July 21, 2014

Mr. Michael J. Derivan
P.O. Box 1162
Bisbee, AZ 85603

Dear Mr. Derivan,

On behalf of the U.S. Nuclear Regulatory Commission (NRC), I am responding to your letter of June 2, 2014, and email of July 10, 2014, to Chairman Allison Macfarlane. You have requested that "operator error be removed as the root cause" of the accident at the Three Mile Island Nuclear Generating Station (TMI) on March 28, 1979, as has been "the stated position in some official documentation." However, none of the five major investigations of the accident commissioned by the NRC, Congress, and President Jimmy Carter claimed that operator error was "the" root cause of the accident.

Virtually all of the studies I reviewed agree with your analysis that while the operators committed errors, the chief culprits behind the accident were industry-wide and regulatory flaws. These included a poor understanding of PWR plant response to loss-of-coolant accidents (LOCA), a failure to circulate information about several precursor events at plants in the United States and Europe, flawed operator training and plant procedures, and inadequate control-room design. While you argue that these reports implicitly blame the operators as a "default position," my reading of them indicates they were careful to avoid such a conclusion, and some pointedly challenged the thesis that operator-error caused the accident.

The report that comes closest to claiming operator error as the primary cause of the accident was NUREG-0600 issued by the NRC's Office of Inspection and Enforcement in July 1979.[1] It concluded "had the operators allowed the emergency core cooling system to perform its intended function [as directed in the plant's emergency procedures], damage to the core would most likely have been prevented."[2]

This assessment, however, came with several important qualifications. NUREG-0600 concluded that it was "difficult to fault only the actions of the operating staff." The NRC's investigators found that training had a significant influence on the operators' response to the accident, particularly their efforts to avoid "going solid" in the pressurizer. This "mind set" that gave priority to maintaining pressurizer level at the expense of reactor coolant pressure was common among operators at other nuclear power plants. As a result, they called for changes in training and emergency procedures at all operating PWRs.[3]

To avoid duplicative effort with other official investigations, the NRC staff who issued NUREG-0600 focused on the adequacy of the licensee's response to the immediate accident and its

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[1] U.S. NRC, Office of Inspection and Enforcement, *Investigation into the March 28, 1979 Three Mile Island Accident by Office of Inspection and Enforcement, Investigative Report No. 50-320/79-10,* NUREG-0600 (Washington, DC: U.S. NRC, August 1979).
[2] NUREG-0600, 2.
[3] NUREG-0600, 2-3 and I-2-49.

adherence to emergency procedures. They emphasized that their report was not definitive and that other ongoing investigations were necessary to gain a complete picture of what caused the accident. It is unfortunate that NUREG-0600's conclusions were sometimes reported without the qualifications it made, but subsequent assessments rejected operator error as the main cause of the accident.

A more comprehensive Lessons Learned Task Force report concluded that the accident was caused by a systemic failure in the industry and NRC to consider human factors as a part of defense in depth: "Inadequate attention . . . had been paid by all levels and all segments of the technology to the human element and its fundamental role in both prevention of accidents and the response to accidents." The Task Force called for human factors reform in many of the areas cited in your letter as contributing factors, such as training, operating procedures, the work environment, improved evaluation of operating experience, and redesign of control rooms to improve the man-machine interface.[4]

The three investigations receiving the greatest public and media scrutiny rejected operator error as a sufficient explanation for the accident. For example, the NRC's Special Inquiry Group (Rogovin Report) wrote:

> We reject this conclusion [that operator error was the root cause] as being incomplete. While there is no question that operators erred when they interfered with the automatic operation of the high pressure injection (HPI) system even though conditions that had initiated the system (low pressure) persisted, we believe there were a number of important factors not within the operators' control that contributed to this human failure. These include inadequate training, poor operator procedures, a lack of diagnostic skill on the part of the entire site management group, misleading instrumentation, plant deficiencies, and poor control room design. For these failings, the industry and the NRC must share responsibility with Met Ed.[5]

Nearly identical positions blaming industry and regulatory failing were taken in a report to President Carter, the so-called Kemeny Commission Report, and to the U.S. Senate. So pervasive were these deficiencies, the Kemeny Commission concluded, "We are convinced that an accident like Three Mile Island was eventually inevitable."[6] Rejecting the operator error thesis in favor of industry-wide and regulatory factors was, in fact, critical to the reports' justification for wide-ranging reform.

Your correspondence places particular emphasis on the industry and NRC's failure to analyze and communicate to TMI operators the lessons of several precursor events. The official reports agree with you on the critical role the precursor events might have played if properly analyzed and communicated. For example, the Rogovin Report reviewed the Dopchie letter, the NOK-1 Beznau event, and the 1977 Davis-Besse event in which you were involved before issuing a strong condemnation of the industry and NRC's lax oversight of reactor operations. The report

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[4] U.S. NRC, *TMI-2 Lessons Learned Task Force Final Report,* NUREG-0585 (Washington, DC: U.S. NRC, October 1979), 1-2.

[5] Mitchell Rogovin, *Three Mile Island: A Report to the Commissioners and to the Public,* NUREG/CR-1250, vol. 1 (Washington, DC: U.S. NRC, January 1980), 102.

[6] John G. Kemeny, *Report of the President's Commission on the Accident at Three Mile Island: The Need for Change: The Legacy of TMI* (Washington, DC: October 1979), 10-11, and Senate, Subcommittee on Nuclear Regulation for the Senate Committee on Environment and Public Works, *Report to the United States Senate: Nuclear Accident and Recovery at Three Mile Island, A Special Investigation* (Washington, DC: U.S. GPO, 1980), 9.

argued that "the nuclear industry and the NRC had little or no concern about what the operators saw during a transient and what they did as a result. . . . Incidents were assessed almost entirely from the perspective of the hardware with little concern about what the operator saw or did."[7]

It may be correct, as you argue, that more should have been made of the industry's poor understanding of plant response during a LOCA in the pressurizer steam space, but as you know, the NRC and industry addressed this issue with numerous reforms in training, reporting requirements, and event analysis. In fact, learning from precursor events may be the most important history lesson from TMI. On the 25th anniversary of the accident, NRC Historian J. Samuel Walker published *Three Mile Island: A Nuclear Crisis in Historical Perspective.* The Davis-Besse event, Walker shows, was a critical missed lesson: "Neither Babcock and Wilcox nor the NRC had taken effective action to draw lessons from Davis-Besse or provide warnings to other plant operators that 'could have prevented the accident' at TMI-2."[8]

In sum, the official reports and NRC histories have been and continue to be in substantial agreement with your overall analysis as to the causes of the accident. Like you, they place the errors committed by the TMI operators in the context of general industry and regulatory failings regarding human factors.

It is not for today's regulators to revise or restate the conclusions of these carefully balanced reports, but we should heed their lessons. TMI today is remembered not for the personal failings of a few operators but as a critical warning to the nuclear industry and NRC that systemic reform was necessary. On the 30th anniversary of the TMI accident, NRC Chairman Dale Klein testified before a Senate committee on the accident and its legacy.[9] Like the earlier reports, he emphasized that the errors committed by the operators were the result of faulty instrumentation and training. The extensive post-TMI reforms described by Klein belie the notion that the NRC wrote off the accident as simple operator error. Were that so, TMI would not have been the most formative event in the history of nuclear power regulation.

I appreciate reading your perspective on the accident and making me aware of your excellent website. It will be particularly helpful primary source material for my current research.

If you would like to discuss this further, please feel free to contact me by phone at (301) 415-1965 or by email at thomas.wellock@nrc.gov.

Sincerely,

/RA/

Thomas R. Wellock, Historian

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[7] Rogovin Report, vol. 2 part I, 129-130.
[8] J. Samuel Walker, *Three Mile Island: A Nuclear Crisis in Historical Perspective* (Berkeley: University of California Press, 2004), 212.
[9] The former Chairman's testimony may be accessed at http://www.epw.senate.gov/public/index.cfm?FuseAction=Files.View&FileStore_id=964be27b-0738-4cd6-b24e-fa5bdc45641d