

MEMORANDUM

20 September 1982

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TO: Dave Fischer  
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Mail Stop H1016

FROM: Ivan Catton  
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SUBJ: USNRC Integrated Human Factors Program Plan

The "NRC Integrated Human Factors Program Plan" is a rather vague document. I agree with all the criticism heard at the meeting and would second the remarks found in the Project Status Report written for the subcommittee. The program elements as titled are reasonable as far as they go. A good plan, however, should first clearly state what is needed and why as well as how satisfying the need will be worthwhile, then describe what will be done or is being done to satisfy the need.

Most of the human factors considered at the subcommittee meeting were common sense. For example, we all know that an operator must be trained and then examined to see if the training has taken. How one examines others to see that they have learned what you have taught them is a question that has received a great deal of attention in the academic community. The bigger question is one of subject matter and how to be sure it is properly chosen. Clearly stated objectives or goals would have shown that this aspect is missing from the document. The report is written so that it contains enough motherhood to cover all bets. This style of writing is common to academia and whether you are satisfied with it depends on whether you are buying or selling. It's my view that the motherhood should be reduced to a minimum and more specificity should be demanded. Specific comments on the report contents follow.

Section II of the report is supposed to establish the need for the six elements of the program described in Section III of the report. Several problems and issues are identified and discussed with some solutions being given. Section II leads logically to program elements that should appear in Section III but do not. With some digging and interrogation during the oral presentations one can find the relationship. The two sections of the report need to be combined or inter-related in a logical fashion.

The discussion of regionalization of NRC functions should itself receive some attention. It has been my experience that regional offices for the most part perform an audit function. An audit of human factors may be of value but somehow I doubt it will yield as much as expected. One must also think about the required function of what is being reviewed. This usually means one must have some technical knowledge as well as being sensitized to human factors needs.

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Discussion of PRA and the NRC Safety Goals notes that nearly half of the overall public risk is a result of human error, yet fails to note that most of this error is in the maintenance area. It seems to me that one has to review technical specifications (human interpretation), maintenance procedures (sloppiness and misunderstanding), system design (ease of maintenance and operations) as well as the control room (the operator) together in an integrated way to obtain human error numbers suitable for PRA. This is not a defined goal of the study.

The "Study of Hardware vs. People-Oriented" solutions to human factors problems will be very important to older plants. For example should the PORV indicators and system pressure gauges be located so that the operator can see them when he opens or closes the PORV. At some plants it takes two operators. A number of such quandries exist and deserve attention. It would have been more meaningful if some of them would have been spelled out. The statement about "expanding training" programs is not very meaningful.

Advanced Technologies that may be incorporated into existing or new plants certainly needs attention. It goes without saying that we need criteria for staffing, personnel qualifications, training and procedures evaluation. The big question is: how do we develop them? We cannot rely on experience unless we are going to have a large number of undesirable incidents. We cannot rely on data from LOFT or other similar nuclear facilities because the operations personnel are quite different. The EPRI program at SNPSS could be an inspiration here.

As pointed out in the EPRI publication, maintenance is a very important but somewhat overlooked element in the safety picture. Maintenance should be a major program element in Section III. Rather, it is buried under broader categories and as a result does not receive the attention it deserves. The only reason for not spelling it out would be deferring to EPRI or INPO.

Simulators are the only tool available for fully testing the operator - nuclear power plant interface. It is my view that the level of fidelity required to simulate a number of more serious accidents will soon be achieved.\* The increased fidelity along with the EPRI operator action recording and analysis capability make it a very important tool. It would have been useful to see a study of the simulator as a research tool for training evaluation, and EPOs as well as normal operations.

The technical basis needed for development of criteria for human factors reviews needs to be defined before one can develop it. I can find no clear statement anywhere in the report that tells me what a human factors "technical basis" is.

\*Singer-Link now has a fast-running code that will realistically simulate the primary system.

Section III describes the overall objectives, approaches and expected results of six major program elements. The first element of staffing and qualifications. The major issues as stated cover almost everything. Just how they will be resolved is not very clear. Data base maintenance is a fine goal if I know what data I need to collect. For abnormal situations and accidents data may be very scarce. A more specific game plan is needed. I think a research program directed at finding out what is needed would be fruitful.

Establishing whether or not a given training program is adequate for safe operation of a LWR will be difficult. Most utilities firmly believe that their training programs are more than adequate and some believe that NRCs emphasis on training is not justified. It seems to me that until NRC has its own research program all it can do is rely on INPO for a basis for evaluation. Once a basis has been established accreditation seems to be a worthwhile approach. Programs developed by others such as Ontario Hydro should also be considered when establishing the basis for evaluation. Ontario Hydro has a different view of training than those I have seen in the U.S.

Licensing examinations are the final measure that NRC takes before licensing an operator. The use of examinations to determine whether or not your training program has been a success is a well studied process. How well it works depends on the examiner and his knowledge of the subject of the examination as well as his skill at constructing the examination. Further studies of how to examine are not needed. Rather, qualifications of the examiner must be established. This seems to have been missed or at least seems to have not received sufficient emphasis.

Establishing the adequacy of procedures and plant testing programs under all plant operating modes and abnormal conditions is an important task and is really the bottom line. A given procedure does not stand alone. It must be evaluated with a specific plant's staffing, training, and maintenance, among other contributors in mind. Whether this will be done or not is not clear from the report. There should be some mention of how this program element is to be integrated with other elements. The EPRI and INPO efforts seem more integrated.

The Man-Machine Interface program element has a goal that includes everything. This section of the report contains probably the clearest and best presented elements of the program. It could serve as a model for the others.

The final program element, Management and Organization, is an important one. After reading the report I still am not sure what is intended. Every utility has its own ideas about how one should structure plant operations. Any one of them could result in good plant management if the people in the organization are good. How one sorts this out will be difficult. Further, what does NRC do if the local I&E inspector says a plan super is not good enough? On what basis is such a judgment made

and under what regulation can the utility be forced to replace him. Maybe NRC should increase its frequency of inspection (harassment) under such circumstances. Assuming that NRC will evolve some management criteria, some thought needs to be given to their usefulness. If a plant is up for its OL, the history of its performance during construction is available. Consideration should be given to how one can use this information to assess future management and operations in a meaningful way.

Long Range Research, Section IV is composed of elements that correspond exactly to the six elements of the "Program Plan". The goals of the long range research plan are broad and somewhat vague.

Staffing and qualifications research should contain an element that will be devoted to establishing how many power plant operations personnel will be produced in the future. Acceptable methods of accommodating a shortfall need to be found. Augmented control rooms may not be the best answer.

Training research is to result in establishing criteria for assessing existing training programs. Training research should focus on what the training should be not how to assess what you have. More research of the type conducted by EPRI at SNPS could be carried out by examining operators on a simulator following various kinds of specialized training. More and better audits are not necessarily helpful.

Examinations are a tremendous incentive for learning when the rewards are high. The educational community has been interested in how to best evaluate performance with examinations for years. Studies of the subject don't contribute a great deal. One must just take examination preparation seriously and spend the time to do it right. The research would be more useful if it resulted in a set of qualifications for the "examiner". He will be the key to meaningful use of examinations.

Procedures and Testing research must be integrated with training research and control room human factors along with knowledge gained from experimental studies about control room signatures of various transients. This area of research is probably the most important of the six elements that make up the plan. Again the EPRI approach using a simulator and teams of real operators is probably the only credible approach.

Some of the Man-Machine Interface research seems far fetched. Automation of the plant seems like a good subject for research. Studies of human performance using new control room devices will be very rewarding. An interesting subject for Management and Organization research is the relationship between management performance during construction and during plant operation. It's not clear to me which aspect of construction period one should look at and how well it correlates with subsequent operations.

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A seventh element of human factors research should be maintenance and its role in nuclear power plant safety. I was surprised to find very little discussion of human error in the maintenance area when it seems to be a major part of the human error contribution to risk.

In conclusion, there is nothing in nuclear power plant human factors that is really new. It is more a matter of insuring that the basic principles of good human factors are adhered to. It would be helpful if the NRC staff were able to (forced to) attend courses that would make them more sensitive to human factors elements of engineered devices.

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