I did. Powell issued a similar advisory out of Washington. That was to be, in effect, the end of the panic avoidance phase of our crisis.

V.

DAY FIVE

The President and Mrs. Carter did arrive the very next day, and he and I toured the plant together – in full view of network television cameras. The image beamed around the world on

April 1, Day Five of the crisis, had its desired effect. If it was safe enough at Three Mile Island for the Governor of Pennsylvania and the President of the United States, it had to be safe enough for anyone.

Over the next several days, Harold Denton continued to oversee the cooling of the reactor core and offer progress reports to a press contingent that was fast losing interest in the story.

On Friday, April 6, just ten days after that fateful opening of what had become the most famous power plant valve in the world, I prepared to tell our people that the crisis had been passed, and that those who had chosen to leave the area "can, indeed, come home again." And the crisis wound down.

VI.

LESSONS LEARNED

The experience of Three Mile Island provided a number of lessons useful not only in managing unforeseen crises, but some of the normal problems of governing as well. Let me try to summarize these.

1. Perhaps the first among these lessons is to "expect the unexpected" and be prepared to adjust accordingly. As governor, I was to find that if it wasn't Three Mile Island, it was three-mile gas lines. If it wasn't a water shortage, it was a flood. If it wasn't a transit strike, it was a subway crash. And so it went throughout my eight years in office.

The importance of limiting those things that any executive should attempt to do in the time allowed, the importance of carefully choosing one's battles, is implicit in the fact that some of the toughest of those battles are chosen for us.

Of prime importance in mounting those battles is to insure that good men and women are in place to handle the planned agenda – should the boss become occupied by an item that never was planned at all.

2. When an emergency does strike, a trusted "ad hocracy" may be far more useful than an entrenched or untested bureaucracy. It was not in our job description to function like a virtual grand jury, grilling witnesses to a nuclear emergency, and then to serve as a worldwide communications center, but it worked. A manager should not be afraid to scramble the organization chart, as in a familiar example, President Kennedy did during the Cuban missile crisis, when his own brother's advice weighed more heavily with him than that of the Secretary of State or the Joint Chiefs of Staff.

3. Be ready to restrain those who, as described by our emergency management director during the crisis, may be "leaning forward in the trenches," helmet, sirens and all, and thinking solely in terms of "doing something," regardless of the safety or necessity. This applies not only to emergency volunteers and staff, and not only to emergencies, but to bureaucrats, technocrats, academicians, medical and other professionals, and, yes, even to those in the political end as well. The impulse in government to act merely for the sake of action, or to test a plan or agency simply because it is there, must be kept firmly under control.

4. Be wary of what might be called "emergency macho" – the temptation to stay up all night and then brag about it, or, more likely, allow the press staff to brag about it. While it often is important for a manager to maintain a visible and reassuring presence, anyone making life or death decisions for thousands of innocent people owes those people a mind that is clear and a body that is rested.

5. Don't try to manage an emergency away from the site. This does not mean, of course, that one must be on-site personally, but someone must be in charge there whose competence and judgment you can trust.

As you have seen, most of our communications problems originated in Washington. Even Harold Denton, I later learned, had been a major participant in that bogus evacuation advisory the NRC sent up to us on the third day.

Harold later was to concede that "I've learned that emergencies can only be managed by people at the site. They can't be managed back in Washington."

6. Search for and evaluate the facts and their sources again and again, and communicate those facts truthfully and carefully to the people, remembering that credibility can be as fragile as it is crucial in the cauldron of a genuine public emergency. Of course, the fact-gathering task would have been immeasurably easier had we access to cell phones, text messaging, the Internet and the like in March, 197, but none of them had yet been invented!

7. Respect but do not depend on the news media. Throughout the Three Mile Island incident, we developed a considerable empathy for the more than 400 reporters from around the world who were assigned to cover this event. Their frustrations mirrored ours in the attempt to establish reliable facts. In many instances, our decision makers and members of the media "compared notes" on vital issues to ensure both the quality of the reporting and the quality of action within the state government. Not all of the reporting was reliable, however, and some was downright outrageous. For example, I was informed that a British news organization, in its attempt to convey the gravity of the situation, carried an item to the effect that "the governor's wife, pregnant with their first child, has left the area." In fact, my wife was not pregnant; we already had four children, and most important, she stayed with me in Harrisburg during the entire

episode, as did the Lt. Governor, incidentally, whose wife was pregnant with their first child and who also stayed with him.

8. Forget partisanship, for there is no Republican or Democratic way to manage a real emergency. In our stewardship of this most basic of all public trusts, we inevitably survive or suffer together, and not incidentally, so do the people we are elected to serve.

9. Value and learn from history. While the Fuller book on the Fermi plant proved useful, let me assure you that if one of my colleagues already had experienced a nuclear emergency like Three Mile Island, and had recounted it in published form, such a publication would not long have lingered on my bookshelf.

10. And finally, as that well-known American philosopher, Yogi Berra, once said: "It ain't over 'till it's over."

Within a year after the accident, I had to step into a new furor over a plan to vent radioactive krypton gas into the atmosphere as part of the TMI cleanup operation. Public hearings on the safety of the plan almost turned into riots.

One imaginative opponent of the krypton venting put on a "Superman" suit and proceeded to "choke" himself on the front steps of the capitol.

I took the unorthodox step of asking the Union of Concerned Scientists, a well-known group of nuclear industry critics, to study the venting plan. When that organization concluded that it posed no physical threat to public health and safety, the venting proceeded peacefully.

The year after that, however, we learned that no plan had yet been devised to fund the billion-dollar effort necessary to decontaminate the damaged reactor.

Because the site could not be considered truly safe until cleanup has been completed, and because the established institutions appeared to be at an impasse, I had no choice but to develop

and push my own $billion-dollar national cost-sharing plan for its funding, a plan which was finally contributed to by the utility, state and federal governments and the nuclear industry and which finally accomplished the cleanup in August of 1993.

Protracted proceedings were held as well involving the utility's application to restart the undamaged Unit I reactor at Three Mile Island. This question ultimately went to the Supreme Court of the United States and consumed thousands of hours of state time in our effort to ensure a maximum commitment by the plant operators to public health and safety and the integrity of the environment in the area of the facility before restart was undertaken. And new problems were raised almost daily with regard to the process of decontamination and the legal, economic and social aftermath of the accident.

Of course, the effect of the accident on the nuclear power industry in America was devastating. New construction was stopped dead in its tracks and no new plants have been undertaken since 1979. And while we still derive about 20% of our electrical power from nuclear sources, the added cost and increased scrutiny by regulatory authorities since the accident, together with the decreasing costs of competing sources, have added up to an uncertain future for an industry which, prior to 1979 appeared to hold so much promise. One positive fallout from the Three Mile Island era, to be sure, has been a much higher emphasis on safety at the over 100 presently operating facilities in the country.

One final postscript is of interest. In December 1979, some eight months following the accident, I visited the then-Soviet Union and met in Moscow with top governmental and scientific leaders in their nuclear energy and emergency management programs to share with them some of the lessons of Three Mile Island, or as our interpreter called it, "Five Kilometer Island." To our discomfort, they told our party that they regarded nuclear safety as a "solved

problem"; that the problems raised by our experience had been "over-dramatized"; and quoted the head of their National Academy of Science as saying that Soviet reactors "would soon be so safe as to be installed in Red Square."

The rest, of course, is history. How hollow those boastful observations rang on April 26, 1986, when a far more terrifying event occurred at Chernobyl. One must wonder if that accident might have been prevented if the people of the Soviet Union had been as free to question their authorities as were Americans following the Three Mile Island accident in 1979.

Without a free press, however, the Soviet people had no opportunity to learn that Chernobyl was probably more dangerous than TMI, or even to alert their people to the accident itself, which became known only after unusually high radiation levels were detected in other countries with a free press.

There was no right of free speech to protect a Soviet citizen who might have warned of such a danger or the need to quickly evacuate.

And, of course, there were no free elections which might have prompted the Soviet government to be more accountable to its constituents and more attentive to their health and safety needs.

For all of its shortcomings, the genius of our political system is that its open nature makes it difficult, if not impossible, to ignore or suppress problems such as those raised by TMI.

And that suggests the larger lesson of the accident of March 28, 1979. Democracy may indeed be, as Winston Churchill once observed "the worst system of government man could possible devise – except for all the rest."

One parting observation which may be self-evident.

A prominent Pennsylvania judge, in observing the challenges of emergency management, recently wrote:

> "The ability of decision makers to make wise choices and to exercise good judgment depends on their ability to receive accurate technical information whether it is medical, engineering, epidemiological, biological or whatever."

To this I can only lend a loud "Amen." That, I suggest, is the essential take away from my presentation this morning.

Thank you.