EPRI

January 13, 1977

Dr. S. H. Hanauer
Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Steve:

At our meeting here you asked me for some further estimates on ATWS and for some indication of how I view the usefulness of probabilistic/statistical (P/S) techniques vis a vis the licensing process.

First ATWS. I will only discuss the base goal 10^{-7}/year and its relation to PWR's. The rationale for 10^{-7} appears from WASH 1270 to be 1000 reactors and a 1000 year desired return time for accidents outside the DB envelope. This yields 10^{-6} and ATWS gets 1/10 hence 10^{-7}. The only statistical meaning that one can ascribe to this is that the expected (average, mean, whatever you want to call it) value of the time between such accidents should be 1000 years. Since we are presuming 1000 reactors we expect a complete mix in plant ages hence 10^{-7}/year effectively becomes the average value during the plant lifetime, and not necessarily the value in any single year.

Consider now the following. The RPS is 10^{-4}/demand; one accident per year; the mitigating system is 10^{-3}/demand. The consequences in terms of pressure, etc. must also be acceptable using a 99% MTC and the accident must be assumed to occur during a Boron dilution. In fact, a normal PWR is in Boron dilution about 3% of the time. If we are required to have the probability of ATWS exceeding 10 CFR 100 be 10^{-7} during Boron dilution this is equivalent to requiring the lifetime average ATWS probability be about 3×10^{-9}/year. Further if we demand 99% MTC rather than 95% it is equivalent to demanding less than 10^{-9}/year ATWS average probability during the plant lifetime. This of course is equivalent to a one million year average return period for a 1000 reactor family. I believe such a requirement to be an unacceptable one to require even if it could be met with minor expenditure! This is even more true since the ATWS risk is only 1/2% of the total risk; hence the major expenditures actually required will not meaningfully increase public safety, but it will certainly greatly increase the public costs.

Let me now address the question of the general utility of probabilistic/statistical techniques. Your recent letter to Erdmann concerning an invited paper that you chose not to present indicates a belief that risk analysis, risk acceptance criteria, indeed the entire panoply of P/S techniques has no usefulness in licensing since the data etc. available are not sufficiently well based to establish anything. Assuming that you were serious, I believe that you are quite generally incorrect. No one is suggesting that NRR should blindly accept or use any particular quantification. What I am suggesting is that NRR already does an implied P/S analysis when it makes its famous "judgements". However, since these "judgements" are not made on a consistent and rational basis (in the sense that they can be explained to anyone) we have the origins of the entire NRR/vendor/utility licensing conflict. The use of a formalized structure, be it fault/event trees, cause-consequence, or GO allows rationality to be reintroduced. The result is an explicable and defensible procedure! Secondly, the fears that seem to reside in NRR concerning "common mode failures" really seems

to have reached the stage of mysticism; it would appear that NRR feels that common failure modes are not only unknown but unknowable. Such behavior is irrational at best. These are relatively clear-cut ways of examining a piece of equipment to determine its potential failure modes, common or otherwise. After all, the laws of macroscopic physical/chemical behavior are pretty well known.

Further I would suggest that failure by NRR to explicitly use such methods can be detrimental to the public welfare and safety! In the recent SRP a list of designs acceptable to NRR and intended to reduce the risk of an interfacing system LOCA was provided. Implied was that they are all useful in reducing the probability of such a LOCA. In fact, a probabilistic analysis (enclosed) shows not only that the three methods are greatly different in their effect on such a LOCA, but that one of them can be implemented in a fashion acceptable to NRC, but in such a way as to worsen the situation. These results can't be achieved by "judgement", but only by careful quantification.

In sum, I believe that P/S techniques and data exist to handle very large areas of licensing and that a refusal to rationalize the licensing process by their use is not in the public interest.

Sincerely,

G. S. Lellouche, Program Manager
Nuclear Safety and Analysis Department

GSL/mw

Enclosure: EPRI NP 262

cc: W. B. Loewenstein (w/o enclosure)

Thadani

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RE REVIEW OF PART 1 OF THE INSTITUTE STUDY OF ATWS

ENCLOSURES

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Ross to Respond as per 1/25 conversation with him.

It may be that the NRC requirements related to ATWS are only incidentally related to the numerical results and conclusions cited above. If this is the case, the documentation on this point has not come to my attention. However, if the NRC intentions are heavily based on the data and analytical manipulations cited above, the course recommended in the above paragraph may be an appropriate one.

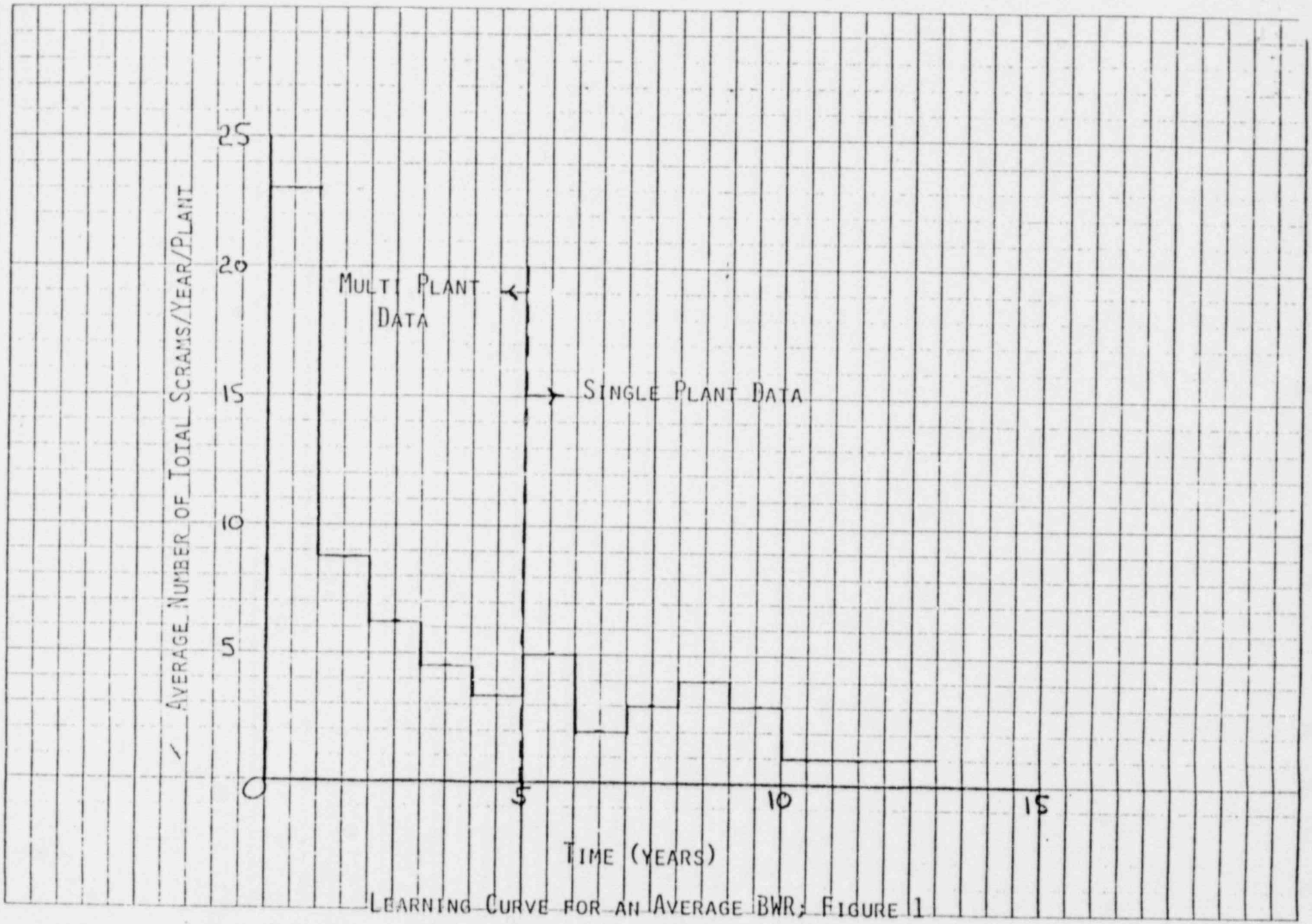
I hope this letter makes our concern clear to you; we remain actively interested in the realistic consideration and valid technical assessment of ATWS, as well as other regulatory issues touching our research program. We remain ready to discuss this or any other topic of mutual interest. To this end I have instructed Dr. Lellouche to attempt once again to meet with the NRC staff, and as soon as possible, to discuss the full range of technical issues implicit in the differing conclusions obtained by our respective staffs.

Yours truly,

W. B. Loewenstein

W. B. Loewenstein, Director
Nuclear Safety & Analysis Department

WBK/rt



LEARNING CURVE FOR AN AVERAGE BWR; FIGURE 1

ENCLOSURE

Comments on Comments

1. The NRC staff conclusions relative to the EPRI study on the number of limiting transients/year are partly correct. The variation of number of scrams/year with plant age is not accounted for (see attached graphs) in the NRC evaluation.

2. The statement that the Navy data was considered by NRC staff is correct. However, it is not clear to us that NRC staff attempted to determine the actual testing rates of naval units (hence to determine the actual total number of scram trials). If such an attempt had been made the NRC staff would have discovered, as we did, that many more trials than twelve per year were held. Alternatively, the NRC staff may have determined the actual testing rates and then not used the data.