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SUBCOMMITTEE ON HUMAN FACTORS

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1 UNITED STATES OF AMERICA
2 NUCLEAR REGULATORY COMMISSION
3 ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
4 SUBCOMMITTEE ON HUMAN FACTORS

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Nuclear Regulatory Commission
1717 H Street, N.W.
Washington, D.C.

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Tuesday, September 7, 1982

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The Subcommittee on Human Factors convened at
1:00 p.m.

10

PRESENT FOR THE ACRS:

11

DAVID A. WARD, Chairman
JEREMIAH J. RAY
DADE W. MOELLER

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DESIGNATED FEDERAL EMPLOYEE:

14

DAVID FISCHER

15

CONSULTANTS TO THE ACRS:

16

W. KEYSERLING
J. BUCK
R. NERTNEY
G. SALVENDY
I. CATTON
R. PEARSON
A. DEBONS

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NRC STAFF MAKING PRESENTATIONS:

21

H. THOMPSON
J. ZWOLINSKI
D. BECKHAM
V. MOORE
D. ZIEMAN
J. NORBERG
T. RYAN

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P R O C E E D I N G S

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2 MR. WARD: The meeting will come to order.
3 This is a meeting of the Advisory Committee on Reactor
4 Safeguards Subcommittee on Human Factors. I am David
5 Ward, chairman of the subcommittee. Other ACRS members
6 present today are: Mr. Ray and Mr. Moeller.
7 Consultants present are: Mr. Keyserling, Mr. Nertney,
8 Mr. Salvenly, Mr. Catton, Mr. Pearson; and I believe Mr.
9 Debons will be with us shortly.

10 The purpose is to review the NRC Staff's
11 integrated human factors program plan. The meeting is
12 being conducted in accordance with the provisions of the
13 Federal Advisory Committee Act and the Government in
14 Sunshine Act. David Fischer, to my right, is the
15 Designated Federal Employee for the meeting.

16 Rules for participation in today's meeting
17 have been announced as part of the notice of this
18 meeting previously published in the Federal Register on
19 August 16. A transcript of the meeting is being kept.
20 And we request that each speaker first identify himself
21 or herself and speak with sufficient clarity and volume
22 so that he or she can be readily heard.

23 We have received no requests for oral
24 statements from members of the public. We have received
25 no written statements from members of the public.

1 The agenda for the meeting has been sent to
2 the members and the consultants previously, and we will
3 follow that agenda with the exception that several of
4 the speakers, including the first one, will be other
5 than those indicated on the preliminary agenda.

6 I think for the consultants, you have had a
7 chance to read the program plan. I am sure you have
8 some questions. The agenda is organized to follow the
9 program plan. And so I ask you to please feel free to
10 ask questions and make comments as our speakers are
11 taking us through the plan, to expose any areas that you
12 think need exposition, and get comments from your own
13 experience and background where you think they are
14 appropriate.

15 In addition to going through the program plan
16 itself, we are going to have a little extra presentation
17 at the end by Mr. Ryan, I believe, a little expanded
18 presentation on the research and organization and
19 management because of particular concern and interest
20 and research in that area.

21 And then after that, I would like to get,
22 while we are still on the record, the considered
23 comments of each of you consultants and committee
24 members, so that we can formulate some sort of a
25 subcommittee report to carry to the full committee and

1 if the full committee sees fit to make some sort of a
2 report to the Commissioners.

3 So our goal today is to establish some sort of
4 a consensus for what we think of the program plan, what
5 advice or comment we believe should be passed on to the
6 Commission and the Staff regarding the program plan.

7 Okay, with that, I would like to introduce Mr.
8 Hugh Thompson and ask him to go ahead with his
9 introduction of the agenda and overview.

10 MR. THOMPSON: Thank you, Mr. Ward.

11 Is the microphone on? Can you hear all right?

12 Today we would like to discuss our present
13 preliminary integrated human factors program plan. It
14 is one in which the staffs of NRR and Research have been
15 working together for some time to produce the document.
16 Ever since the TMI accident occurred several years ago,
17 we have been really trying to put human factors into the
18 mainstream of nuclear reactor regulation and nuclear
19 power operation.

20 As you know, we have been reviewing the
21 operator licensing plants, done human factors reviews of
22 control rooms, looked at human factors considerations in
23 procedures, training programs at their initial test
24 programs, increased our review of their management
25 capabilities and in the staffing and qualifications,

1 make changes to the operator licensing examination
2 process both looking at the content, grades, and
3 including simulator examinations where plant-specific
4 simulators were appropriate.

5 We have added shift technical advisers, and
6 now with the Commission's recent efforts on SECY 82-111,
7 we are applying many of these efforts to the operating
8 plants to look at control rooms and procedures. But to
9 do this, we used our best judgments of the information
10 that was available to us, developed some documents:
11 NUREG--0700 and 0801 for the control room, NUREG-0835
12 for the SPDS, NUREGs 0799 and 0899 for the procedures.

13 Based on these judgments, we have a lot of
14 proposals outlined by the TMI Action Plan items. And,
15 in particular, some of these were well received, and
16 some we moved forward on. And some were not as well
17 received.

18 Some that we felt had the basis to move
19 forward on were the second SRO. We had policy
20 statements on overtime, requalification exam procedures.

21 But what we really found was that there were a
22 number of areas in which a sounder technical basis would
23 be appropriate, both for establishing rulemaking and
24 policymaking for the long term as well as we needed
25 confirmatory research to provide the basis and the

1 judgment that backed up the judgments that we made
2 earlier.

3 The fiscal year 1983-85 human factors program
4 plan was developed in order to provide that sound
5 technical basis. We have been aware of efforts by
6 industry and others who have programs, parallel programs
7 along that line, and this particular program we
8 developed was to be consistent with our 1983 and 1984
9 budget process.

10 (Slide.)

11 The particular efforts so far have been
12 consistent with the budget. And all of the
13 high-priority items that we had identified both from the
14 TMI Action Plan are included.

15 (Slide.)

16 One of the things we had to face in developing
17 the human factors program plan was how long and how
18 detailed a program should it be. As you know, the Human
19 Factors Society has produced recommendations with
20 respect to the human factors program, and it is some 700
21 pages long and goes into it in very great detail. On
22 the other hand, you needed a document that was available
23 for the public and for the Commissioners and for others
24 to look at and have a sufficient overview of our
25 programs to understand where we are, where we are going,

1 and what some of our major issues were.

2 The real objective, as you can tell, is to
3 resolve the remaining TMI Action Plan issues. To date,
4 we have, as indicated in Table 1, about 19 of the TMI
5 Action Plan items in the process of being implemented.
6 Some of these are in the early implementation phase with
7 respect to operating reactors, and others are being
8 fully implemented.

9 We were also attempting to make an initial
10 response to the Human Factors Society recommendations.
11 They have done a detailed effort over 18 months to
12 produce some significant recommendations to a number of
13 our programs, and we have included in there an initial
14 attempt to identify those areas where we felt we were in
15 agreement with their recommendations. Those where we
16 had additional evaluations to be done on our part and
17 those where we, in fact, had some disagreement or they
18 were not applicable.

19 I might note that as I go through the various
20 documents, it is difficult to determine specifically
21 where we respond to each and every of the Human Factors
22 Society recommendations in particular as it relates to
23 some of their subtasks and some of their recommendations
24 about ongoing programs for which they supported but had
25 some questions that we had to resolve.

1 I have asked my staff to look at those areas
2 in detail, working with Research, and we should have
3 before we make any major commitments of the fiscal year
4 1983 funds a sound basis for moving forward in all of
5 those areas.

6 Likewise, as we have gone through the reviews
7 of the OL plants and have become smarter at it and added
8 additional human factors individuals to our staff, other
9 factors that were not identified in the TMI Action Plan
10 have been identified as needing additional review by our
11 staffs, again primarily to determine what the
12 appropriate regulatory position has been.

13 Those types of areas, for instance, are
14 maintenance, where we do not have a formal regulation
15 requiring us to get involved in maintenance. But as you
16 know, the ACRS, as others, have identified the
17 maintenance area as one which the human factors would
18 benefit significantly.

19 And finally, one of the major objectives is
20 really to integrate the overall program. NRC has a
21 major number of offices involved: NRR, Research, I&E,
22 the regional administrators. Now that we are going to
23 regionalization, becoming more involved in this effort
24 as more and more responsibility for the day-to-day
25 review of the operation of the plants are transferred to

1 the regions, it is even more important that they be
2 there.

3 The national laboratories that we have
4 contracted with with researching ourselves, there are
5 six: Battelle, I&E, Livermore, B&L, and Sandia. We
6 have other contracts to other groups which are primarily
7 through subcontractors of the national labs. So the
8 ability to have an integrated program is important.
9 Industry has INPO, EPRI, EEI, AFI, IEEE, and others, as
10 well as the Department of Energy has their own efforts
11 under way in the human factors area.

12 And primarily it is because we are all starting
13 out from a ground where there was not a significant
14 level of human factors involvement before TMI, we are
15 all, in essence, paralleling some of our programs, and
16 we need to ensure that we take maximum advantage of the
17 other programs, not duplicate their efforts, in order to
18 produce benefits for our dollars.

19 MR. RAY: Mr. Thompson, you have used the
20 pronoun "we" repeatedly, and your second major objective
21 is to ensure integrated programs, I think, is certainly
22 essential to the effort. But I have no sense either in
23 your program delineation or the document we have or
24 anything you have said so far that satisfies me that
25 there is someone central either element in the

1 organization or personality who is going to administer
2 this thing.

3 And I cannot understand then how it is going
4 to be efficiently integrated. It seems to me like after
5 reading the document, a lot of different elements in the
6 organization, the NRC organization, have certain
7 responsibilities, and they are all going to gallop off
8 in different directions, and nobody is going to grap
9 them by the hair and pull them back when it is not the
10 efficient thing to do.

11 Is there not a central organization, a central
12 administrator, in this whole outfit?

13 MR. THOMPSON: Well, I think that you are
14 looking at him, and I can say that I do have the same
15 feeling that it is not as well articulated as you would
16 like. Basically, NRR has the responsibility for
17 identifying our user needs to Research, working with
18 Research to ensure that their programs are consistent
19 with ours, as well as identifying our ongoing technical
20 assistance area, interfacing with INPO and those areas.

21 And I agree that that should be done, and it
22 should be done by NRR in conjunction with Research. And
23 I feel that responsibility.

24 MR. RAY: What is your charge in that
25 respect? We have often said the committee, the ACRS,

1 that NRC Staff needs a QA organization for its own
2 purposes. Do you have the authority to preempt activity
3 of these various organizations if the quality of what
4 they are doing does not satisfy you?

5 MR. THOMPSON: I think I have the
6 responsibility to identify. I do not know that I have
7 the responsibility to preempt it. That is, Research is
8 responsible for administering the research contract
9 itself; I am responsible for identifying any technical
10 concerns to Research. If it is sufficiently divergent,
11 then I think it is one that needs to be elevated up to
12 Vic Stello.

13 MR. RAY: And you are supposed to be alert to
14 the possibility of its being divergent for the purpose
15 for which it is requested?

16 MR. THOMPSON: That is correct. And that is
17 one of the responsibilities we have, to ensure that the
18 NRR needs are being met by the research efforts as well
19 as the communications that they have together.

20 MR. RAY: So that there is one person in the
21 NRC Staff who has this responsibility?

22 MR. THOMPSON: I feel that responsibility
23 because the Commission directed NRR to develop the
24 integrated human factors program plan. It was not in my
25 job description.

1 MR. RAY: Certainly, this does not come
2 through to me from reading what we have.

3 MR. THOMPSON: Well, that is a good comment,
4 and I think we will certainly take that into
5 consideration.

6 Along the lines you had, Dr. Ray, we do feel
7 that this plan is not final as it is. It is a plan, I
8 think, that needs to be revised annually, and it is a
9 plan, in fact, that I would see being in sync with the
10 budget process; that is, we need to have our revisions
11 in time that the budget can process them, that they will
12 be able to flow for the fiscal year 1984-and-beyond
13 budget.

14 And so I would anticipate that the comments
15 that you have made or the comments that the Human
16 Factors Society and the efforts that will be ongoing in
17 the meantime will be those that will, hopefully, give
18 you the confidence and give me the confidence that this
19 overall program is being integrated to a greater extent
20 than it has in the past.

21 (Slide.)

22 Our presentation we have today, although it
23 will be presented by a number of NRR branch chiefs, it
24 does present both the ongoing programs that we have in
25 NRR, Research, and some of the industry-related effort.

1 They are in six major program elements, as identified.

2 And the following individuals, which are a
3 change from your schedule, will be making the
4 presentation in those areas: John Zwolinski, who is the
5 acting branch chief of the licensing qualification
6 branch, will make the presentations on the first two and
7 the last issue. Don Beckman will make the presentation
8 on examination. Denny Seamon on procedures and testing.
9 And Voss Moore will make the presentation with respect
10 to the man-machine interface.

11 For a kind of understanding where the program
12 is, we have transmitted to the office directors and the
13 regional administrators copies of these preliminary or
14 draft human factors program plan for their review and
15 concurrence and requested their comments to be received
16 back by close of business tomorrow.

17 So with your schedule about identifying your
18 major concerns today, that would be helpful for us
19 making our initial evaluation as to how far we can look
20 forward at this time. The EDO has committed to providing
21 a copy of the program plan to the Commission Wednesday,
22 September 15. So the schedule we are working on would
23 have a copy going from EDO to the Commission about that
24 time.

25 So if there are no other questions or if there

1 are some questions, I would be happy to answer them. If
2 not, I would like to turn it over.

3 MR. WARD: Yes, I do have just a couple of
4 comments. As you know, we have scheduled, I think, an
5 hour Friday morning at the full committee meeting for
6 the presentation of some sort of summary of what we
7 heard today. And at the end of the meeting, we can talk
8 about that. But if there is to be a comment from the
9 full committee, you will be getting it, and the letter
10 will be written on Saturday so you can get it next
11 week. And I guess that fits in with your schedule
12 reasonably well.

13 MR. THOMPSON: Well, it depends upon how much
14 we want to work Sunday. I appreciate the difficulty in
15 responding much more promptly than that. And depending
16 upon the seriousness of the comment, we would be able to
17 go to Dircks to get a relief either from the 15th date
18 or it might be something that we need to address along
19 the line of making a major revision.

20 If it is a major revision that is required,
21 then we probably would not be able to get the 15th date
22 unless Dircks wanted to move forward recognizing that we
23 will have to respond to your comments.

24 MR. WARD: A second comment. As I read the
25 program plan, I find that in some cases, at least, the

1 written discussion does not seem to tell me as much
2 about what the plan actually is as I had hoped. There
3 seemed to be a statement of the issue, and then the plan
4 is to resolve an issue. And then there is a schedule in
5 the back with a bar chart showing the time period over
6 which this resolution will be realized.

7 But there really, in many cases, there does
8 not seem to be, at least to me, a clear discussion of
9 exactly how you are going to resolve the issue. So I
10 guess what I would ask then is for each of the following
11 speakers to keep that in mind. And I think most of us
12 who have read the plan have sensed that or have that
13 sort of problem with it.

14 So if the speakers can in their presentations
15 put as much meat on the bones of the plan as possible,
16 that would help us a lot.

17 MR. THOMPSON: Fine. And we will ask that
18 they do that. It was a decision made as to how many
19 pages to try to put in the document as we went through
20 earlier drafts. We were up to several hundred pages and
21 getting down to each little step in the way. So there
22 should be, obviously, a document, an implementation
23 document which backs up each of these, which we are in
24 the process of. We have in kind of draft form as
25 opposed to this overview.

1 MR. WARD: So you say there is an
2 implementation document coming out?

3 MR. THOMPSON: We will develop internally our
4 own implementation for each of these program elements,
5 showing the integration efforts that are necessary, more
6 along the line of a kind of a perk-chart approach
7 showing where the elements intersect and where are the
8 appropriate items.

9 For instance, those who are doing job task
10 analysis, where they come from, where they will input
11 into the training program, for example.

12 MR. RAY: You say that is still to be done?

13 MR. THOMPSON: Well, we originally had kind of
14 a draft version that did that in an earlier stage. And
15 then rather than trying to keep expanding that effort,
16 we elected to make a document that was not 800 pages
17 long, put that part aside, and focused on a smaller
18 version.

19 So part of it was done, not done to the
20 satisfaction of where I could give you a document and
21 say, this is it.

22 MR. MOELLER: What is the basis for the time
23 schedule? I ask that because I believe you said the
24 Human Factors Society took 18 months or something to
25 develop its report. And what is the pressure to have

1 something to the Commission by September 15?

2 MR. THOMPSON: The initial pressure was in the
3 Commission's policy and planning guidance, which they
4 issued, which was to have a document to them by July of
5 this year. Dircks wrote back in a memo saying, well, we
6 have gotten comments from regional administrators, INPO,
7 and others on an initial draft which we believe need to
8 be addressed, and suggested a September 15th date, which
9 I was unaware of to a certain extent.

10 But politically, it kind of comes up that he
11 is committed to a revised date of September 15. I am
12 not sure he was factoring in waiting and giving 30
13 days, let us say, to respond to ACRS comments in that
14 period of time.

15 So if there are major concerns by the
16 committee or the subcommittee, I think that he would
17 certainly consider a delayed period of time. But I
18 certainly cannot speak for him. And we are under some
19 pressure to get this out.

20 MR. KEYSERLING: I have a question. There are
21 six categories up on the vuegraph right now that are
22 also discussed in the program plan. It is not obvious
23 to me whether these areas have equal emphasis or whether
24 some of the areas will receive more emphasis than
25 others. Would it be possible to give us some type of

1 weighting of the relative importance of each of the six
2 areas?

3 MR. THOMPSON: It is hard for me to right now
4 differentiate between any particular element in any of
5 the areas. If I were to say one area rates the highest
6 efforts, then I felt the management and organization
7 overall would be the one which would have the most
8 significant impact on the organization and which would
9 allow those individuals who are responsible for the
10 implementation of all of the other elements to ensure
11 that they are done appropriately, adequately, and, in
12 fact, have reached the goal of having human factors
13 considered appropriately.

14 It turns out that management and organization
15 tends to be the one we had the most difficulty, and it
16 is the one in which the utilities find that they like us
17 meddling the least in. And therefore, I found that most
18 of our efforts are pretty much -- we have high-priority
19 efforts going on in all areas in a parallel effort.

20 I mean we have certain items, for instance, in
21 the examination process that are long range, those that
22 are lower priority than those which are trying to get
23 the validated examination process upgraded immediately,
24 the subject content improved, and just the consistency
25 among examinations.

1 So I do not have any specific one area that I
2 personally feel should receive higher priority than any
3 of the others, although in each individual element there
4 are those which we believe should receive higher
5 priorities.

6 I would now like to turn it over to John
7 Zwolinski, who is the next speaker.

8 (Slide.)

9 MR. ZWOLINSKI: I am John Zwolinski. I am the
10 acting chief of Licensing Qualifications Branch. I
11 would like to talk to you first about staffing and
12 qualifications element within the human factors program
13 plan.

14 The principal objectives of this element is to
15 improve the capability of utilities to respond to plant
16 conditions by providing adequate numbers of qualified
17 staff. We can break that down into things like numbers
18 of people, qualifications of these individuals, to
19 include such things as fitness for duty, work
20 scheduling, for example, shift work, overtime.

21 We find that Research is complementing this
22 effort by conducting confirmatory research and analysis
23 right now in support of these areas and is looking
24 further down the road to issues such as the work
25 scheduling and qualifications of nonlicensed personnel.

1 The focus is clearly on the entire plant staff
2 and not just the licensed personnel.

3 MR. CATTON: Should there not be another
4 bullet on there that relates the technical
5 qualifications as a function of the number of people
6 needed?

7 MR. ZWOLINSKI: I guess the two, I feel, are
8 interrelated.

9 MR. CATTON: If the industry needs a certain
10 number of people, they may be qualified; if you need
11 twice that many, the other half may not be near as good.

12 MR. ZWOLINSKI: That is a fair point, yes.

13 MR. CATTON: I think somewhere in this initial
14 part you need to look at that. You can make a rough
15 calculation of the number of people you are going to
16 need as a function of time over the next 10 years. You
17 know how many people the schools are putting out. If you
18 need more, you have got problems. The quality is going
19 to go down.

20 MR. ZWOLINSKI: And the concern exists that we
21 do need more, and we are looking at that very point.

22 MR. CATTON: So I think that ought to be a
23 fifth bullet on your diagram there.

24 MR. ZWOLINSKI: Thank you.

25 (Slide.)

1 In order to resolve the issue of numbers of
2 qualified personnel, several activities are under way
3 and planned, and these are identified on the screen.

4 These activities, we hope, will provide the
5 data, the data base that is really required from which
6 we can regulate.

7 We also feel that this provides a method for
8 evaluating manpower allocation throughout the plant. I
9 think this area also, if you look at the entire list of
10 activities, you will find buried within the numerous
11 research and NRR activities, things like how to
12 determine the number of the sufficient number of
13 personnel in the pipeline. I think that is a question
14 that was raised by the ACRS in a number of our OL
15 reviews.

16 No one activity really stands by itself. It
17 is an integrated set of activities between NRR and
18 Research. If you would like to talk to any one of
19 these, I will. Otherwise, I would prefer to move along.

20 MR. MOELLER: What is the feasibility of
21 licensing others?

22 MR. ZWOLINSKI: Dr. Moeller, we conducted a
23 study about a year ago on the feasibility and value of
24 licensing of plant managers.

25 MR. MOELLER: Oh, other types of personnel.

1 MR. ZWOLINSKI: Yes.

2 MR. MOELLER: Okay.

3 MR. ZWOLINSKI: This is primarily in response
4 to TMI Action Plan A.1 through .4.

5 MR. WARD: John, the simulator experiments,
6 what is the magnitude of the effort there? Do you have
7 any idea -- I do not know -- dollars per year or
8 something?

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1 MR. ZWOLINSKI: I know NRR dollars, and let me
2 couch it this way. We have a simulator task in FY '83
3 that will be about \$300,000, and there is a research
4 task, and if I could ask Ellis Meershaw.

5 MR. MEERSHAW: Ellis Meershaw of the NRC
6 Research staff. \$500,000 per year in '83, '84, and '85.

7 MR. WARD: I guess I wish Mr. DeBons was here,
8 but in the past we have heard about this. These are
9 simulator experiments, and the data, the conclusions you
10 are going to draw from these are what qualifications,
11 operating people, our operating people ought to have. I
12 mean, there have -- in the past, there have been some
13 simulator experiments done on seeing what should be done
14 to optimize operating procedures, what should be done to
15 improve or optimize control room hardware, are these
16 experiments touching on those things, or just on the
17 individual qualifications that are required?

18 MR. ZWOLINSKI: I think it is going far beyond
19 that, and I would like to ask Ellis or Chuck Ogilvie to
20 talk to it.

21 MR. MEERSHAW: Ellis Meershaw of the NRC staff
22 again. The simulator experiments are aimed primarily at
23 determining appropriate qualifications for the control
24 room personnel, the reactor operator, and senior reactor
25 operator and shift supervisor. The work -- there is

1 some work within this program involving procedures as
2 well. We had an opportunity to investigate the same
3 group of people who performed accident scenarios using
4 event based procedures, performing the same scenarios
5 using symptom based procedures, so we used this
6 opportunity to take a look at the effectiveness of the
7 two types of procedures, and we are also doing some work
8 with the type of control room events versus conventional
9 and whether or not there is an SPDS, but primarily it is
10 focused on the performance of the control room personnel
11 and the qualifications and training necessary to do the
12 job.

13 MR. WARD: Is this looking at just individual
14 qualifications or is it looking at how a shift crew
15 functions? I mean, looking at the type of leadership,
16 for example, that a shift crew should have?

17 MR. MEERSHAW: It is looking at both of those,
18 yes, sir. It is very difficult to separate out the
19 individuals from the group, so at first you look at the
20 group and how the group performs, but by attempting to
21 separate out the performance shaping factors and getting
22 to the individuals involved at the background, the
23 education, the experience, we hope to be able to cull
24 out some of the finer points of the individual
25 performances. The gross aspect, the crew performance,

1 is the first thing that can be measured.

2 MR. WARD: I guess the reason I asked about
3 the magnitude is, I have the impression from some
4 earlier discussions that while you can -- while it is
5 fairly straightforward to talk about an experimental
6 program of this sort, when you look at the number of
7 experiments that you would need to furnish useful
8 results, and you look at the cost of simulator time, it
9 gets to be -- the impression I have is, it would get to
10 be a tremendously expensive way to go if you are really
11 going to get anything very solid and meaningful out of
12 it, and you are talking about half a million dollars.
13 That doesn't sound like an awful lot of simulator time
14 to me. I guess it depends how you define "a lot."

15 MR. ZWOLINSKI: And how efficiently you use
16 the simulator.

17 MR. CATTON: It is probably a few days.

18 MR. WARD: Is this going to be done? I mean,
19 who are the guinea pigs in this work? Are they crews
20 from utilities that are in for routine retraining?

21 MR. MEERSHAW: If I can address that question,
22 again, primarily we are using a piggyback approach to
23 the simulator time rather than buying the simulator time
24 outright, which is extremely expensive. We kick in a
25 few dollars to watch a utility perform its training, and

1 we get some input into the type of scenarios they run,
2 and it is an awful lot cheaper that way. We can get an
3 awful lot more data. We have been running experiments
4 primarily to this point with TVA personnel on the
5 Sequoia nuclear power plant simulator and Brown's Ferry
6 simulator. We have been performing experiments with
7 both initial qualification type personnel, those
8 personnel that have never operated a plant before or
9 gone for their first license as well as
10 pre-qualification personnel.

11 And so, we are broadening, we are expanding
12 out beyond TVA in the coming years, in fiscal year '84
13 and '84, to broaden the base and try and isolate some
14 performance shaping factors like the type of control
15 room, that sort of thing. But to answer your question
16 directly, it is primarily TVA now, and it is both requal
17 and initial qualification personnel.

18 MR. CATTON: EPRI has supposedly developed
19 some kind of a code where they can keep track of second
20 by second maneuvers within the simulator. Are you going
21 to be taking advantage of this?

22 MR. MEERSHAW: I think you are referring to
23 the performance measurement system that General Physics
24 uses. Yes, sir, we found that to be extremely useful,
25 and we have done all our experiments using the

1 performance measurement system. It is sort of a
2 misnomer. It is not really a performance measurement,
3 but more closely a performance monitoring system.

4 MR. CATTON: Well, they also have a
5 performance analyzer where they can analyze the
6 information as well.

7 MR. MEERSHAW: Yes, sir, that's a
8 programming. You input your data and you can cull out
9 from these ranges of data points whether an act was
10 committed or a specific act was left out. What you
11 really don't get is an output in A, B, C, or D grade for
12 instance.

13 MR. CATTON: I understand, but you are going
14 to use that.

15 MR. MEERSHAW: Yes, sir. We have in the past,
16 and will continue to use it.

17 MR. CATTON: And then you are going to try to
18 correlate some of this information to the types of
19 training the person had?

20 MR. MEERSHAW: We will attempt to correlate it
21 to various things. Training is one thing. Age might be
22 another. Experience. Education. Admittedly, the data
23 is dim, and we will only be able to infer some things
24 from it, but it is a starting point.

25 MR. CATTON: With most operators being trained

1 pretty much the same way, the way they are told to be
2 trained, it is probably going to be tough to ferret
3 anything out.

4 MR. MEERSHAW: That may be true, but there are
5 some differences that we can investigate. Additionally,
6 a big part of this program is taking a look at field
7 data, where we can investigate the same sort of
8 scenarios. We are looking at the simulator out in the
9 field that actually occurred in the plant, and by
10 comparing response and the actions taken in a simulator
11 to what actually happened in the real world, we will be
12 able to learn a little bit more about interpreting
13 simulator data as far as what will actually happen in
14 the plant, so that besides just collecting the data, we
15 will have some feel for how good it is in relation to
16 what actually happens in the real world.

17 MR. CATTON: I think that the simulator
18 experiments would probably be one of your best efforts
19 out of this whole list. You probably could learn more
20 from it than anything else, and I am a little
21 disappointed at the relatively small amount of funding.
22 That is just a comment.

23 MR. GAWLER: I would like to speak to that.
24 Paul Gawler, from the Office of Research. We don't want
25 to give the impression that this half a million dollars

1 is all of the simulator work that is going on. To
2 directly answer your question, this is research work
3 that we have going on on simulators that is addressed
4 specifically at staffing and qualifications. There is a
5 great deal more going on that has to do with simulators
6 in one form or another. For example, the first item on
7 the list, job and task analysis, a lot of that is being
8 done on the simulators. Dr. Catton just alluded to EPRI
9 is doing work on simulators. We are fully aware of
10 that. Our research is coordinated with theirs. And
11 individual licensees are doing experimental and research
12 work on simulators of various kinds, and there is
13 research work being done on the simulators themselves,
14 and I just want to leave the point that there is a lot
15 of work going on on simulators, not just a half a
16 million dollars which is specifically addressed at the
17 staffing and qualifications.

18 MR. RAY: In your piggyback development
19 initially with TVA, if you see a training exercise, the
20 modulation of a plant training exercise that the utility
21 has in its program, would it give you additional input
22 of data? Were you in a position to suggest that they
23 prescribed that change to the utility or piggybacking?
24 Do you have an agreement with them of this sort?

25 MR. MEERSHAW: Do you mean as far as selecting

1 which scenarios can be run?

2 MR. RAY: No, in making a different scenario
3 that they had no intent to use in their training program.

4 MR. MEERSHAW: Well, we haven't had that
5 problem yet. Initially, we sit down and discuss which
6 ones we would like to see run, because we are trying to
7 have scenarios run to collect field data on, and we have
8 been very successful in that thus far. The types of
9 scenarios are very common that they would run anyway,
10 dropped rod, small break LOCA, steam generator break
11 rupture, that sort of thing.

12 MR. RAY: But you do have a preliminary
13 session out of which you might influence the exercises
14 they conduct?

15 MR. MEERSHAW: Well, yes, sir, we talk with
16 them ahead of time.

17 MR. RAY: To better suit your purpose?

18 MR. MEERSHAW: Yes, sir.

19 MR. RAY: All right.

20 MR. GAWLER: But that would be done on a
21 voluntary, cooperative basis, not prescribed, is the
22 word you used. We might be in a position, particularly
23 in these research activities, to direct or require, but
24 we don't have any problems with this. This is generally
25 done in a mutually cooperative and helpful basis.

1 MR. RAY: Okay.

2 MR. MOELLER: When you first introduced the
3 subject staffing and qualification, I thought you were
4 talking about the entire nuclear power plant staffing.
5 Am I wrong? This is only for operators?

6 MR. ZWOLINSKI: Much of the work that is
7 ongoing today is for the licensed operator staff. We
8 have planned a number of activities which go beyond the
9 licensed operator staff.

10 MR. MOELLER: But at the moment, you are
11 concentrating then on operators?

12 MR. ZWOLINSKI: Our FY '83 budget contains a
13 number of activities that go beyond licensed personnel.
14 For example, the engineering expertise on shift/shift
15 technical advisor is a non-licensed position. We are
16 going into maintenance personnel.

17 MR. MOELLER: Yes, I saw that in your plan.
18 Of the items here, Number 5, human performance and
19 reliability research, how does that relate to Number 7,
20 the relationship between qualifications and job
21 performance? Are those closely intertwined?

22 MR. ZWOLINSKI: Dr. Moeller, I am going to
23 have to ask my research counterpart to answer that,
24 please.

25 MR. MOELLER: That was on the relationship

1 between human performance reliability research versus
2 the relationship between qualifications and job
3 performance, and a related part of this is in the plan.
4 Although you don't state it exactly, I received the
5 impression that somewhere the NRC has developed data
6 that shows a relationship between organization and
7 management, organization and management as compared to
8 the safety related performance of a nuclear power
9 plant. Is that true, that you have now such data, or
10 inklings of such data?

11 MR. ZWOLINSKI: To that particular statement,
12 we don't have those performance measures as yet. That
13 is a long-term effort in the management and organization
14 area that I will talk to towards the end of the day, but
15 to your first question of your tie between human
16 performance and reliability research, with
17 qualifications and job performance, I would like to ask
18 Jim Norberg of Research to address that.

19 MR. NORBERG: Jim Norberg, Office of
20 Research. I think the human performance and reliability
21 research that we are doing is primarily aimed at the
22 probabilistic risk assessment aspect in determining
23 human performance in terms of risk and their
24 reliability, the sort of thing that Allen Swain is
25 working on at Sandia, and we are planning to do similar

1 with the maintenance area, to determine what the
2 probabilistic aspects of human reliability and
3 performance are, and I think that is the aim of what you
4 are talking about there, and I don't think they are
5 related directly to the qualification and job
6 performance, although there certainly is an indirect
7 relationship.

8 MR. MOELLER: Well, I would think they are
9 very closely related, and that is why I need
10 clarification. I mean, if you have people who do a good
11 job and maintain the equipment properly, et cetera, then
12 you ought to have a high reliability.

13 MR. NORBERG: From that aspect, you are
14 correct. I misinterpreted what you meant by
15 relationship, but certainly the models that we are
16 developing for human performance and reliability will
17 give insight as to what the qualifications should be for
18 the performance.

19 MR. GAWLER: I think if I could characterize
20 the difference between the two, Dr. Moeller, the human
21 performance and reliability research is aimed primarily
22 at getting absolute quantitative numbers for purposes of
23 PRA. The other research is aimed at determining
24 performance factors and trying to prove matters, where
25 are the deficiencies. Here, this is more of a relative

1 thing rather than an absolute.

2 MR. MOELLER: That is helpful.

3 MR. WARD: Well, Carl, or maybe John, maybe
4 you could tell us a little more about the seventh one
5 there, assess the relationship between qualifications
6 and job performance, which is a tremendously desirable
7 thing to understand. I mean, right now, you assume
8 there is a relationship. You are going to turn over
9 that rock and ask whether there really is one. How are
10 you going to do that? I mean, is that the simulator
11 experiments? Are you looking at plant operating
12 experience and trying to see what LER's are telling you,
13 or what? How are you doing that?

14 MR. ZWOLINSKI: I think Research is going to
15 answer this.

16 MR. MEERSHAW: Ellis Meershaw of Research
17 again. We are approaching that from two directions.
18 First of all, from the simulator experiments, we are
19 attempting to obtain or develop performance measures in
20 linking these performance measures with qualifications
21 and training. Additionally, with the field data we are
22 collecting, we are attempting to develop performance
23 measures and link the actual real world type data with
24 performance measures, sort of like the LER approach,
25 only much deeper. We found that going beyond the LER's,

1 going to the plants, and going to the logs, we can
2 obtain a lot more data with respect to the time of
3 response and what has actually happened in using the
4 LER's alone than actual use in the LER's alone, so the
5 answer to your question is, you were using both the
6 simulator experiments and LER type data to link
7 performance with qualifications.

8 MR. WARD: Do you mean you look at -- you go
9 to plants, you are saying you take an LER that you think
10 may be human performance related and then you
11 investigate that in more depth?

12 MR. MEERSHAW: Precisely. We use the LER's,
13 the original screen, to tell us something interesting
14 has happened.

15 MR. MOELLER: Well, one of the first things I
16 think you ought to do is to examine the LER reporting
17 system, and remove from it the deficiencies in reporting
18 human errors, so that you would have some sort of a data
19 base hopefully in a few years on which to reach some
20 conclusions. If you examine LER's, if you find that the
21 human error contribution year by year has gone down
22 because the form was changed and utilities were required
23 not only to report that human error contributed, but to
24 name the skill involved, and as soon as you did that the
25 percent went right down. Am I not correct?

1 MR. GAWLER: That improvement in reporting
2 requirements on the LER's is also being done. It is
3 being worked on.

4 MR. MOELLER: Right, you have a change in LER
5 rule, but I would think one of your prime targets right
6 away would be to be sure that that portion of it was
7 done as efficiently as possible.

8 MR. GAWLER: And it is.

9 MR. MOELLER: Very good.

10 MR. RAY: Could someone amplify the first
11 bullet for me? Is that an attempt to evaluate the need
12 for an STA?

13 MR. ZWOLINSKI: No, sir. As you are aware, a
14 couple of years ago propagated the need for the shift
15 technical advisor on shift. That was to be in place as
16 of July 1st of this past month. In talking to the
17 Commission, it was very clear that the Commissioners
18 felt we ought to take a harder look at engineering
19 expertise on shift over and above what was presented
20 through the role of the shift technical advisor, so we
21 are modifying that particular effort which we were
22 trying to ascertain the preferred role and
23 responsibility for shift technical advisor to look at
24 the preferred role with respect to putting engineering
25 expertise either on shift or on duty through an

1 integrated program plan, and we will be transmitting
2 that to the Commission here in October.

3 MR. RAY: And this is supplementary talent
4 from the viewpoint of the STA and the need for the STA,
5 or will they supersede the STA? Do you have any
6 objective in mind?

7 MR. ZWOLINSKI: The long term objective is
8 probably a rulemaking in a couple of years regarding
9 engineering expertise on shift. In the interim, we
10 would probably allow the role of the STA to remain as it
11 is, or the licensees could consider alternative vehicles
12 to putting engineering expertise on shift as an interim,
13 and I think we are going to probably solicit comments
14 from industry plus present some of our own thoughts
15 regarding engineering expertise on shift, and that will
16 be in the paper that we will transmit in October.

17 MR. CATTON: Could I exchange qualifications
18 for training in reading some of these sentences?

19 MR. ZWOLINSKI: I guess -- well, maybe, sort
20 of. I would be hesitant to do it.

21 MR. CATTON: Well, there is an examination
22 that assures qualifications.

23 MR. ZWOLINSKI: There is certainly a one to
24 one tie, and in some cases I think you can.

25 MR. SALVENDY: Could you clarify what you mean

1 by fitness for duty?

2 MR. CATTON: Sober.

3 MR. SALVENDY: Well, do you mean mental
4 fitness or do you mean physical fitness? And the reason
5 why I am raising the question -- let me elaborate --
6 was, recently there is some evidence to indicate that as
7 the physical fitness of people increases, the
8 decision-making significantly increases, and the
9 probability of making errors of the type of situations
10 that operators in nuclear power plants are faced with
11 could be significantly reduced, so I wasn't sure if you
12 planned to take cognizance of that fact, or do you
13 really just mean here fitness in terms of he is
14 apparently sober, or do you really mean to provide the
15 fitness test in terms of ensuring minimal human error?

16 MR. ZWOLINSKI: It is primarily the latter.
17 It is the alcohol and drug abuse concern that has
18 prevailed. We are moving into the area of psychological
19 fitness for duty, and that is a more longer term program
20 that is being sponsored by Research.

21 MR. SALVENDY: But not the physical fitness?
22 What I mean by physical fitness, if you measured how fit
23 is a person physically using any established indices for
24 physical fitness, there is evidence to indicate that
25 people basically improve their decision-making and

1 reduce their making of errors in the type of situations
2 that you find. You would find the control room
3 environment, and I just wondered whether you planned to
4 take advantage of that and planned to further expand on
5 that research, and maybe in the future require a certain
6 level of fitness from people that also would enhance the
7 performance significantly. Obviously, more research
8 needs to be done in that area.

9 MR. ZWOLINSKI: Let me ask Don Beckham to
10 address that.

11 MR. BECKHAM: Don Beckham, Operator Licensing
12 Branch. Physical fitness, as far as the person's
13 medical condition, is assessed for preliminary, for
14 initial licensing, and as a portion of the license
15 renewal every two years, regulatory guide addresses an
16 ANSI standard on medical certification for operators and
17 all licensed senior operators and reactor operators
18 undergo complete medical examination every two years.
19 The results of those examinations are forwarded to the
20 NRC for review, and the license is not initially issued
21 or renewed until the operators meet those medical
22 requirements. So we do assess the physical aspects of
23 the operator's qualifications for duty at this point.

24 MR. SALVENDY: A person may be completely
25 healthy, but he may have different levels of fitness. I

1 am assuming that the persons you employ are medically
2 all healthy. I am referring to fitness in terms of, you
3 know, being able to run in seven minutes a mile or
4 whatever, any standard incides, if you will, that do
5 exist, and the reason I mentioned it is, there is really
6 evidence now that people who become more fit, you know,
7 we have known for a long time or speculated that people
8 that are fit have certain medical efforts. The evidence
9 over the last couple of years is that people who have
10 become more fit in effect can make better decisions and
11 reduce the making of errors in the type of
12 decision-making task that you may find in a control
13 environment, and the reason why I asked the question is
14 because fitness was mentioned in here, and I just
15 wondered if the word is there, how broad you plan to use
16 it.

17 MR. BECKHAM: I don't think we would go to
18 that depth in the present programs. I would like to see
19 more evidence of that before we went into a regulatory
20 mode of requiring that type of qualifications, but I
21 will say that I saw Arnold Schwarzeneger in Conan the
22 Barbarian, and he didn't make a single mistake through
23 the whole movie.

24 (General laughter.)

25 MR. SALVENDY: What I think I am really

1 talking about, and not in terms of implementing the
2 regulatory, but in terms of the research plan, and the
3 notion is that in some research the indication is
4 available. The question was whether you in effect plan
5 to capitalize on that research and expand that research
6 further and see whether it really applies to your needs,
7 of course, before you go to any regulatory mode.

8 MR. ZWOLINSKI: And I think Mr. Thompson
9 intended to capture the thought that we are in the
10 process of giving the entire program a very in-depth
11 wash, and this is the kind of thing that would come out,
12 as to, should we request Research to take a look at
13 this, and so on and so forth. I will say that fitness
14 for duty tended to focus the staff as to alcohol and
15 drug abuse, but could I get to the bottom line of this
16 slide?

17 MR. WARD: Well, not yet.

18 (General laughter.)

19 MR. WARD: Go ahead.

20 MR. KEYSERLING: This question is just a
21 follow-up to Dr. Moeller's question. But it is also
22 slightly expanded, and it gets back to licensee event
23 reports, and or a more sensitive measure if there exists
24 a more sensitive measure, and how these are analyzed,
25 and what I am saying here is that given that there has

1 been some type of event that involves human error, is
2 there any way that this event is analyzed to determine
3 if this error is due to problems in qualification of
4 operators, problems in training of operators, or
5 problems in the managing interface?

6 Now, I know that this gets beyond your
7 specific presentation, but I think it is an important
8 point, because there are certain errors that are
9 probably going to reoccur no matter how well you train
10 people and no matter how well you qualify people, if
11 they are problems in the managing interface, and where
12 does this evaluation of event occur, and is this
13 information being used to determine a remedy to make
14 sure that such events don't reoccur?

15 MR. THOMPSON: Hugh Thompson, NRC staff. The
16 major effort that I am aware of that really addresses
17 the specific concerns that you have is done by INPO
18 right now. They have a pilot program with two U.S.
19 reactors and one foreign reactor, in which they are
20 analyzing the specific near miss operator error problems
21 and in fact they have a human factors expert on staff
22 that will conduct an interview with the individuals, and
23 they will have a very detailed list that they go through
24 in order to determine precisely what their best judgment
25 is as to what was the causative factor.

1 Now, depending upon how that result is made
2 available and is productive, and that information will
3 be available to the NRC and to the nuclear industry in
4 order to improve our own programs. Part of the effort
5 they have had in the past is the protection of some of
6 the operators, the names and the individuals, to get
7 them into the regulatory mode, where in fact it wasn't
8 really an issue. They had created a safety problem and
9 it clearly was a man-machine interface difficulty that
10 was identified, and so there is an effort ongoing that
11 way. We are monitoring that effort, and it has, I
12 think, started up probably this month, or it will start
13 later this year.

14 MR. KEYSERLING: Are there any plans to expand
15 it beyond two or three sites, because my feeling is that
16 some of these events are going to be fairly rare, and
17 the more locations you deal with, the more quickly you
18 will build a data base up, and the better that data base
19 will be.

20 MR. THOMPSON: I think they do plan to extend
21 it. I think what they are trying to show is the
22 benefits to utilities for putting this extra effort into
23 it and producing a safety benefit for the plant
24 operation as well as purely the reliability of the
25 plant, and I anticipate that they would probably like

1 the top 50 percent of the utilities to make some effort
2 to implement a program.

3 We have not right now considered that as a
4 regulatory requirement. We can obviously evaluate the
5 benefits as it progresses.

6 MR. KEYSERLING: And I take it when you keep
7 saying "they" that we, meaning the NRC, is not actively
8 conducting research or expanding the data base in that
9 area.

10 MR. THOMPSON: Not to the level that INPO is.

11 MR. KEYSERLING: Thank you.

12 MR. ZWOLINSKI: Could I follow up with a
13 couple of thoughts also that you should be aware of?
14 Brookhaven National Lab has conducted a study of human
15 error related maintenance, and Oak Ridge National Lab
16 has conducted a study on the man-machine interface in
17 control room. Those were both limited programs. I
18 believe technical reports have been issued, but it did
19 talk to operator error in both cases. The other program
20 with INPO is their significant evaluation, and that is
21 an ongoing program which I understand is being
22 expanded.

23 MR. CATTON: Is anybody continuing the type of
24 thing that EPRI did when they actually came to some
25 conclusions with respect to how well the operator

1 performed and his background? Because I think that is
2 in direct relation to training, or what you might want
3 to do in training.

4 MR. ZWOLINSKI: To that specific question, I
5 am not aware that we have a program that is one to one
6 carrying on. We have enough activity in Research and in
7 our safety and technology work that we are picking up a
8 large majority of that activity.

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1 MR. CATTON: You are familiar with the
2 conclusions that they came to, and I think those kind of
3 conclusions are very important, and I didn't see
4 anywhere in reading through what you people have put
5 together anything that indicated to me that you might be
6 going to do that.

7 MR. WARD: Ivan, isn't that really what the
8 seventh item is up there?

9 Oh, I guess I didn't understand what you were
10 asking.

11 MR. CATTON: The relationship between
12 qualifications and job performance. It depends upon how
13 they define qualifications, which is why I asked him if
14 I could exchange training.

15 MR. WARD: What did he say?

16 MR. CATTON: He said I really couldn't do it
17 on a one-to-one basis, and I didn't quite understand the
18 answer. So apparently not. It is not direct. I would
19 like to see it very direct. That's just a comment.

20 MR. WARD: John, I have another question
21 before you go on. I am not sure whether this fits into
22 the staffing and qualifications or the management and
23 organization, and maybe that is part of the problem, but
24 a year or so ago there was a paper in one of the
25 technical journals which received a lot of discussion

1 which the thesis was that the major human factors issue
2 in the nuclear industry was one of a man-man interface,
3 that is, what the author describes as a cultural
4 difference between operators and engineers, and the fact
5 that every essential communications between those two
6 groups don't occur or fail because of this cultural
7 difference.

8 A couple of weeks ago at a meeting of another
9 subcommittee here, we had several operators in, and a
10 couple of things that they said I guess made me wonder
11 again whether there might not be something to this, the
12 thesis of the paper. For example, when they were
13 questioned about what they thought about STAs, they
14 seemed to say well, it was nice to have another hand on
15 the shift, that it was helpful in getting certain
16 procedures done and certain actions done to have another
17 man there. Well, this seemed to me to raise a question
18 of whether they were really prepared or interested in
19 using the engineering expertise, if there was any, that
20 the STA had, and then it also raised the question, are
21 the shifts undermanned? Do they need extra help?

22 I guess at least the first one, the failure of
23 communication between these two groups I don't find
24 addressed in the human factors plan. Is that because
25 you don't really see it as an issue or is it addressed

1 somewhere in there that I just can't find it?

2 MR. ZWOLINSKI: Let me try to take them all.

3 Communications we feel is very important, and
4 that is addressed in the management and organization
5 area, and we are looking at that issue. We are also
6 concerned at your point, are the shifts undermanned?
7 This comes back to the seconds SRO, which we are not in
8 the process of going through rulemaking on. We believe
9 that the shifts do need an extra pair of hands to assist
10 and to the premise or thesis that the man-man
11 relationship tends to really drive the human factors
12 concerns versus a man-machine interface. We have been
13 sensitive to the man-man relationship, and it tends to
14 permeate the staffing and qualifications training
15 examination and management and organization issues to a
16 measure, and we think it is relevant, and therefore we
17 have tried to tackle it in several of those elements.
18 For example, in the examination, we are concerned about
19 how the examiner interrelates with the examinee. We are
20 also concerned in the staffing and qualifications, how
21 that entire shift complement interacts with each other.
22 And you have heard from research and myself that indeed
23 we are looking at the composition of the crew and how
24 the crew interacts, and I think that comes back to the
25 man-man concern.

1 MR. CATTON: With respect to the STA, one of
2 the plants where they recently had an incident, the
3 comment was that the requirements for the STA were such
4 that he was just too junior a person to do them a hell
5 of a lot of good in an emergency, but he did make a fine
6 pair of extra hands to keep track of what had in fact
7 gone by.

8 MR. ZWOLINSKI: We are aware of the comments,
9 both pro and con.

10 MR. CATTON: But one year out of school is not
11 much good.

12 MR. ZWOLINSKI: A fair point.

13 MR. WARD: Why don't you go ahead? What are
14 you waiting for?

15 MR. ZWOLINSKI: I think it is important that
16 the bottom line be presented. We have done a lot of
17 work and the culmination of this work is clearly that
18 these activities will yield a technical basis for
19 resolving several TMI action plan items, and issues
20 which have evolved over the past few years in the area
21 of staffing and qualifications.

22 (Slide.)

23 MR. ZWOLINSKI: If I might, I would like to
24 just talk through this slide briefly.

25 I feel it is important that the subcommittee

1 be aware that there are a lot of actors in the area of
2 staffing and qualifications; NRR and Research are not
3 all by themselves. We have identified on the chart
4 industry groups such as INPO and Edison Electric
5 Institute and our ANSI associates. Be aware that
6 individual utilities are working in the area of staffing
7 and qualifications, looking at such things as
8 shiftwork. The unions are looking at staffing and
9 qualifications. We are aware of programs at selected
10 universities such a Memphis State, in which they have
11 done task analysis on DCE reactors. One I am aware of
12 focused primarily in the area of training, but the
13 bottom line is we have a lot of actors in the effort,
14 and if you look to NRR and Research you will see again
15 many of the ongoing programs which we feel will yield
16 rules, guidance, regulatory positions. The results of
17 these efforts have been and will be integrated into the
18 NRC efforts on a whole, with the result being the
19 developing of regulatory positions.

20 (Slide.)

21 MR. ZWOLINSKI: I thought you might like to
22 see some of the activities that are under way that we
23 have developed in bullet form which tend to complement
24 the schedule that is Appendix B to the Human Factors
25 Plan. As you can see in each of the bullets, there

1 is -- these programs are what is currently ongoing and
2 envisioned over the next couple of years.

3 In our Chapter 4, we talked to the more longer
4 term research.

5 If we could go on to the next slide --
6 (Slide.)

7 MR. ZWOLINSKI: In our attempts to put a
8 presentation together, some of the same titles ended up
9 on this format as the first activity slide.

10 (Slide.)

11 MR. ZWOLINSKI: The bottom line in the area of
12 staffing and qualifications is the regulatory process
13 itself, and currently we are in the process of looking
14 at three different activities for rulemaking, policy
15 guidance on overtime, Regulatory Guide 1.8 and ANSI
16 Standard 3.1 are in the process of being updated, and
17 they will be finally updated when shift crew
18 qualifications are nailed down, which will be about two
19 years, and then the staff and their contractors will
20 issue technical reports over the next couple of years in
21 these other areas. The staffing for non-licensed
22 personnel is clearly away from the control room.

23 MR. CATTON: There is another aspect on the
24 qualifications. What about the NRC personnel the person
25 who goes out and takes a walkthrough in a plant? Do you

1 have any kind of an in-house program to teach him
2 awareness of human factors elements? Do you plan to? I
3 would think that research should set up such a program or
4 decide what such a program should entail.

5 (Slide.)

6 MR. ZWOLINSKI: What we have tried to do is
7 attract human factors professionals to come and work for
8 the Commission.

9 MR. CATTON: Well, I think when the engineer
10 walks through, he knows what a piece of equipment is for
11 and what is going to be done to it, and if he were made
12 a little bit more aware of the human factors elements
13 associated with it, I think he could act at a better
14 point in time with respect to a design.

15 MR. ZWOLINSKI: To your specific question, do
16 we have a program in place, it is an informal program at
17 best. We did try to take an awful lot of engineers and
18 make them instant human factors types with courses in
19 the area of just familiarization. I will say that in
20 the development of, let's say, NUREG-0700 on your
21 control room design reviews, many of the engineering
22 staff became highly familiar with the work that had been
23 done and the more man-machine areas of human factors.
24 This is also true in the development of procedures
25 guidelines, a great deal of sensitivity has evolved.

1 This is also evolving in the area of staffing
2 qualifications, management and organization, and
3 examination.

4 Hugh?

5 MR. THOMPSON: Hugh Thompson. One item which
6 I have directed my staff to do is to meet with each of
7 the regions on a periodic basis to discuss the human
8 factors programs that we have. They have meetings about
9 once every two months with the senior residents
10 inspectors, the guys who are responsible at the plant
11 for making the tours so that they are aware of the human
12 factors areas that we have ongoing as well as they can
13 learn of available human factors guidelines, regulatory
14 positions that we have.

15 In addition, one of the TMI action plan items
16 which presently is not receiving major activity but
17 which will be evaluated is the resident inspector
18 training program to determine what is the appropriate
19 level of human factors, the areas to be covered in that
20 training program.

21 MR. CATTON: Off the top, that's enough, but I
22 just went through a plant, and I noticed the valves that
23 somebody has to turn off, and they are eight feet up in
24 the air, and I was wondering where the NRC inspector
25 was. Probably like me, I'm an engineer. I never

1 thought about those things before.

2 MR. THOMPSON: I think some of the programs
3 with respect to maintainability and operability have not
4 been integrated in the existing design program.

5 MR. CATTON: But the way these valves are a
6 part of a particular procedure --

7 MR. THOMPSON: Those ought to be looked at.

8 MR. RAY: John, on your last slide under
9 technical reports, you had an item that intrigues me.
10 Techniques for manpower modeling, what is the nature of
11 manpower modeling which you would like to have
12 techniques for?

13 MR. ZWOLINSKI: If I recall correctly, that is
14 the report that we would expect to have on operator
15 qualifications and associated performance measures that
16 would come from research.

17 MR. RAY: In other words, the techniques
18 associated, the word "techniques here," and what it is
19 intended to convey is what is confusing me.

20 MR. ZWOLINSKI: Let me ask Jay Persensky of
21 the Staff to comment?

22 MR. PERSENSKY: Jay Persensky, NRC Staff.

23 Techniques, just a word that we threw in there
24 for the title, deals with different methods that have
25 been developed primarily in the military system for

1 determining the numbers and allocations of staff using
2 various modeling techniques, and we are looking to see
3 whether or not these types of models or programs could
4 be applied to the nuclear industry.

5 MR. RAY: Are you talking about representative
6 compositions of crews or shifts? This is what you are
7 talking about?

8 MR. PODOLAK: We are just beginning this
9 effort. As I understand it, we can get into shifts
10 crews, the allocation of functions based on the types of
11 work that have to be done.

12 MR. RAY: Whether you need two operators or
13 three operators and so on?

14 MR. PERSENSKY: Yes.

15 MR. RAY: It sure is a sophisticated title for
16 what you have delineated.

17 MR. WARD: Okay, any other questions? Are you
18 going to go on to training now, John?

19 MR. ZWOLINSKI: I would like to, unless there
20 are any other questions on staffing and qualifications.

21 MR. BUCK: Are we coming back to reliability a
22 little later, because human performance reliability was
23 up there and I should not sure when I should ask this
24 question.

25 MR. WARD: Go ahead.

1 MR. BUCK: But the question deals with the
2 difference between the NRC staff attitude towards the
3 reliability measure techniques like the Swain-Guttman
4 techniques, and the human factors recommendation group.

5 I did want to hear that addressed sometime
6 today, if we could.

7 MR. WARD: Is this going to come up later?

8 MR. ZWOLINSKI: Yes, I think it would come up
9 in the man-machine interface discussion.

10 MR. BUCK: Okay, I will hold back and ask it
11 then.

12 Can I go ahead and start on training?

13 MR. WARD: Yes.

14 (Slide.)

15 MR. ZWOLINSKI: The principal goals in the
16 area of training are, first, to upgrade industry
17 training programs for both licensed and unlicensed
18 personnel. There have been numerous action plan items
19 which have the highest priority placed associated with
20 them, and that is the primary reason that we initiated
21 the effort in training. We have also identified
22 deficiencies based on results of the examination process
23 and in our independent audits of selected training
24 programs.

25 (Slide.)

1 MR. ZWOLINSKI: There are also in the training
2 area selected other issues that tie back to the
3 objective. One is the preferred role of simulators, and
4 another one is the accreditation thrust that INPO has
5 undertaken.

6 We envision that training programs can be
7 significantly upgraded by using a systems approach to
8 training. What we envision is the development of audit
9 criteria in which we can use the instructional systems
10 development technology as a basis, audit requalification
11 training programs. As we learn from these audits, we
12 would iterate on the criteria, improve those and issue
13 guidance.

14 The completion of these audits will allow the
15 staff to modify the current IE inspection modules.

16 MR. CATTON: What is JTA?

17 MR. ZWOLINSKI: Job task analysis.

18 MR. CATTON: Thank you.

19 MR. ZWOLINSKI: To the specific activity
20 thrust, the general area of accreditation has -- we have
21 taken a rather hard look at accreditation ourselves.
22 INPO has put a program in place in which we have just
23 recently transmitted to the Commission a paper which
24 recommends that we take a wait and see posture regarding
25 the quality of that program and its applicability to the

1 regulatory process.

2 MR. WARD: Well, what do you see as
3 possibilities there? If a training program gets
4 accredited, does that mean that the NRC is going to back
5 off from licensing in the area or back off from some
6 other form of regulation?

7 MR. ZWOLINSKI: Let me give you a little bit
8 of background, and I will work into that currently.

9 Applicants will submit in Chapter 13.2.1 or
10 13.2.2 of the FSAR their training programs for licensed
11 and non-licensed personnel. Once they are licensed, our
12 counterparts over in Inspection and Enforcement and the
13 regional offices now through their inspection modules
14 will periodically check on the adequacy of the training
15 programs as they exist at the utility. Our examination
16 people and operator licensing branch serve the role of
17 indeed conduction of a replacement exam. If the man has
18 a great deal of problem, clearly he has had a problem
19 with his training, there is a give and take between the
20 two. Well, that training program that is in place at a
21 utility can now, based upon INPO's accreditation
22 program, maybe one day be accredited such that it would
23 no longer be reviewed by the Commission. We would be
24 able to take a posture of accepting a third party as the
25 regulator in this case, in which we would probably

1 perform an audit function to some degree.

2 So I think the statement within the Commission
3 paper was more one to let's try it out, let's see if it
4 really works, take some of the bad actors, to what
5 extent are these training programs really upgraded
6 through the accrediting process? If they are indeed
7 upgraded, perhaps we can bank on it. And that would
8 allow us to back out of the role of a hard regulator or
9 a regulatory position in the area.

10 MR. THOMPSON: I want to caution before we
11 make any real judgments as to where we are going with
12 respect to the credits to be given to accreditation
13 program, that we would want to be sure that the products
14 that the training program produced are indeed what we
15 anticipate that are needed, and we would, I think, want
16 to evaluate whether we would want to give
17 requalification exams that often at that facility to the
18 extent that we would review and audit their type
19 programs. I think it is too premature for us to say,
20 but generally what we would like to do is to be able to
21 rely on the industry effort to upgrade their program and
22 rely less on NRC having to do the inspection, although
23 the quality should remain the same.

24 MR. RAY: Do you know enough about the INPO
25 program for accreditation now to be satisfied that it

1 would be updated in itself? That is, there will be
2 re-accrediting periodically to make sure that is once
3 accredited, hasn't deteriorated?

4 MR. ZWOLINSKI: Within the program itself,
5 they go through a four year cycle, and every second year
6 they do get feedback as to are they maintaining their
7 standards of excellence. We have looked very hard at
8 their program. We are looking at a preferred role for
9 simulators over the next year in both the training area
10 and the examination area, trying to report back to the
11 Commission on or about the first of July of next year,
12 at the request of the Commission.

13 On the last bullet on the ISD process, we have
14 found that the more systematic engineering approach to
15 training tends to allow for additional training in
16 selected areas such as the unresolved safety issues
17 program, to be fully integrated with little or no
18 disruption to the course content.

19 There are a number of activities being
20 sponsored by INPO.

21 (Slide.)

22 MR. ZWOLINSKI: They have issued a number of
23 training guidelines and criteria documents for their
24 best practices for many of the non-licensed positions.
25 They have also again sponsored the accreditation program

1 and are sponsoring a rather large task analysis which is
2 focused at the licensed operating staff and selected
3 non-licensed positions, the end result being the
4 training that one should sponsor for each individual as
5 far as the knowledges and skills that will evolve from
6 the task analysis will clearly yield a curriculum that I
7 believe INPO intends to them propagate to the industry.
8 It is a generic task analysis. They need the plans to
9 to the more plant-specific parts. Also, research is
10 sponsoring a rather significant effort as far as crew
11 task, job task analysis for the crew, and one of the
12 offshoots of that program, one of many, would be focused
13 in the area of training.

14 Again, to a point mentioned earlier regarding
15 simulators and simulation, another piece of their
16 simulator work is in this area. The bottom line, of
17 course, is that we feel that the entire program, that
18 entire mapping will yield an upgraded nuclear power
19 plant training program for both licensed and
20 non-licensed personnel. It will give the Commission a
21 much more firm stance, a better understanding of what
22 training really should be in the nuclear power
23 industry.

24 (Slide.)

25 MR. ZWOLINSKI: I have listed a number of

1 activitie that are ongoing. As you can see, the
2 majority of these affect lthe knowledges and skills and
3 simulators.

4 MR. DE BONS: I wonder if I could ask a point
5 of clarification. I am sure it may be a function of my
6 misunderstanding of the documents, but perhaps you can
7 help me out on this.

8 Do I understand correctly that the people who
9 participated in the simulation actually are familiar
10 with the scenario upon which the simulation proceeds?

11 That can't be right, can it? I mean, in a
12 training situation, in other words, that they do know
13 the outcomes of the situation? This can't be true, is
14 it?

15 I got the interpretation in the documentation
16 that I read that the students knew what the outcomes
17 were for particular nodes of the simulation, and that is
18 not correct, is it?

19 MR. MEERSHAW: Ellis Meershaw of the NRC
20 staff.

21 Is the question do they know what the scenario
22 will be before it occurs?

23 MR. DE BONS: Yes.

24 MR. MEERSHAW: The answer is no. It is a
25 surprise to them, although they can quite often infer

1 from a small group what it will be because their
2 classroom work may have concentrated on perhaps ten
3 different scenarios, and they are probably going to get
4 one or two of them during that specific training
5 program, but they don't know specifically which one is
6 coming at any given time.

7 MR. DE BONS: The understanding is that they
8 do not know which one is coming.

9 MR. MEERSHAW: Yes, sir.

10 MR. DE BONS: All right.

11 But are they familiar with the concepts as a
12 scenario that they could in fact increase their
13 competence in dealing with the situation? Do you see
14 the question I am asking?

15 Do they have enough insight about the general
16 conceptual structure of the simulation that they can
17 pre-estimate the situation?

18 MR. MEERSHAW: The fidelity of the simulation
19 is very good for the specific people we are dealing
20 with. We are dealing with people who are training on
21 the plant that the simulator simulates. So the response
22 of the simulator is very close to the response of the
23 real plant, and they know they are in a training
24 environment, and so I can only assume that they realize
25 that they can learn a great deal from the actions they

1 do or don't take.

2 MR. DE BONS: Yes. I am worried about the
3 preset of the situation in that if you have a preset,
4 I'm not sure really -- I'm not really comfortable with
5 the credibility of the training, but maybe I need to
6 understand it a little bit more.

7 MR. MEERSHAW: If I could address that just
8 briefly, we are worried about that, too, and we have
9 tried very hard not to get much of a preset, but some of
10 it is inevitable. They know they are in the simulator,
11 and they know from a given group that they are going to
12 get some casualties. That is why we are working to hard
13 to correlate the performance in the simulator to
14 performance actually in the real world, to try and get
15 some sort of calibration factor to better understand
16 what we are seeing in the simulator.

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1 (Slide.)

2 MR. ZWOLINSKI: I mentioned at the outset that
3 the goal was to establish a firm technical basis using a
4 systems approach to develop training criteria and
5 guidelines. We would expect that the results of our
6 effort would yield a number of revisions to regulatory
7 guides, ANSI standards on selection and qualification.
8 3.5 is on simulation. The Standard Review Plan 13.2.1
9 is on licensed operators, 13.2.2 on non-licensed.

10 The last bullet, the IE inspection module, we
11 feel is the big ticket item from a regional point of
12 view as far as taking the modified audit criteria and
13 incorporating it into their inspection criteria. We
14 feel that would be a major upgrading of the training
15 audit.

16 I have just said that. I have also said let
17 us take a hard look at accreditation. We believe the
18 two go hand-in-hand. The finalized training evaluation
19 criterion are really the vehicle in which we would go
20 through the committee for the review of generic
21 requirements to upgrade our training evaluation.

22 MR. CATTON: Is this the bottom line?

23 MR. ZWOLINSKI: Yes, sir.

24 MR. CATTON: To me, I think that training and
25 research should focus on what training should be and I

1 do not see any of that here. I just see an audit, sort
2 of an audit kind of function. Where do you make that
3 decision? I mean, one type of training might be better
4 than another.

5 If you talk to two utilities, they could have
6 dramatically different concepts about training and they
7 will both swear up and down -- actually they will do
8 more than that -- that they are adequate.

9 MR. ZWOLINSKI: We are taking the approach in
10 a number of these tasks that such programs as the INPO
11 job task analysis which will categorize the knowledges
12 and skills required of the reactor operator, senior
13 reactor operators and so on as being a fundamental
14 program that will carry through with curriculum
15 development and, from that, we can ensure that we are
16 training the individual such that he is going to perform
17 well as a reactor operator and so on and so forth.

18 We are trying to get a more bigger picture to
19 get into the mode of selection, training, examination
20 and then operation and not be out of phase on any one of
21 those four issues. And the job task analysis tends to
22 drive several of those issues.

23 MR. CATTON: So this particular aspect is then
24 missed?

25 MR. ZWOLINSKI: The aspect of?

1 MR. CATTON: Well, if you look at the way
2 Ontario Hydro does business, which I happen to like, it
3 is quite different than what is done with many utilities
4 here, which is the best way. I think that is a part of
5 training research, is deciding what training should be,
6 and I do not see that anywhere in this particular module.

7 MR. ZWOLINSKI: What we have done from the
8 licensing side has been to focus through the
9 instructional systems development process, this ISD
10 process, the more systematic approach to training. Now
11 this is not to say that other vehicles do not exist that
12 would be acceptable to the regulator.

13 I think over the longer term research will be
14 looking at alternative systematic approaches to
15 training. I would assume that Ontario Hydro uses a
16 systematic approach. I am not familiar with their
17 program.

18 MR. CATTON: It is well worth looking at. It
19 is just a comment. I do not see it, and I really feel
20 it ought to be in there.

21 MR. ZWOLINSKI: If I interpret your comment,
22 you are saying that we ought to certainly take a look in
23 the area of research as to --

24 MR. CATTON: As to what training is all about.

25 MR. ZWOLINSKI: Thank you.

1 Any other questions?

2 (No response.)

3 MR. WARD: I guess that is all on training, so
4 let us go ahead with Mr. Beckham, I believe, is next.

5 (Slide.)

6 MR. BECKHAM: My name is Don Beckham. I am
7 Chief of the Operator Licensing Branch in NRR. I would
8 like to discuss the examination element.

9 The basic objectives that we have are
10 twofold -- one, to develop a valid and reliable
11 examination and, two, to develop a process that assures
12 that that examination is administered and graded
13 consistently across all of our examiners, the regions
14 and the different facility types.

15 It is a reasonably easy objective to lay out.
16 It tends to be rather difficult to me, primarily because
17 of the current lack of information on exactly what it is
18 we are supposed to be examining.

19 (Slide.)

20 Therefore, we initially focused on the content
21 of the NRC exam. A properly structured exam determines
22 if learning objectives have been met, if a training
23 program or qualification program has in fact brought a
24 set of candidates up to the point where they have the
25 knowledges, skills and abilities to perform the task at

1 hand. Therefore, we are basing in the initial portions
2 of the exam development work on the identification of
3 these knowledges and skills through the job task
4 analysis being conducted both by INPO and by a research
5 organization.

6 We are very sensitive to the criticism that
7 the NRC exam requires the candidates to learn skills and
8 knowledges other than those needed to operate a nuclear
9 power plant and that after they pass the exam they learn
10 to operate the plant. Therefore, we are looking very
11 hard at information that is available, information that
12 is being produced, to glean from that the abilities and
13 knowledges that are necessary for the operator to
14 perform the job.

15 We are looking at it in two different lights,
16 one for initial licensing, which is the main thrust of
17 the NRC involvement at this point, and also from the
18 point of view of requalification exams. We have been
19 directed by the Commission to conduct a minimum twenty
20 percent audit of all requalification operators.
21 Therefore, we have to come up with a different type of
22 examination. Do you in fact look for the same things in
23 a requalification exam as you do in an initial exam, and
24 that leads us into the second activity -- do you do it
25 the same way.

1 In the last three years we have made major
2 changes to the examination process. We established
3 minimum section passing scores. We established a higher
4 overall passing score. We have added new categories to
5 the examination and just recently we completely revised
6 the format that the written examination was conducted
7 under.

8 We added simulator exams to the examination
9 and after subsequent reevaluation required those
10 simulator exams only for those plants with
11 plant-specific simulators. Therefore, we need to work
12 within the examination system to ensure that our process
13 for examining operators is as dependable and reputable
14 as we can make it.

15 Therefore, we are working on assessing the
16 role of simulators in the examination, identifying the
17 optimal format and administrative procedures for
18 conducting the written examinations, developing
19 standardized examination practices, the actual
20 administrative procedures used by the examiners,
21 developing new and better guidelines and training for
22 the examiners, and developing the test, administering
23 and grading the test to ensure that we have consistency
24 across the examiners, and we are working very closely
25 with the efforts in the training area to ensure that the

1 examinations provide valid and consistent indications of
2 training program effectiveness.

3 MR. WARD: Let me ask a question. What are
4 you going to do if you come to the conclusion that
5 examination on a plant-specific simulator is the most
6 important thing you can do to assure that an operator is
7 qualified?

8 MR. BECKHAM: If we come to the conclusion
9 that the best method of determining that an operator is
10 qualified is through examination on a plant-specific
11 simulator and we have concluded through the studies that
12 we do have under way that there is no other method that
13 will give us that same assurance, then we would provide
14 recommendations to the Commission on rulemaking in that
15 area.

16 We have a report scheduled for the Commission
17 in July of 1983 that is specifically to discuss the role
18 of simulators in the examination process and make
19 recommendations to the Commission on that very
20 question.

21 MR. WARD: Out of the 70 or 80, or whatever
22 there are, operating plants, how many have
23 plant-specific simulators?

24 MR. BECKHAM: At this point there are
25 non-operational plant-specific simulators of the

1 operating plants announced and contracted for,
2 simulators that are under construction or in the
3 construction pipeline. There are 76 percent of the
4 operating plants, 85 percent of the plants that are in
5 the licensing phase and 98 percent of the plants with
6 construction permits have ordered or have simulators
7 under construction.

8 So in the next -- between now and 1986 about
9 85 percent of the operating units will have
10 plant-specific simulators.

11 MR. WARD: So it is going to go from what, ten
12 percent or something to 85 percent?

13 MR. BECKHAM: We are about 15 percent now, and
14 it will climb to 85 percent, and it is being paced now
15 by the capabilities of the simulator manufacturers to
16 respond to the orders that have been placed.

17 MR. WARD: Thank you.

18 MR. BECKHAM: The final effort that we have
19 currently under way is to use the efforts that have been
20 described previously on identifying and the job
21 performance as measured in simulator experiments and
22 relating that to performance on the examination.

23 This is essentially to back up the information
24 provided by the job task analysis. If we do in fact
25 find that there are reliable measures of job performance

1 being generated, we can then cross-correlate those with
2 the same subjects, examination reports, and determine if
3 we can get an indication of the reliability and validity
4 of the examination based on objectively-measured job
5 performance in a controlled setting.

6 We are also reviewing the efforts that are
7 under way by various industry groups and individual
8 utilities to provide more subjective job performance
9 measures. We are essentially following their research
10 to see how their programs develop, to see if that can be
11 used as a validity measure for the examination.

12 I would like to stress that all of the efforts
13 that we currently have under way will be constrained to
14 the current examination system. The system of written,
15 oral, walkthrough and simulator exams we feel very
16 strongly that we have made sufficient changes for the
17 immediate time in the examination process, considering
18 the long period of time that a candidate is in training
19 for his initial exam, considering the implementation of
20 NRC requalification exams, the change in the format of
21 the initial exam.

22 We feel that another set of immediate changes
23 to the examination are not warranted until we have
24 significant indication that we need to change that
25 system. Therefore, we are working primarily within the

1 existing system to ensure that we have proper content
2 validity of the existing examination.

3 MR. WARD: In the past, I guess until the
4 present, a large number of your examiners are contract
5 people rather than NRC employees, is that right?

6 MR. BECKHAM: Yes, sir.

7 MR. WARD: Do you plan to continue that? What
8 is the situation? What will it be in five years or ten
9 years?

10 MR. BECKHAM: We have direction from the
11 Commission to internalize the operator licensing
12 function. We are pursuing regionalization to help in
13 the serious problems that we have had with recruiting
14 licensing examiners. We are essentially competing for
15 the same people that are highly desirable to the rest of
16 the industry for licensing examiners.

17 Therefore, we are going to them rather than
18 forcing them to go to us.

19 MR. WARD: Who else wants licensing examiners?

20 MR. BECKHAM: Well, the people that we are
21 getting for licensing examiners are your basic
22 off-the-street nuclear engineer with a master's degree
23 and ten years of operating experience, including an SRO
24 license and experience in the training organization of a
25 utility.

1 They are pretty much dime-a-dozen and it seems
2 that if we make them an offer, whatever organization
3 they are working for will somehow manage to meet that
4 offer and maybe do us a little bit better without
5 causing them to move to Bethesda. Therefore, we have
6 the Region III operator licensin section fully
7 operational. We are staffing a Region II office. We
8 plan to start the Region I office in the
9 December-January timeframe to start staffing there, with
10 spring-summer staffing for the Region IV and V
11 sections.

12 By doing that, we hope to make job location
13 not be one of the problems with recruiting the
14 examiners. I will point out that we have significantly
15 reduced the number of part-time examiners. We have
16 major contracts with Oak Ridge, Idaho and Battelle
17 Pacific Northwest Labs for providing most of our
18 contract examiner help, and we have a commitment for
19 those people.

20 At two of the labs they are full-time
21 examiners. At one they are no more than half-time
22 examiners. So that we are providing them with a
23 significant amount of training and indoctrination in the
24 exam. That is either their main job or a significant
25 portion of their job. And we have a great deal more

1 control over their activities than we may have had in
2 the past to ensure examination consistency across
3 examiners.

4 Now we are working on getting our internal
5 procedures as well thought out as possible so that we
6 can provide as much validity to the examination process
7 as we can.

8 MR. CATTON: Is the exam that this person
9 makes up reviewed by anybody to make sure that its scope
10 is broad? I would be a little bit concerned about an
11 exam that was put together by a nuclear engineer.

12 MR. BECKHAM: The exam is created in
13 accordance with the examiner standards. We have
14 separate examiner standards for reactor operator and
15 senior operator exams.

16 MR. CATTON: The standards are with respect to
17 the balance of the exam? There is so much of this and
18 so much of that?

19 MR. BECKHAM: Yes. They have percentage
20 criteria for the five areas of each exam. They specify
21 the type of questions that should be asked, the
22 percentage of any category that you can ask in any given
23 area -- that type of direction.

24 After the exams are prepared, they are
25 reviewed by -- if they are prepared by one of the labs,

1 they are reviewed by the senior lab people, approved,
2 and forwarded to headquarters or the regional office for
3 review. There they are generally reviewed by one of the
4 NRC examiners and, as a minimum, the section leader for
5 that section prior to being administered.

6 MR. CATTON: I think your examination is
7 probably the key to getting the proper kind of training
8 you want them to have.

9 MR. BECKHAM: I tend to believe that also.

10 MR. CATTON: And this is not my own view. It
11 is also the view of some of the people at the
12 utilities. They will do whatever they have to to pass
13 your exam, particularly the OL exams, so it is really
14 important that you do it right and this is a tough
15 business.

16 MR. BECKHAM: It is an extremely tough
17 business and we are very much aware of the fact that we
18 can drive training programs with the examination with
19 very little difficulty. If we change the exam, the
20 training programs will change almost instantaneously.

21 MR. CATTON: I heard immediately about the
22 fact that there was thermohydraulics being put on to the
23 exam. Some of the screams were from 120 miles away.

24 MR. BECKHAM: The communication system that
25 exists in the industry is quite efficient.

1 MR. CATTON: That is right.

2 MR. BECKHAM: That is why we do not want to
3 make changes to the exam until we have a solid basis for
4 making those changes, and that is why we are looking at
5 the current efforts on relating operator performance to
6 actual job performance, and on the job task analysis for
7 ensuring that we are covering those skills and
8 knowledges that are necessary for the operators.

9 MR. CATTON: That is why I asked the earlier
10 question about research into what would really be best
11 to be in the training program, because you can drive it
12 with your examinations. If you decide certain subjects
13 ought to be covered, all you have got to do is ask
14 questions and they will be covered.

15 MR. THOMPSON: We kind of look at that as
16 balance, though. We should have the training program
17 being able to be integrated and self-sufficient, part of
18 the overall process that produces qualified operators.
19 Obviously, we can drive it, but hopefully the job task
20 analysis will identify those training needs and we will
21 all be kind of in a lock step, that we do not run off
22 and develop an exam without the training program having
23 to identify as a need from a systems approach to
24 identifying training needs for operators.

25 MR. CATTON: Sometimes a single person sort of

1 biting the bullet and deciding they ought to know a
2 little bit more about something and then putting it on
3 the exam is the best way to go.

4 MR. BECKHAM: Ideally, though, the INPO job
5 task analysis, the major thrust, is to identify the
6 training necessary in the ideal world. That will come
7 out. The training programs will be modified and then in
8 the examination, as it rightly should be, would be a
9 measure of whether those training objectives had been
10 met.

11 If we can work in the ideal world, that is the
12 way we will work.

13 MR. DE BONS: I assume that the training
14 objectives are not entirely knowledge-based -- in other
15 words, how many pigeons are there in the coop or how
16 many eggs in the basket. But, rather, they are problem
17 oriented so that if you give the student certain
18 alternative actions he can respond in a way that is
19 reasonable. Is that correct?

20 MR. BECKHAM: The current NRC examination
21 takes both sides. We ask a certain number of questions
22 that are memorized knowledge. What do you do if you get
23 the following condition? We ask a certain number of
24 questions that are here is the indications that you
25 have. Here are the alternatives. What would you do?

1 We are -- part of our effort is to evaluate
2 all three portions of the examination -- the written
3 exam, the operational exam, and the simulator exam -- to
4 get a better determination of what skills and abilities
5 are measured by both the individual questions. We are
6 doing content analysis on the individual written
7 questions. We are also doing analysis of the oral
8 portions of the exam to determine the skills and
9 knowledges that are measured there.

10 So that we assure ourselves that the overall
11 process measures both the memorized knowledge that is
12 necessary and the development of the skills and
13 abilities that are necessary to properly operate a
14 nuclear power plant.

15 MR. DE BONS: So that means essentially that a
16 student responds in a certain way to the examination
17 question, that one possible conclusion could be that the
18 individual did not have the necessary analytical skills
19 or the synthesis skills that were appropriately
20 determined to be necessary for that task. Is that right?

21 MR. BECKHAM: For the short term effort of
22 current activity, we would not get to the level of
23 making the determination that the operator failed this
24 section of the exam because he was not able to maintain
25 in short-term memory the memorized information or he

1 failed the examination because he was not able to
2 synthesize three different bits of information into the
3 proper thing.

4 In our longer-term activities, we are not
5 constraining ourselves as much as we are in the
6 short-term activities. That may very well be something
7 that comes out of the studies that we are doing
8 long-term.

9 MR. DE BONS: Thank you.

10 MR. WARD: One more question. I guess it is
11 under training research, and maybe they will answer.
12 But there is something called an operator examination
13 data bank. Are you going to talk about that or was
14 someone else going to talk about that? What is that?

15 MR. BECKHAM: We essentially have two systems
16 that we are in the process of finalizing now. They are
17 more tools for us than anything that is going to
18 dramatically affect the examination.

19 The examination question bank is a
20 computerized bank of questions that are available to the
21 examiners to use in developing the written exam. It
22 takes some of the work out of writing the exam. It can
23 also be -- we also intend to use it to ensure that we
24 have the proper mix of the skill, analytical ability,
25 memorization type questions that was referred to

1 earlier.

2 It is a tool for the examiners to use to use
3 the computer technology essentially to present them with
4 alternative questions for preparation of the written
5 exam. The other information bank is a data bank that
6 includes all of the demographic information on all of
7 the docketts that we currently have in-house, and will be
8 added to as each licensing action is complete.

9 So we now have operators -- information on
10 operators available in the computer so that if we want
11 to know if cross-eyed, left-handed operators with a
12 minimum of four years of nuclear experience did better
13 on section 5, we can do that type of statistical
14 analysis. We will be using that system extensively when
15 we are in the evaluation of the examination.

16 MR. CATTON: EPRI found that from their
17 simulator study, that the operators thought more in
18 terms of the heat balance did better with respect to the
19 various scenarios that they were run through. Are you
20 going to be able to put that together?

21 MR. BECKHAM: We believe that we can put
22 together an examination that in fact does track for that
23 type of ability. We are working very closely with
24 people in the procedures area to determine how the new
25 procedure formats and the training programs that are

1 being instituted for the procedures are going to impact
2 the examination area.

3 Since most of those efforts are essentially
4 the identification of heat balance as the basis for the
5 procedures development work, I can anticipate that we
6 will have more operationally-oriented questions in the
7 heat transfer section than perhaps we do now.

8 MR. KEYSERLING: This is probably going to be
9 an integrated question, but I am going to ask it at this
10 time anyway. And it comes out of a concern I have with
11 increasing use of simulators and increasing use of very
12 expensive simulators.

13 As I understand it, the verdict is not in yet
14 as to the level of fidelity that is required in the
15 simulator system, whether or not simulators are required
16 at all in an effective training program or an effective
17 evaluation program. I would like to know if anyone has
18 ever looked at the relative cost and benefits of
19 building a simulator, building an expensive simulator
20 which duplicates some serious human factor engineering
21 errors that happen to be within the plant, as opposed to
22 trying to eliminate those errors in the plant itself.

23 This was one of the big concerns I had when we
24 toured Singer Lake. We saw beautiful machines being
25 built that included human factors efficiencies. And has

1 anyone looked at the cost effectiveness of building a
2 simulator versus changing the problem?

3 MR. BECKHAM: There are several people that I
4 recognize over on this side of the room that have done
5 quite a bit of analysis on the cost effectiveness of
6 building simulators to duplicate your plant and also on
7 the cost of upgrading simulators to conform to the
8 control room design list -- the results of the control
9 room design review studies.

10 I do not have that information at hand. We do
11 not anticipate, unless, as was brought out earlier,
12 there is a clear indication that the best way to examine
13 an operator is on a plant-specific simulator, we do not
14 anticipate requiring a plant-specific simulator just for
15 the examination purposes.

16 I share your concerns that if we required them
17 to duplicate a bad machine we are not helping anything.
18 That is one of the reasons that we do have in the
19 discussions of compliance with ANS 3.5 and Regulatory
20 Guide 1.149 on upgrading simulators, we have had several
21 discussions with utilities on their plans for
22 incorporating the results of the control room design
23 review into the upgrade of their simulator and what sort
24 of time lags there may be associated with that.

25 But I do not know of a specific cost-benefit

1 analysis that has been done.

2 MR. WARD: Don, you seemed to say there was
3 someone in the audience that had done some work on
4 that. Is there someone who would like to volunteer an
5 opinion, an answer to the question?

6 (No response.)

7 MR. KEYSERLING: Could I ask a more
8 fundamental question. That is if we have X number of
9 dollars to reduce human factors errors, should those
10 dollars be spent in training, and by training I am
11 talking about building simulators to duplicate human
12 factors engineering errors, or should those same dollars
13 be spent on eliminating those errors and which approach
14 is ultimately going to give us the fewest errors being
15 made?

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1 MR. BECKHAM: I don't think that is a yes or
2 no question. I think the purpose of the control room
3 design review is to identify the control room
4 deficiencies that a cost-benefit analysis will justify
5 being corrected. I think that at the completion of that
6 program, we will have a much better idea of what then
7 the training program will be required to compensate for,
8 but I don't think it is a should we put all of money in
9 training or should we put all of our money in hardware
10 corrections. I think it is more of a let's find the
11 correct mix for the operating reactors that will yield
12 the maximum level of safety.

13 MR. KEYSERLING: Well, that sounds like a
14 reasonable answer. I hope that is being done.

15 MR. WARD: Go ahead, Don.

16 MR. BECKHAM: Moving right along.

17 (Slide)

18 As I said, our current activities are
19 constrained to the existing examination system. For our
20 long-term activities we in no way intend to maintain
21 those constraints. We intend to identify the state of
22 the art in testing.

23 This is a multi-area effort because we are
24 dealing with a broad group of people in different
25 technologies who are dealing with different portions of

1 the examination. If we can develop new strategies for
2 the licensing of operators and senior operators that
3 provide us better content and performance validity, we
4 certainly want to pursue those tactics.

5 To give you an example, we are looking at the
6 FAA's check pilot concept where the certified best SROs
7 in the industry have some certification from the NRC and
8 then go in and spend a shift with licensed operators as
9 a check examination. We want to take the results of the
10 industry and NRC programs on training programs. If they
11 identify a logical conclusion as a valid measure of
12 training effectiveness, we would want to incorporate
13 that into the exam. We will be forced to consider the
14 maximum use of our headquarters and regional people in
15 the examination process. That may very well change the
16 entire concept of the exam.

17 We want to use the best testing improvements
18 that the utilities have made. They are doing a great
19 deal of work on improving their training programs, and
20 believe me, they don't send someone to the NRC exam
21 without having given them exams themselves. Therefore,
22 if they develop new innovations, we want to be on top of
23 those innovations and incorporate those into the exam if
24 possible. And we would also like to incorporate any
25 technological advances.

1 If we can develop an SAT-type exam that is
2 both content and performance valid, that we announce
3 that. In March of 1988 we will be at the local
4 auditorium in Atlanta and we will be giving the RO and
5 SRO exams, and anybody that wants to take them can come
6 in and fill out the form and give us their \$5
7 registration fee, similar to the way the SATs are given.
8 We are going to pursue that.

9 This is not to say that we have absolutely
10 decided that any one of these methods is the best way.
11 What I want to point out is we have a completely open
12 mind about the NRC examination. We want it eventually
13 to be the best measure of the operator's qualification
14 to be a safe operator or senior operator in the control
15 room. We intend to draw on the state of the art in both
16 the nuclear area and in other related technologies to
17 provide us with the assurance that the examination is in
18 fact doing that, and prior to implementing changes of
19 that magnitude in the exam, we would insist that the new
20 technology be fully validated. In that we would be
21 working with the available objective measures of
22 on-the-job performance, correlating with the INPO and
23 Research task analysis results, and we would ensure that
24 we had a system in place to ensure that the new
25 examination was kept current and valid.

1 MR. DE BONS: To date what has been the
2 correlation between the examination philosophy and
3 practices and selection and employment practices?

4 MR. BECKHAM: I can't answer that question for
5 you. We do not at this time have a study that would
6 correlate between the practices used by the utilities in
7 selecting the candidates for the licensing program and
8 subsequent performance on the NRC exam. I can tell you
9 that 95 percent of the candidates that are initially
10 proposed by the utilities for licensing eventually
11 receive their license, so the utility screening seems to
12 working fairly well.

13 MR. WARD: Any other questions? Mr. Buck.

14 MR. PUCK: I have one question here. In the
15 integrated human factors program, it states in the
16 section under personnel staffing, validation of current
17 new selection procedures. And then I look at your third
18 bullet up on that last slide, and it says validation of
19 new examination programs. However, in the program that
20 was pre-set up, it states that the staff disagreed with
21 the human factors group on this particular item. I
22 somehow am very confused as to what is the differences
23 and what is the similarities.

24 MR. THOMPSON: Hugh Thompson. The particular
25 disagreement that is identified on the paper is whether

1 it should be an NRC-run program versus an industry-run
2 program. In personnel selection we clearly agree that
3 that effort should be done and the effort should be made
4 to have the utilities have a good selection process for
5 their candidates. We feel that that is more
6 appropriately an industry-run program rather than an NRC
7 telling the industry how to go out and select their
8 candidates. We are monitoring their process now. Wayne
9 Jones of Memphis State is running tests. Joe Johnson at
10 TVA has his bring anybody in and we will test them along
11 the way, kind of a different kind of approach. So we
12 are monitoring what the industry is doing and we think
13 that is the appropriate level for the effort to be done
14 at.

15 I think if you will notice in the Human
16 Factors Society recommendation they said it should
17 either be done by the industry and monitored by NRC, so
18 this agreement here was probably a mischaracterization
19 of our position. We agree that it ought to be done and
20 it ought to be done by industry.

21 MR. BUCK: I think it says if the industry
22 isn't going to do it, then the NRC should.

23 MR. THOMPSON: That's right. Then it gets a
24 little touchy, but at least industry is doing it and we
25 are monitoring their efforts right now.

1 MR. BUCK: Okay, but that is over and above
2 licensing.

3 MR. THOMPSON: That's correct.

4 MR. BUCK: Okay.

5 MR. WARD: Any other questions on training?

6 (No response.)

7 MR. WARD: Okay.

8 Let's take a break, and we will reconvene at
9 3:20 on the man/machine interface.

10 [Recess.]

11 MR. WARD: Our next speaker is Voss Moore, who
12 will talk on the man/machine interface program area.

13 (Slide)

14 MR. MOORE: As Dave said, I'm Voss Moore,
15 Chief of the Human Factors Engineering Branch, and I
16 will be talking about the man/machine interface
17 element. The objective as laid out here is to develop
18 technical bases really for making decisions in the
19 man/machine interface, and I think perhaps it would be a
20 little more accurate to say "improve" the technical
21 bases, because we are really not starting from ground
22 zero.

23 As you people know, we have been working in
24 this area for a couple of years and have been meeting
25 with the Operations Subcommittee and the Human Factors

1 Subcommittee and the Full Committee on a number of
2 occasions. We have reviewed 25-plus control rooms. A
3 number of those we have discussed with the Committee on
4 individual operating license reviews.

5 We have discussed control room guidelines,
6 evaluational criteria with you people, SPDS, functional
7 criteria and evaluation criteria, and on a number of
8 occasions we have discussed the integration of these
9 initiatives with regard to the SECY 82-111
10 recommendation to the Commission. But as you are aware
11 from the various meetings we have had with you, our
12 involvement with the man/machine interface has been
13 restricted pretty much to the control room and pretty
14 much to the operability aspects of the control room. And
15 you and our staff and others have identified a number of
16 areas that go beyond the control room and operability,
17 and it is really that area that the man/machine
18 interface element of the program plan is aimed at.f

19 Now, with regard to the second bullet, the
20 purpose of the initiatives or the efforts in the program
21 plan is to enable us or to provide a technical basis for
22 making decisions with regard to regulatory positions.
23 Regulatory positions could be in the form of new
24 requirements or new guidance to implement existing
25 requirements, and the "where needed" was added to

1 indicate that if indeed our studies show that a
2 particular problem isn't amenable to a regulatory
3 solution, we don't intend to force fit, or if it
4 indicates that it is really not beneficial to place new
5 requirements on the industry in a particular area, we
6 don't intend to go that way.

7 Now, how will we use the new regulatory
8 positions? Obviously, new designs, if any come along.
9 Evaluating modifications of existing plants is probably
10 one of the most likely ways that we will use this new
11 knowledge, and certainly the assessment of operating
12 experience and incidents. We will have incidents. We
13 will have operating experience that will give clues to
14 certain inadequacies or possible needs for improvement.

15 We would like to have a technical basis for
16 evaluating those properly.

17 MR. RAY: Will the LER reports be your prime
18 source of the operating experience?

19 MR. MOORE: Probably not. They certainly
20 haven't been too helpful to date. More incidents where
21 there was a clearcut case or a hint of an operator error.

22 MR. RAY: Do you mean a major transient or
23 something like that?

24 MR. MOORE: Yes. I think that is probably the
25 more likely place. We do review the LERs and we are

1 still optimistic that the system will improve and
2 provide us the kind of information that will let us
3 determine whether there is a man/machine interface
4 problem, but to date it hasn't been.

5 MR. RAY: Dr. Moeller made a point earlier
6 that the present form of the LERs may be efficient for
7 this purpose. Have you reached a conclusion to that
8 effect? Do you see improvements in the LER requirements
9 that might help you?

10 MR. MOORE: Well, I have read some drafts of
11 improvements, and it looked to me like it would make
12 them clearer. I think Dr. Moeller may have been saying
13 that the additional analysis and information might
14 discourage people from reporting things. Was that the
15 tone? That was the tone I thought I gathered.

16 MR. MOELLER: To some degree, but we both
17 know, of course, they are looking at the LER system and
18 they are proposing revision. Now, I must confess that I
19 have not looked at it specifically in terms of meeting
20 your needs or your needs as described here today, and I
21 think that is Mr. Ray's point.

22 MR. RAY: That's right.

23 MR. WARD: It seems that every time the
24 question of LERs used in this area comes up, everybody
25 says they aren't really much good. I guess the most we

1 got is that there was a core screen indicating
2 interesting incidents. I guess I don't find anything in
3 the Human Factors program that is addressing that.
4 Shouldn't the Human Factors people be going to the LER
5 people and insisting on some changes in the LER format
6 or reporting methods?

7 MR. MOORE: There was a Research NRR task
8 force on that. Jim, can you shed any light? I know I
9 had a fellow working on the task force. I don't know
10 what progress they have made.

11 MR. JENKINS: My name is Jim Jenkins. I am
12 with the Human Factors Branch in the Division of
13 Facility Operations in the Office of Research. Almost a
14 year ago, perhaps more, a series of recommendations were
15 made for specific changes and requests for types of
16 information that we recommended should be reported in
17 the event that an LER would have to be completed, and
18 these were submitted to AEOD. In fact, I think we have
19 the author of the report here. And we recognize, very
20 frankly, that a final decision has not been made on the
21 structure and content of a revised LER system, but we
22 have recommended specific changes so that information
23 relating to human reliability circumstances of a pulse
24 and other data might be available.

25 In fact, as you know, Mr. Ward, we have just

1 completed an analysis of LER reports to identify the
2 time of day and the time during a shift when a variety
3 of human errors occurred, and this was a recent analysis
4 that we had completed trying to use the current data.
5 So we have made recommendations until, I guess, the
6 other side of NRC responds. That is where we are.

7 MR. WARD: In the aircraft business there is a
8 system of anonymous reporting of near misses that pilots
9 and air traffic controllers use. I guess it is
10 available to other people in the business, too, but they
11 are the two users. And I think NASA collects -- well,
12 these anonymous reports are sent into a NASA office. It
13 is a NASA office because I guess they don't want the FAA
14 doing it. And I mean it isn't LER-type events but
15 lesser events where there is some human failure that
16 some people in the operating business knows. The
17 reactor power operator organization, PROS, at least some
18 of the representatives have expressed an interest in
19 providing that sort of service for the nuclear power
20 plant business. What do you think of that?

21 MR. JENKINS: In response to your first part,
22 you all kindly brought this to our attention in April,
23 as I recollect, and we now have a contract with the
24 Aerospace Corporation to look into the NASA and the Air
25 Force and other forms of reporting of human performance,

1 and to come in with a feasibility plan as a consequence
2 of their analysis. Because of a number of reasons, that
3 plan has been delayed and will now be available in
4 December or January of this year, or 1983.

5 We have discussed last week with the reactor
6 operators society the kind of information that they
7 might have that could help us, and so discussions have
8 begun with them. How it will end, I wouldn't know, but
9 we do have the work started. We are also cognizant that
10 INPO, through some of their international associates,
11 have looked into a variety of reporting systems and are
12 evaluating these methods in a pilot study which I
13 understand is now taking place or soon will take place,
14 and we have asked for that information.

15 MR. WARD: Thank you.

16 MR. MOORE: These are the activities in the
17 man/machine interface that are discussed in the program
18 plan.

19 (Slide)

20 Maintenance. As you will remember, I
21 mentioned that we had looked at the control room from
22 the man/machine interface in the control room from the
23 operability standpoint, not from the maintenance. There
24 are strong hints that significant contribution to risk
25 of accidents comes in the maintenance area. There are a

1 number of groups working in that area now, and I was a
2 little parochial when I made out the Vu-graph because I
3 know that INPO and EPRI are both working in the
4 maintenance area. NRR started a technical assistance
5 program just this fiscal year, and our scope was to
6 really look at the extent of the problem with the idea
7 of determining where safety might be improved from
8 improved maintenance and the extent to which that might
9 be amenable to a regulatory fix. And we all had some
10 top of the head ideas concerning what one ought to do
11 about maintenance, but we didn't want to fly into this
12 without a careful study.

13 The near-term program is in NRR and the longer
14 or intermediate range will be with Research, but it is
15 geared toward looking for where new regulatory positions
16 might improve safety. We have had to be very careful
17 that our programs that sounded very much like, Research
18 and NRR, didn't overlap, that they complemented each
19 other rather than us both doing the same thing. And we
20 also have had interaction with EPRI and INPO to avoid
21 the conflict.

22 MR. WARD: I noticed on the bar chart where
23 you showed the time. Under the maintenance program
24 there is a program: develop design for maintainability
25 guidelines, and the work on that starts this year or has

1 started. And then there is to develop general
2 maintenance guidelines, and the work on that doesn't
3 start until 1985.

4 I wonder, since there aren't really any plants
5 that I know of being designed now, if the priorities
6 shouldn't be swapped there. What is the urgency, unless
7 I don't understand what that is, but why the urgency to
8 start on develop design for maintainability guidelines.
9 It is a good idea when there are new plants coming.

10 MR. MOORE: I think that we feel that here is
11 a place here incidents and experience may indicate that
12 there is a problem and that where we do need some
13 requirements and we would like to know how to handle
14 those. Now, the general maintenance guidelines, I'm not
15 sure why they are so far out. Ann, do you know? Ann
16 Ramey-Smith of the Human Factors Engineering Branch.

17 MS. RAMEY-SMITH: What we are referring to
18 with the general maintenance guidelines there is an
19 integration of a number of different NRC efforts in the
20 area of maintenance, so the general maintenance
21 guidelines will be addressing such things as perhaps
22 staffing, procedures, man/machine interface concerns,
23 these sorts of things. That is why the timing is
24 several years out, so that these efforts can get under
25 way so that we will have the information available to

1 put together those general guidelines.

2 MR. MOORE: Yes. I failed to mention that in
3 the next fiscal year there is a look into maintenance
4 procedures. It is very, very hard to separate design
5 from maintainability, training from maintenance, and
6 managing maintenance and maintenance procedures. So our
7 technical assistance program is under the same
8 contractor so that there will be a proper coordination
9 under P&L.

10 MR. WARD: Well, it is hard to separate them
11 but I would assume that design for maintainability would
12 apply to new plants.

13 MR. MOORE: It would apply to new plants or
14 modifications.

15 MR. WARD: Plants not yet designed?

16 MR. MOORE: Well, it could be modifications.
17 Very often something will happen and the utilities will
18 propose a modification, and the reason for the
19 modification may be improve the maintenance.

20 MR. MOELLER: You said earlier that -- and I
21 am quoting the same statement in the plan -- "There is
22 evidence to indicate that human error in nuclear power
23 plant operations contributes to nearly half of the
24 overall risk to public health and safety." What is the
25 evidence?

1 MR. MOORE: I think there have been several
2 studies. I am tempted to say LER data after having said
3 LERs are not too good. Carl Gawler, do you want to
4 comment?

5 MR. GAWLER: WASH-1400 shows that.

6 MR. CATTON: I think there has been subsequent
7 data from EPRI.

8 MR. GAWLER: Yes, there have been subsequent
9 PRA analyses that have further verified that.

10 MR. MOELLER: Well, I understand what you are
11 saying and the context in which it is said, but I have
12 read NRC reports from other offices or branches that
13 have stated, for example, on the Zion PRA that 90
14 percent of the risk was associated with seismic events,
15 and I am just reading on the Indian Point 2 and 3 PRA
16 where 50 percent of the risk is associated with fires.
17 I know what you mean, but I think it has to be said in
18 context.

19 Now, if you assume that the 90 percent of the
20 risk contribution from seismic events is due to errors
21 in design or failures in properly testing equipment to
22 resist such events, then that is the context, I presume,
23 in which your statement was made.

24 MR. CATTON: EPRI says that a little
25 different. They just say most of the human errors are

1 associated with maintenance. It doesn't say what
2 percentage of risk is human error.

3 MR. RAY: Well, I don't think we need to
4 pursue this, but perhaps they understand my point.

5 MR. GAWLER: There could also be considerable
6 overlap, Dr. Moeller, in the example you gave. For
7 example, even in the seismic event, the consequences
8 could be compounded or erroneous actions taken. There
9 are overlaps in those two sets.

10 MR. MOELLER: Thank you.

11 MR. MOORE: The second --

12 MR. WARD: I'm sorry, Voss. One more
13 question. The program plan under maintenance says a
14 program plan has been developed which addresses numerous
15 issues in the area of maintenance. Is that something
16 that is published?

17 MR. MOORE: Only in draft form. It is from our
18 contractor at P&L and it is being reviewed now, and that
19 more or less recommends the future action to be taken in
20 a program. The second activity is local control
21 stations. As I said, we have concentrated in the
22 control room.

23 We think there is reason for some concern for
24 local control stations. I think somebody mentioned the
25 valve way up in the air that had to be operated. Our

1 concern stems partly from the fact that unlicensed
2 operators, and presumably not as well-trained operators
3 as the licensed operators in the control room, will be
4 operating at local control stations and probably under
5 less direct supervision than the people in the control
6 room.

7 Now, there is another side of the coin, or
8 another group of people that say, well, it really isn't
9 that big of a problem because most of those operations
10 can be monitored in the control room. So the purpose
11 of this program is to look into what we should do and it
12 is likely to end up as a revision to our standard review
13 plan. And also a number of organizations are involved,
14 emergency response facilities, particularly the
15 technical support center. I&E has the lead on the
16 emergency response facilities.

17 We will be doing the human factors review in
18 conjunction with their review. We will be developing
19 some guidelines to help us perform the reviews, and we
20 will be turning out a number of reviews up through 1985,
21 and I believe -- I don't have Research there. I thought
22 you had a program in the emergency preparedness, and
23 here I may have been -- yes, I have been parochial again.

24
25

1 Annunciators. That has been identified as a
2 problem since before Three Mile Island, by Joe Simonera
3 and others. And certainly the accident at Three Mile
4 Island emphasized it. Our control room reviews have
5 certainly indicated that for major events, major
6 transients, the annunciator systems are perhaps as much
7 of a distraction as an aid.

8 We are looking into that. We are looking for
9 possible short-term, cost-effective fixes, and Research
10 is looking toward some longer-range fixes. We have had
11 some hints from INPO that we think there will be fairly
12 big changes, utility-initiated changes in the control
13 room where they will make changes to their annunciator
14 systems, not just because of safety but because of
15 difficulty in supporting the present-type systems with
16 their vendors.

17 So we really do think that even if no new
18 plans come in and even if we don't require backfits for
19 annunciator systems we need to have the technical basis
20 for reviewing improved systems.

21 Computers. There is an awful lot of activity
22 in the industry in improving the information and data
23 management. Historically, NRC hasn't done a great with
24 computers, with computer protection systems. We have
25 done some B and B audits and have done a fair amount of

1 work, but in the "non-safety systems" we have not done
2 very much, and here this is most of the work we expect
3 to be done by Research, EPRI, Halden and others, and we
4 at NRR will be following it.

5 But in the next year we have a fairly small
6 technical assistance effort to sort of scope out what we
7 think NRR and the Division of Human Factors Safety needs
8 are in computers and computerized information and data
9 handling.

10 MR. WARD: Voss, I guess I've raised this
11 point before, but I'm concerned about QA of computer
12 software. As you make more use of computers, there has
13 to be some way to control the software and the software
14 changes, analogous to configuration control of
15 hardware. And it just seems to me that that is a
16 regulatory concern.

17 MR. MOORE: It is, particularly with the
18 SPDS. And while we are working, number one, with an
19 INPO working group and our review is centered on an
20 audit of the vendor and utilities, B and B, with the
21 thought of good configuration management of the program
22 -- now, with regard to managing it or auditing it after
23 it is in place and being changed, I think that is an
24 area that we will be exploring to see perhaps what
25 guidance should be given to the resident inspectors.

1 I know there has been a great deal of concern
2 by INPO with the possibility of people buying software
3 that is proprietary and that, to make changes, if the
4 vendor has gone out of business, they have to start all
5 over. So the management of changes in those systems
6 over the life of the plant I think is one of the areas
7 that we definitely need to explore and may indeed have
8 to develop requirements or perhaps inspection modules
9 for.

10 MR. GAWLER: Excuse me, Voss. I would like to
11 also add that in the area of research we have initiated
12 programs to investigate this question of QA in computer
13 software. This is not limited to human factors
14 considerations. Therefore, this is being sponsored in
15 our Instrumentation and Control Branch in my Division of
16 Facility Operations.

17 One of the first steps we have taken in this
18 regard is to promote an industry and voluntary consensus
19 standard, to develop a standard on QA for computer
20 software.

21 MR. WARD: Carl, who is doing that work?

22 MR. GAWLER: IEEE.

23 MR. WARD: It is a contract with IEEE?

24 MR. GAWLER: No. As I say, this is being done
25 under a voluntary consensus standard effort, so it is

1 not a contract. But we are causing this to happen.

2 MR. WARD: It's voluntary, but you're making
3 it happen?

4 (Laughter.)

5 MR. WARD: I've heard about things like that.

6 MR. GAWLER: Actually, in this case we got a
7 lot of help from an individual who was active on that
8 committee.

9 MR. WARD: Thank you.

10 MR. SALVENDY: If you could clarify, please,
11 whether you plan to carry out any work in the area of
12 supervisory control? We're talking in the area of
13 computers.

14 MR. MOORE: To date, software type systems
15 have not been used. To the best of my knowledge, there
16 aren't any being used to actually manipulate the plant.
17 Most of that is hard-wired. There are protection
18 systems that are software-oriented. So if that were to
19 become a problem, I think we would get involved in it.
20 But I think the functional allocation, that is a later
21 element, we'll be looking more directly at that: what
22 the man should be doing, what the machine should be
23 doing.

24 MR. SALVENDY: No, I was really thinking when
25 the human actually interacts with the computer and gets

1 information via computer. Is there a special branch
2 within this research program which is cogenerating --
3 called in the field of human factors "cogenerating
4 control"?

5 MR. MOORE: Yes.

6 MR. SALVENDY: What specifically do you plan
7 to carry out in the area of human factors control?

8 MR. JENKINS: Jim Jenkins.

9 We just finished a conference on cognitive
10 modeling, including supervisory control models, at MIT
11 over the past three weeks, and we were pulling together
12 a variety of thoughts. We had Tom Sheridan, who is
13 noted for his supervisory control models, among others.
14 And at this date we are evaluating the many concepts
15 which came out of that to focus a direction of
16 research.

17 At the same time, we are getting in a more
18 pragmatic sense some empirical information related to
19 man-computer interaction through our evaluation of a
20 variety of SPDS-type displays. We hope to present to
21 the ACRS a more thoroughly defined research program in
22 the near future.

23 MR. SALVENDY: Then in the current plan you
24 don't have any plans, in the current proposal here, to
25 carry out the research in the supervisory control?

1 MR. JENKINS: We don't. We have not defined
2 the plan, but we intend to.

3 MR. SALVENDY: Thank you.

4 MR. MOORE: The next item, advanced controls
5 and displays. A number of advanced control rooms have
6 been bought and, while we've evaluated a few of them --
7 by "advanced control room" I mean one that utilizes
8 extensively CRT displays, computer-backed CRT display
9 system versus the hard-wired, meter-type system. And
10 our present guidelines do have some guidance in that
11 area.

12 But we do recognize that the field is moving
13 very fast and research has a number of projects, as does
14 Halden. And NRR, in looking over the programs, decided
15 that there wasn't any specific short-term technical
16 assistance kind of a job that we ought to do, but that
17 we will be following those efforts to be sure that in
18 evaluating advanced control rooms we will be using the
19 best information that we can get our hands on.

20 MR. WARD: Voss, how do you plan to integrate
21 the programs there with research and what is going on at
22 Halden? And I guess there is some other European work
23 going on. I think the French have some.

24 MR. MOORE: Yes, Research is following that.
25 They do have a representative at Halden. They have the

1 integration function and will be just keeping step with
2 what has been generated. They will be providing us with
3 reports, and also information as to what research is
4 going on.

5 Is there anything you can add to that, Jim?

6 MR. NORBERG: We just recently had a
7 discussion with three representatives from the Halden
8 Research Project, technical people, at which time NRR
9 people and staff members were also involved in some of
10 the discussion, particularly relative to what was being
11 done on the annunciator systems and some of the computer
12 work. And so the staff members are being kept informed
13 on this basis.

14 And also, our research program is basically
15 aimed at developing the data base and the criteria and
16 guidelines from which we would then pass on to the NRR
17 side of the house for them to take whatever regulatory
18 actions they believe to be appropriate in terms of
19 advanced controls and display systems. What the
20 research program is doing is trying to provide the
21 technical basis for the criteria and the guidelines, and
22 NRR will then apply these as may be appropriate for
23 regulation.

24 That is kind of the interface we have.

25 MR. MOORE: The next item, function

1 allocation. In our review of control rooms to date, we
2 have been dealing with plans that are designed and a
3 functional allocation was made when the systems were
4 designed. We have accepted those as the functional
5 allocation and haven't challenged those unless the
6 systems review or the walk-through of procedures
7 indicates that possibly that is an improper allocation.
8 But we feel that it is very important to carry on
9 research in this area, even if we didn't expect new
10 plants to come along.

11 Obviously, if there is a new design coming in,
12 the review of the allocation of functions between the
13 man and the machine would be significant. It would be
14 an important part of our review. But we believe that --
15 well, we know that in many of the incidents in the past
16 there has been raised the question, gee, should the man
17 have been tagged with that responsibility? Shouldn't
18 there have been an automatic system?

19 We feel that we do need better data, better
20 background for evaluating that sort of an incident,
21 because invariably when a human error is involved in an
22 incident the question comes up, well, did he make the
23 error because he was doing something that shouldn't have
24 been assigned to him? So that is a research effort that
25 we will be, we in NRR, will be following.

1 Our last item is safety system status
2 indication. Task action item 1.D.3 called for us to
3 investigate the desirability of applying Reg Guide 1.47
4 to the plants that it hasn't been applied to, and Reg
5 Guide 1.47 really calls for a status, an automatic
6 status indication of the safety systems of the plant.

7 This seems to be confused with the SPDS. That
8 is looking at the status of the plant itself. But this
9 is looking at the status of the normally static safety
10 systems, their readiness for operation. Now, Reg Guide
11 1.47 does acknowledge that certain of those functions
12 may be left to administrative controls and I think
13 probably in the past we have left things to
14 administrative controls that were difficult to automate,
15 and we are looking into what systems it is appropriate
16 to leave to administrative controls and which ones
17 really ought to be automated so that we will be looking
18 at those systems with regard to the need for automation
19 rather than the ease of automation.

20 (Slide.)

21 I have covered most of this, I think, in going
22 over the activities. But there are a large number of
23 groups involved in all of the various activities
24 associated with the man-machine interface.

25 (Slide.)

1 The products, you will notice these are in the
2 form of reports that will provide us the technical basis
3 for making decisions, as I mentioned earlier, and the
4 implementation. --

5 (Slide.)

6 -- as I indicated before, could be in the form
7 of regulatory positions or improved guidance to meet, or
8 new requirements or improved guidance to meet existing
9 requirements. Maintenance -- we essentially don't have
10 human factors requirements in the area of maintenance.
11 We will have to make a decision with regard to that.

12 The local control stations could -- the output
13 of this could be a revision to the standard review
14 plan.

15 Computers, we really don't know. I think it
16 depends on what comes out of the research. Backfits;
17 certainly we will be considering short-term backfits for
18 annunciator systems and will consider whether the plants
19 that have not met Reg Guide 1.47 should be required to.

20 Now, I have a number of other slides that go
21 into sub-elements and sub-elements to these that I have
22 discussed, and cover some of the research and NRR
23 technical assistance.

24 I see I have more than used up my time. I
25 would propose to go ahead if you want me to, but I would

1 really propose to answer your questions if you have
2 them.

3 MR. WARD: Does anyone have any questions?

4 MR. KEYSERLING: Yes, I have a question that
5 really did not show up under "activities," but may have
6 come under maintenance, and that is, are there any
7 ongoing efforts to look at the human factors aspects of
8 protective clothing and how the use of protective
9 clothing could interfere with or actually prevent a
10 person from doing what they are supposed to be doing,
11 maybe even in an emergency situation? Is that being
12 considered anywhere in your activities?

13 MR. MOORE: Yes, in the research. But before
14 Jim starts, in our control room reviews to date we do
15 have the people put on the protective clothing and we
16 check their ability to communicate across the control
17 room. But obviously a lot more needs to be done.

18 Jim?

19 MR. JENKINS: Yes. Jim Jenkins.

20 Over a year ago we met with EPRI, and at that
21 time they were making a human factors analysis of a
22 variety of protective clothing, used particularly to
23 handle the heat transfer problem and the cooling
24 maintenance. And they have an active research program
25 to look into a variety of designs, which I understand is

1 near completion.

2 As part of our maintenance task analysis, as
3 well as our control room crew task analysis, we will
4 include those instances for which protective clothing is
5 a requirement to get a baseline of information on the
6 effectiveness or baseline information on the use of
7 current protective clothing.

8 Beyond that, we have done some literature
9 research, primarily the Army's work in the Quartermaster
10 Corps, of protective clothing, and it appears that --
11 and, excuse me. There is one other item. There is some
12 work by I&E, I believe, and I could stand corrected on
13 this one, on various applications of protective clothing
14 in testing that they are doing on the maintainability of
15 capability provided by the current protective clothing.
16 It has been well documented that the suits are not well
17 designed for maintenance, that maintenance activities
18 are very difficult to perform.

19 And so I think the task analysis information
20 and the EPRI information provides us the analytical and
21 the empirical basis for determining what kind of
22 regulatory response should be made. We are not in a
23 position to do that yet.

24 MR. KEYSERLING: Is the EPRI program looking
25 at improved designs or are they just evaluating current

1 designs?

2 MR. JENKINS: They are looking at improved
3 designs. They are actually shooting for, I believe, up
4 to an hour of habitability with this particular
5 garment.

6 MR. CATTON: Their recent, what is this, EPRI
7 journal describes the suit in part.

8 MR. WARD: One other question, Voss. We
9 talked about the need for, possible need in the future,
10 for a better QA of software. There will also be a
11 companion need for better reporting of incidents related
12 to software problems or software errors. LER's I don't
13 think now are a very rich source of that sort of thing.
14 Is there any plan now to structure the LER reporting so
15 it would be sensitive to software as software becomes
16 more important?

17 MR. MOORE: I don't know of any, but I think
18 that is a good point.

19 MR. CATTON: Where does Michelson's group fit
20 into this?

21 MR. MOORE: They are developing the new LER
22 system, and we have had contact with them.

23 MR. CATTON: I guess if there are new
24 categories you ought to be informed.

25 MR. WARD: Yes. But these people are the

1 potential users and they ought to be beating on them to
2 include what they want.

3 MR. CATTON: That's right.

4 MR. WARD: Thank you, Voss.

5 Our next speaker is Mr. Ziemman.

6 MR. ZIEMAN: I'm Dennis Ziemman, Chief of the
7 Procedures and Test Review Branch.

8 (Slide.)

9 The objective of the procedures and testing
10 elements of the program plan obviously are to upgrade
11 the plan procedures, to improve the operator's
12 capability of operating the plant safely under all modes
13 of operation, including emergency conditions, normal
14 operations, plant shutdown, or off-normal conditions.

15 This objective or goal will be met by
16 developing guidelines which the licensees or applicants
17 will use in the preparation of their emergency
18 procedures, and of course must include the development
19 of those procedures from the guidelines, training of the
20 operators, and implementation.

21 The objective of the testing portion of this
22 element is to increase operator understanding of the
23 plant behavior. This is accomplished by or has been
24 accomplished by performing additional tests during the
25 initial startup test period to gain some additional

1 information about the plant's behavior, and also by
2 requiring the operators to more actively participate in
3 the entire initial startup testing program.

4 In view of the fact that the short-term
5 objectives of this portion of the element are pretty
6 well in place and have been met for all of the operating
7 plants or the applicants for new operating licenses and
8 the long-term aspects of it have a very low priority, I
9 plan to say no more on this subject other than the fact
10 that we plan to reconsider and reassess the need for
11 developing or for reviewing the adequacy of the test
12 program in fiscal year '84.

13 (Slide.)

14 The first major activity for this element is
15 to develop the guidelines for the preparation of
16 emergency operating procedures. We chose emergency
17 operating procedures because we felt this was the area
18 for improving procedures that would realize the greatest
19 improvement in safety in operating the plant, although
20 there were some that disagreed with their importance.

21 The preparation of emergency operating
22 procedures guidelines has been a cooperative effort
23 between us and the industry which has been in progress
24 for some time. And as a matter of fact, it is now
25 nearing completion. All four vendor guidelines are

1 expected to be completed by the end of this year, this
2 calendar year, or very early next year.

3 The technical guidelines provide the link
4 between the transients and the accident analyses and the
5 procedures that the operator uses for operating the
6 plant. They also provide the guidance for preparing
7 what we call symptomatic or functional-based
8 procedures.

9 They have been developed by the vendors, the
10 four major vendors and the four owners groups associated
11 with those vendors and with INPO. NUREG-0899 is our
12 contribution to the guidelines. That document includes
13 the human factors type of guidance in providing, in
14 developing procedures. That document reflects the
15 resolution of comments that we received on its
16 predecessor, 0799, and is considerably less prescriptive
17 than the original document that was sent out for
18 comments.

19 We took many of the details out of 0799, with
20 the agreement that INPO and the owners group would
21 prepare a writer's guide that would include the kinds of
22 details that we had previously included in 0799. The
23 writer's guide has been completed. We have seen a final
24 draft version of it and it does in fact include the
25 kinds of details that we had previously included in

1 0799.

2 So by the end of this year the operating
3 reactors should have all the guidance that they are
4 going to need to start preparing their plant-specific
5 emergency operating procedures. Our authority for
6 implementing the emergency operating procedures is given
7 in a document which I'm sure you're all familiar with,
8 SECY 82-111.

9 We are currently initiating a program to
10 evaluate the methods of implementing revisions to EOP's
11 that will minimize negative transfer and retraining
12 time. This work is scheduled to be completed in
13 September of '83 and so it should pretty much coincide
14 with the time that most of the operating plants are
15 ready to start implementing their revised procedures.

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1 MR. WARD: Dennis, could I ask you a question
2 about that? I guess if a plant has an SPDS, that would
3 be something important in the emergency operating
4 procedure. Where does that get -- is that in the
5 generic technical guidelines, or is that just in the
6 plant-specific procedure that the licensees would write?

7 MR. ZIEMAN: Well, right now, it is neither.
8 When they come to pass, they will have to be geared into
9 the plant-specific procedures. Now, the generic
10 guidelines, of course, are a living document. They are
11 never going to be fixed.

12 As new Ginna problems arise, there is going to
13 be a need seen for revising those guidelines, and as the
14 guidelines are revised, so must the procedures be
15 revised. So as SPDS becomes a reality, then I see it
16 becoming a part at least by reference in the procedures.

17 To obtain a reasonable assurance that the
18 licensees have appropriately used the guidances provided
19 in developing their plant-specific procedures, we plan
20 to review all of the procedure-generation packages.

21 The procedure-generation packages include:
22 the plant-specific technical guidelines, the
23 plant-specific writer's guides, if they have used
24 something other than the generic writer's guide, a
25 description of the program or a description of their

1 verification and validation program, and a description
2 of their retraining program.

3 In addition to that, we plan to audit eight or
4 ten plants and audit the procedures of eight or ten
5 plants. The plants selected will probably include at
6 least one from each vendor type, may very likely include
7 plants from a small utility and plants from a large
8 utility and probably old and new plants.

9 Hopefully, as a result of this kind of an
10 audit, we can have a fairly secure feeling that those
11 licensees have appropriately implemented the guidelines
12 into plant-specific procedures. We would then leave the
13 audit of the remaining operating plants, the procedures
14 for those remaining plants to the regions in the normal
15 inspection functions.

16 (Slide.)

17 The next activity deals with Task Action Plan
18 item I.C.9, which was the long-term program for
19 upgrading all procedures. And for the purposes of this
20 discussion, I have not separated or have tried to
21 identify a program for any particular kind of
22 procedures. Included among those will be the operating
23 procedures, the maintenance procedures, surveillance
24 procedures, administrative procedures.

25 We have prepared a statement of work for

1 developing guidelines for the operating procedures and
2 for the maintenance procedures. In other words, our
3 approach to looking at these other kinds of procedures
4 will be very similar to what we did with the emergency
5 operating procedures; that is, we will develop
6 guidelines to give the industry from which they can
7 develop plant-specific procedures.

8 The estimated completion date for these two
9 tasks, which we are currently looking to specific
10 northwest laboratories for assistance on, is September
11 of 1983. The combined level is about 4 man-years.

12 In addition to the experience gained from our
13 review of the emergency operating procedures, the
14 operating and maintenance procedures guidelines will be
15 based on ongoing NRC and industry experience and
16 research. I reluctantly say, recognizing the problems
17 of LERs, we would hope to get some information there
18 that might be beneficial.

19 A survey of existing procedures at nuclear
20 plants or at non-nuclear plants of a similar type of
21 plant, examination of current technology and job
22 performance aids that could be applied to procedures, a
23 look at applicable industry standards and at the
24 problems that have already been experienced with
25 procedures.

1 These guidelines, when completed, will
2 probably be published as a NUREG, as was 0899. Our
3 authority, however, for implementation of this phase of
4 the program is not covered by 82-111. We are hoping
5 that many of the utilities will see the advantages of
6 improved procedures in these other areas and voluntarily
7 do them as they have with the emergency procedures. And
8 we undoubtedly will have to discuss the matter with CRGR.

9 (Slide.)

10 This vuegraph merely shows all of the
11 interfaces that have already been identified from the
12 activities that we have been involved in to date. They
13 are well-established lines of communications.

14 I guess it is perhaps obvious that PTRB is
15 shown in the hub of this, and you may understand the
16 why. In so doing, I may have shortchanged Research a
17 little bit because, obviously, they have an interface
18 with EPRI, an interface with INPO, and an interface with
19 the regional offices as well.

20 The specific research programs that are
21 developed or are either under way or planned to support
22 the development of the procedures element are shown on
23 this slide.

24 (Slide.)

25 And if you have questions on any of them, I

1 will be happy to try to redirect them to the appropriate
2 research person.

3 (Laughter.)

4 Are there any questions?

5 MR. WARD: I have one, Dennis. The situation
6 with SEP plants seems to be kind of a special one. Is
7 what you are saying there that it is likely that they
8 will be recognized in SEP plants some deficiencies
9 compared with more modern plants which, instead of
10 fixing by backfits, hardware backfits, you are going to
11 attempt to fix with procedures? Is that the idea?

12 MR. ZIEMAN: I think there is no doubt that
13 that is the case. We have already reviewed two plants
14 that they have finished the integrated review of the SEP
15 program. In many cases, it is neither. In some cases,
16 it is impossible. It is certainly not cost-beneficial
17 to make hardware fixes to them. And I think in many
18 cases it is reasonable to solve some minor problems like
19 that with procedures.

20 This, however, in my opinion, should not be a
21 part of this program plan. It is a task that we
22 perform, but it is just one of our routine jobs.

23 MR. WARD: Any other questions on procedures
24 and testing?

25 (No response.)

1 MR. WARD: Thank you, Dennis.

2 MR. ZWOLINSKI: I am John Zwolinski, and I am
3 going to talk about management and organization.

4 (Slide.)

5 The principal goal within the management and
6 organization element is to upgrade utility management
7 and organizational design. In addition, we feel that
8 the need exists very strongly to minimize the
9 subjectivity which currently exists in our review
10 process and in our guidelines that we have today. And
11 further, we should try to enhance to the extent possible
12 the reliability and consistency of our review process.

13 This is all being done in response to TMI
14 Action Plan items I.B.11 to J.31 on construction,
15 management, and item I.B.12 which is related to the
16 independent safety engineering group and its specific
17 role and responsibility. To carry that just a step
18 further, we are looking at the plant operations review
19 committee and off-site safety review group activity in
20 that area.

21 (Slide.)

22 Concurrent objectives under the thrust area
23 are on the research side the development and field
24 evaluation -- excuse me, field validation of new,
25 innovative approaches, techniques, and methods for

1 addressing nuclear facility management and
2 organizational effectiveness in matters crucial to
3 safety during power plant operations.

4 Also, Research is performing analysis and
5 establishing enhancement, modeling, requirements for
6 organization and management functions or practices and
7 roles, which is the collection of activities critical to
8 safety during nuclear power plant design, construction,
9 startup and organization. A rather ambitious program
10 for both NRR and Research.

11 In order to address the overall goal of
12 enhanced or the upgrading of management, we generated
13 document NUREG-0731, which has served as our basis for
14 licensing reviews over the past couple of years. It was
15 our first attempt, and there have been two or three
16 versions of that document, to communicate to the
17 industry what we felt were preferred managerial
18 practices. We find that the document is probably overly
19 prescriptive and not totally complete. And we are
20 building upon the knowledges we gained in the
21 development of that work in the ongoing work of
22 establishing new guidelines in the area of management
23 and organization.

24 The thrust is our moving to develop guidelines
25 which emphasize the responsibility of the utilities to

1 develop and justify their management and organizational
2 plans. One can interpret this to be the development of
3 guidelines that we would use in our review process for
4 OLS or even in operating reactors in an incident-review
5 basis.

6 Concurrent with that would be the development
7 of assessment procedures which would be a modification
8 to the way we do the review; primarily, the Standard
9 Review Plan Chapter 13 sections 13.1 and 13.4. And as
10 the guidelines and assessment procedures are developed,
11 we would then take that package and pilot test it to the
12 extent possible.

13 Prior to promulgating the prescriptive areas
14 that are contained in 0731 and additional regulatory
15 requirements -- such as the second SRO and our movement
16 or our work on shift crew qualifications, for example --
17 those kinds of things as the issues are resolved we
18 would see falling within the general purview of this
19 management and organizational guidelines development
20 thrust.

21 (Slide.)

22 Looking to Research, we believe that they can
23 offer us a great deal of help in performing over the
24 short term confirmatory analysis of our work. And over
25 the longer range, which we feel is just essential to the

1 success of our management and organization guidelines
2 development work, is the thrust of establishing those
3 elements which can be objectively assessed; for example,
4 performance indicators.

5 The bottom line to that research thrust would
6 be to take more of that subjectivity away from the
7 current process. Right now it is highly subjective, and
8 we are taking the first step, Research will take a large
9 leap in that direction of minimizing subjectivity.

10 Just as a brief overview, you should be aware
11 that INPO is doing plant evaluations, and they are
12 planning to expand on that program to do corporate
13 evaluations. They have done two pilot tests so far of
14 their corporate evaluation guidelines. INPO will visit
15 an operating facility and an OL facility, for that
16 matter. And they have criteria they use to assess how
17 well the overall management and plant organizational
18 structure is functioning. They will look at maintenance
19 QA, technical support. They try to give the entire
20 organization a good overview.

21 Again, Research is moving to work
22 hand-in-glove with NRR in confirming our short-term
23 activities, and they have their longer-term activities.
24 And NRR, in developing the near-term guidelines, is
25 looking to our interactions with the region people to be

1 really the troops in the field that would do the reviews
2 for the next generation of OLS and for those coincident
3 reviews which might take place in which we should do a
4 review of an operating facility.

5 For example, just recently there was a problem
6 at Pilgrim at the first of the year. That would be an
7 example of where we would do a review. More recently,
8 Brunswick. I would envision the use of these guidelines
9 in operating-reactors phase maybe two, three, four, or
10 five times a year.

11 Going on to products of the work.

12 (Slide.)

13 First and foremost is the need to generate
14 guidelines to upgrade or replace NUREG-0731, which will
15 lead to revisions of our Standard Review Plan. Prior to
16 revising our Standard Review Plan, I believe this type
17 of work will go through the committee for review on
18 generic requirements. And again, Research, in their
19 efforts, will confirm and tend to reduce our
20 subjectivity of the present review process. And I
21 believe their products will just be a natural fit into
22 our guidelines as they will simply evolve over the next
23 3, 4, or 5 years for the longer term.

24 MR. CATTON: As a part of your management
25 review, do you formally take a look at the performance

1 during construction of the management team? It seems to
2 me there is a track record you could look at.

3 MR. ZWOLINSKI: In the past, we have not as a
4 formal review mechanism gone out and done a very early
5 site review, in other words. They are part way through
6 the plant construction.

7 It is my understanding that with the advent of
8 these new guidelines, it is our intention to get out at
9 docketing at the earliest possible time to do what we
10 would call an early site visit. And then a year and a
11 half, 2 years later, do our normal review, and then
12 probably have a closure review at the end of the
13 licensing cycle.

14 MR. CATTON: So you will have a 10-year record
15 then?

16 MR. ZWOLINSKI: Well, if you complete the
17 Action Plan item II.J.31, which is management and
18 organization, before construction -- and there is a
19 NUREG report written, 0718, on this -- you will find
20 that it deals a great deal with quality assurance.

21 The thrust of our program is more to
22 management effectiveness and the general organizational
23 effectiveness as far as where is the biggest bang for
24 the buck as far as the regulator is concerned. We have
25 not focused to that extent, but as we do, we will be

1 getting out earlier and earlier to look at these plants
2 as they are being constructed to sensitize the utility
3 to what we feel are major concerns once they are
4 licensed.

5 Questions, for example, regarding license
6 staff: There has been a shortage of operators in the
7 industry. It is good to make ourselves aware that the
8 utility is conscious that there is indeed a problem and
9 they have to get out in front of that problem by
10 attracting qualified individuals into training programs
11 to become licensed operators, as an example.

12 Strong maintenance practices that can evolve
13 from that. You can do a lot of other things out of an
14 early site audit. Sensitize the utility to the work
15 that is being done, for example, by EPRI. There is good
16 technical work. That is a source that they ought to be
17 attuned to.

18 MR. CATTON: Well, the NRC people are
19 essentially on site during the full construction
20 period. Maintenance of the equipment starts as soon as
21 it is put in, so you have an opportunity to observe how
22 well they do that.

23 A lot of the prime movers during construction
24 become management people when the plant becomes an
25 operating plant, so you have had an opportunity to

1 observe whether or not they have good management
2 potential or not. It seems to me that you have an
3 excellent opportunity.

4 MR. ZWOLINSKI: We get excellent feedback from
5 the resident inspectors, and they critique our work as
6 we do an audit. They will critique our audit.

7 MR. CATTON: So part of your checklist for
8 management and organization ought to include slots that
9 get checked off based upon the performance during
10 construction, I would think.

11 MR. ZWOLINSKI: I think it is fair to say that
12 there is probably a strong correlation between certain
13 performance indicators during construction phase and
14 performance during the operating phase. And we have not
15 identified those as yet.

16 MR. CATTON: That will be part of the research?

17 MR. WARD: This is a question I am interested
18 in, too. Is Mr. Ryan going to address this?

19 MR. RYAN: Tom Ryan from Research. Yes, I
20 will.

21 MR. WARD: I mean, you need it at this time,
22 that the Staff has to advise the Commissioners whether
23 to grant an OL or not. It has to have a predictive,
24 some predictive tool.

25 MR. ZWOLINSKI: Yes, sir.

1 MR. WARD: You give an operator a license
2 exam. You cannot give the organization a licensing
3 exam, I do not think. So you have to have some tool to
4 make a judgment about their fitness for duty.

5 MR. CATTON: And what to do about it if they
6 are not fit.

7 MR. ZWOLINSKI: Those are fair points, and we
8 have wrestled with this for a couple of years, and we
9 feel we are finally getting our hands around a vehicle
10 that we can use to give the Staff a better feel
11 regarding the utility and get out front of problems that
12 might arise.

13 Any other questions on these shorter-term
14 management and organization?

15 (No response.)

16 MR. WARD: Thank you, John.

17 The next speaker is Mr. Norberg, who will
18 speak about the research program.

19 (Slide.)

20 MR. NORBERG: I am Jim Norberg, chief of the
21 Human Factors Branch in the Division of Facility
22 Operations in the Operations Office of Research.

23 Now, you have heard in the discussions today
24 the near-term human factors research up through fiscal
25 year 1985 and how it interfaces with the activities that

1 NRR is performing. I will discuss the longer-term
2 research that goes beyond fiscal year 1985.

3 (Slide.)

4 Now, I thought I would reiterate what the
5 objectives of the human factors research is by NRC. And
6 these objectives are: to improve our basic
7 understanding of the impact humans have on nuclear
8 safety; the factors affecting the human performance.
9 This research would include evaluating the human
10 contribution to risk through PRA studies and also to
11 provide technical data necessary to develop defensible
12 regulatory positions related to human factors and to
13 reduce the contribution to risk to an acceptably low
14 level. That is the bottom line in our research program.

15 (Slide.)

16 I also thought I would go over the issues we
17 are addressing. Many issues have been identified that
18 need to be resolved to meet the objectives of the
19 research effort. This is a listing of the major issues
20 we are addressing in our current and projected research
21 program.

22 While these issues are quite general, they are
23 primarily related to nuclear power plants in the future
24 years when we expect to address fuel cycle and other
25 licensed nuclear activities. The major human factors

1 issues for these activities can be expected to change
2 somewhat. However, we do not expect them to change
3 drastically, since these are very general and are
4 basically human factors-type issues on any type of
5 facility operations.

6 (Slide.)

7 The human factors research described in
8 section 3 of the plan was developed to meet NRC
9 short-term objectives and was aimed at developing data
10 to address current regulatory issues involving
11 commercial nuclear power plants. Section 4 of the plan
12 provides a general description of RES plans for
13 long-term research in human factors.

14 I will briefly discuss this long-term
15 research. The long-range research will focus in the
16 areas shown in this vuegraph. The first area, the
17 application of the task analytic data gathered on
18 operations, maintenance, and management functions which
19 has been developed up through fiscal year 1985. This
20 data will be used to develop criteria and guidelines for
21 regulatory actions on human factors engineering,
22 staffing, personnel qualifications, training procedures,
23 job aids, and communications.

24 So it is our primary data base that we are
25 going forward with to provide the guidelines for

1 regulation in several areas. We also plan to validate
2 human performance models and criteria guidelines
3 developed specifically in the areas of reliability,
4 maintenance, and cognitive processes.

5 Additionally, validation data will be
6 developed for the appropriate use of simulators in
7 training and examinations. Our thrust will also take us
8 into the development of the technical basis for human
9 factors regulatory actions for advanced LWRs; in
10 particular, advanced control room designs and associated
11 computer applications and automation will be addressed.

12 We also plan to conduct human factors research
13 in non-LWR reactors. This is in response, I guess, to
14 Task Action Plan IV.C, which says, extend the Lessons
15 Learned from TMI to other licensed activities. We plan
16 to carry this research into the non-LWR reactors, which
17 would include LMFBRs and gas-cooled and research
18 reactors.

19 And finally, we plan to conduct human factors
20 research in the fuel cycle facilities, including
21 fabrication, storage, reprocess, and waste management.
22 To date, little research in human factors has been
23 performed in these areas, which are anticipated to see
24 increased activity in the near future.

25 The specific long-range research thrust for

1 the six human factors elements are presented in the next
2 vuegraphs in the same order as the program elements in
3 Chapter 3 of the plan.

4 (Slide.)

5 The first of these is in staffing
6 qualifications. The current staffing and qualifications
7 research is focused primarily on nuclear power plant
8 control room operators. The staffing and qualifications
9 research plan beyond fiscal year 1985 is to obtain
10 information, data, methods, and standards relevant to
11 evaluating the qualifications of other plant personnel
12 for LWRs and for all plant personnel for advanced
13 reactors and fuel cycle facilities.

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1 The issues to be addressed include changing
2 qualifications requirements. For example, because of
3 the increased computerization of displays in control, we
4 feel that the qualifications might be changed. In fuel
5 cycle and waste management, little work has been done to
6 date, as I mentioned previously, in these areas.
7 Personnel qualification measures and crew performance
8 measurement and enhancement research will be performed
9 in these areas for LWR plant support personnel, as well
10 as for advanced reactors such as the LMFBR and also for
11 the fuel cycle and waste management personnel.

12 (Slide.)

13 MR. NORBERG: In the training research area,
14 current research is focused again on control room
15 operators, health physicists, chemical technicians, and
16 maintenance personnel. Research beyond '85 is planned
17 to obtain systematic analysis and validation of
18 guidelines and criteria for training of personnel for
19 other personnel in the LWR's and for personnel in other
20 nuclear facilities.

21 Again, the issues to be addressed include the
22 training requirements for advanced technology systems,
23 the validation of performance measures, the expected
24 increased use of computerization or computerized
25 displays in control rooms, and control systems will

1 require research to determine training requirements and
2 to validate the performance, new applications to fuel
3 cycle, waste management, and advanced reactors.
4 Training research will be performed for these facility
5 personnel to develop a sound technical basis for the
6 guidelines that we expect to be required for regulatory
7 application.

8 Advanced reactors will also be looked at in
9 terms of the training requirements. These again are the
10 LMFBR's, and the gas cooled plants.

11 (Slide.)

12 MR. NORBERG: In the licensing and examination
13 area, the current research again is focused on
14 examinations of the reactor operators and the senior
15 reactor operators. The research is planned beyond FY
16 '85 to obtain information, data, methods, and standards
17 relevant to the licensing and certification of other LWR
18 personnel, as may be appropriate, and for personnel at
19 other nuclear facilities.

20 The issues to be addressed include examination
21 methodology and validation, changing skill, knowledge,
22 and ability requirements associated with advanced
23 reactors. For example, the expected increase in the
24 computerized displays and controls will require new
25 skills, knowledge, and abilities, and the examinations

1 must be responsive to these changing needs.

2 Again, as fuel cycle facility and waste
3 management facilities are looked at in terms of
4 licensing examinations, work will be done in this area
5 in the research.

6 (Slide.)

7 MR. NORBERG: In the procedures and testing
8 area, the near term research again focuses on the
9 emergency operating procedures and plant maintenance
10 procedures. Long-term research will address other
11 operating procedures, including surveillance and testing
12 procedures for LWR as well as for other nuclear
13 facilities.

14 The research beyond FY '85 will provide data
15 and standards relevant to developing and implementing
16 sound procedure systems. The issues to be addressed
17 include procedure analysis for technical support
18 functions such as health physics and water chemistry,
19 also, administrative procedures that impact safety, for
20 example, work permit procedures, tag-out procedures,
21 working hours, and other administrative type procedures
22 that will impact safety or can impact safety.

23 Also, evaluation of new methods of data and
24 information presentation and their impact on the
25 procedures. This is expected to be particularly

1 relevant. Advanced reactor requirements for procedures
2 and testing, for example, the LMFBR's, we would expect
3 might have different procedure requirements, and the
4 fuel cycle requirements. The procedures are certainly
5 different from the LWR type procedures, but we expect to
6 use the same research approach to attack these other
7 facilities as necessary.

8 MR. WARD: Could I ask you a question about
9 procedures? With the development of better EOP's and I
10 presume in plants increased operator dependence on
11 EOP's, it becomes more and more important that all of
12 the things that can happen in the plant, all of the
13 accident scenarios that are humanly possible, and maybe
14 this is a human factors question, that are humanly
15 possible to have been considered are included in those
16 EOP's. Well, there is always going to be some residual
17 that the analyst hadn't thought of. But is there any
18 research going on to address that question? I mean,
19 where do we get assurance?

20 MR. NORBERG: Yes. In fact, this is current
21 research. We are working in this area. We have a
22 research program at Idaho that we are looking at a
23 different methodology for validating the emergency
24 operating procedures. Another way of looking at
25 emergency operating procedures to make certain that they

1 can do what we think they are required to do under the
2 anticipated type of conditions that we foresee, and
3 maybe Mark could speak a little more to that.

4 MR. AU: Yes, this is an ongoing program.
5 Really, it's a tool that we want our staff to have an
6 independent assessment of these guidelines that have
7 been developed by industry. This is our effort on these
8 multiple failures of accidents that may occur. I think
9 we -- it was misunderstood earlier that our approach was
10 to validate the industry's guidelines. That wasn't the
11 approach. It was to try to demonstrate the adequacy of
12 these guidelines that have been developed by industry.
13 It was just to look at these guidelines independently of
14 industry.

15 MR. MOELLER: You mentioned research on health
16 physics personnel or procedures, excuse me. Could you
17 give me some ideas there, a little more?

18 MR. NORBERG: Well, I think that we would be
19 looking at the procedures used in the health physics
20 aspect of the operation of the plant to make certain
21 that the human factors aspects were taken into account.
22 That would be the thrust of the type of research we are
23 looking at, and not the health physics aspects so much.

24 MR. MOELLER: But the human factors aspects of
25 radiation protection.

1 MR. NORBERG: Yes.

2 MR. MOELLER: Thank you.

3 MR. DE BONS: Well, this is an expansion of
4 Dr. Moeller's question. It is obvious this is a
5 relatively important document in the presentation, and I
6 also appreciate that you are limited in terms of time as
7 to what you can present in this, but it would seem to me
8 that there is a level of specificity that this requires
9 for us to make judgments about it. Are there documents,
10 for example, that address these issues in a way that I
11 would in fact approach a dissertation student? Is there
12 an understanding of what the parameters are, for
13 example, variables? Is there a document that would
14 suggest a hypothesis, and is there a document that would
15 say that in our present understanding, this hypothesis
16 is more important than this one, and we should pursue
17 this at the greatest haste?

18 In other words, where do I get a level of
19 specificity on this that would help me make judgments
20 about where we would attribute our efforts?

21 MR. NORBERG: Well, this particular research
22 that we are talking about here is out in the '86 and on
23 time period, so we have not gotten very specific. We
24 are telling you only in the general areas that we
25 currently see that we will be addressing our program,

1 and what we are saying is, we anticipate as we go out in
2 time that we will be shifting our research from LWR's to
3 the advanced reactors and into the fuel cycle areas, and
4 that this type of research will be somewhat similar to
5 what we are doing now with the LWR's in terms of the
6 licensing problems.

7 Now, the issues you are talking about, I agree
8 with you, are very general, and we have specific
9 documents that address those issues with our current
10 research, and we have presented this to the committee
11 before, more or less, on what programs we are currently
12 involved with in our work in fiscal '82 and projected
13 for '83 and '84, relative to the various issues that we
14 were discussing here, but they have been primarily aimed
15 at LWR systems, and what I am saying here is that we
16 anticipate getting out of the LWR systems into other
17 systems in the future, plus, we are obviously going to
18 have some carry-over from LWR's. We don't anticipate
19 all of the problems will be resolved by 1985, although
20 it is hopeful.

21 So, I guess I am sorry to say I can't get more
22 specific in these out years than just to give you the
23 general thrust of the direction we see this thing taking.

24 MR. DE BONS: Thank you.

25 (Slide.)

1 MR. NORBERG: Now, on the man-machine
2 interface research, we have focused primarily on the
3 operator and the control room of the current LWR power
4 plants. Out in the years beyond FY '85, we anticipate
5 that we will be developing information and data and
6 methods and standards relevant to evaluating the design
7 of the man-machine interface for a broad range of
8 nuclear activities.

9 Now, the issues to be addressed include the
10 man-machine interfaces for new technology applications.
11 Now, here we are looking at such things as the possible
12 use of artificial intelligence or voice interaction
13 between the computer and the user. That is getting out
14 fairly far. There are other nearer term efforts that we
15 will probably be involved with in terms of the safety
16 parameter display systems and other computerized things
17 that we will be working on, particularly in the area of
18 maintenance.

19 Another area is the operator roles in advanced
20 reactors, and again we are looking at the LMFBR's and
21 the HTGR types. Design criteria and guidelines for
22 man-machine interface in the fuel cycle and waste
23 management area will be addressed. This is quite a
24 different area now that we will be looking at, but I
25 think that the process that we have used in the

1 light/water power reactors can be applied to the fuel
2 cycle facilities, and we have not decided at this point
3 in time which of these facilities we will be looking at
4 first. It will probably depend on how they are phased
5 into the licensing process.

6 Finally, we will be looking at cognitive model
7 applications and validations, including the development
8 of criteria and guidelines for regulatory actions as may
9 be appropriate in this area, and this is a very
10 difficult area in which to get your hands on, and as Jim
11 Jenkins mentioned earlier, we have initiated work in
12 this area by getting together a group of experts in the
13 field at MIT to kick around the ideas of which way
14 should we be going and what can you do in this area, and
15 so it is just really getting off the ground.

16 MR. BUCK: A question, Jim. What are some of
17 the options there? What are some of the models you are
18 talking about, roughly?

19 MR. NORBERG: Well, I will let Jim Jenkins
20 answer that for you, since I wasn't at the meeting.

21 MR. JENKINS: Some of the cognitive models
22 that we have now that apparently could be useful is
23 Rasmussen's skilled ruled knowledge based application.
24 The second model that is being considered as part of our
25 maintenance simulation work is the Siegel-Wolfe model.

1 The other models that -- I can't say they have names
2 attached to them, but basically they are permutations of
3 some of the SOR paradigms. Others of the supervisory
4 control model which I mentioned before.

5 The difficulty that the cognitive workshop
6 clearly delineated is that we are not very far along in
7 modeling cognitive processes. Some fundamental concepts
8 still have yet to be investigated sufficient to have a
9 model for which a research program such as we sponsor
10 has some use for that. One of the concepts which we are
11 throwing around, one of the ideas which we are
12 considering to start off with is to take a group of
13 people, a cognitive psychologist or a modeler, a systems
14 engineer, someone who knows power plant operations, form
15 a team, interdisciplinary team, and give them a specific
16 problem, and let me pull one out of the air.

17 Let's take a particular SPDS design, and have
18 this team look at the design requirements, look at the
19 design concepts, identify the gain in performance that
20 might be attributable to cognitive modeling or
21 performance prediction, to evaluate the role that
22 research could play in such a system, what should
23 research have done or what can it do to increase
24 performance effectiveness of this particular concept,
25 and to use this kind of team to bring to bear a systems

1 approach, including cognitive modeling, or as someone
2 has used the term, a cognitive task analysis.

3 So, this is our thinking. We are really just
4 starting it, and I would not presume to say exactly
5 which way we are going, but we have started.

6 MR. NORBERG: As I mentioned earlier, ongoing
7 issues such as the effects of automation on the
8 man-machine interface, criteria for alarm filtering
9 systems, computerization and display of technical
10 specifications and procedures, and supervisory control
11 of man-machine interface applications will be continued
12 beyond FY '85. We don't anticipate these things being
13 resolved by then. Also, research will be continued on
14 the effects of severe stress, on severe seismic events.
15 For example, is a severe seismic event relevant to safe
16 operation in the human factors area?

17 (Slide.)

18 MR. NORBERG: On the management and
19 organization area, the near-term research has focused on
20 the plant operations. Research beyond '85 will address
21 the full range of management roles and functions
22 relative to public safety to provide a technical basis
23 for appropriate regulatory actions, whatever they might
24 be. In doing this, information data assessments,
25 standards relevant to evaluation of organizational

1 safety effectiveness and design, construction, and
2 operations of nuclear power plants' fuel cycle
3 facilities will be obtained.

4 The issues to be addressed include the
5 management and organization requirements for fuel cycle
6 facilities and waste management for advanced non-LWR
7 power reactor management and organization, old
8 requirements such as the LMFBR, and also away from
9 reactor management and organizational requirements for
10 LWR's and other nuclear facilities.

11 Now, here we are thinking of such things as
12 corporate level management and how this impacts the
13 potential safety of the plant. I am not going to talk
14 too much about this, because Dr. Ryan will be giving you
15 a much more in-depth discussion of research in the
16 management and organizational area, and I think that you
17 should wait for his discussion before you maybe ask too
18 many questions in this area.

19 MR. WARD: That sounds like good advice. Are
20 there any questions for Jim on the research program?

21 MR. DE BONS: Not a question, Dave, but a
22 reflection, if I may introduce it at this time. Jim
23 Jenkins' statement almost shakes me to the core. As a
24 matter of fact, I am dead scared, and the reason -- let
25 me tell you why I am dead scared -- is that if we are at

1 that level of understanding of the cognitive functions
2 and processes that are involved, I am not really sure we
3 have an adequate system at all to deal with the kind of
4 problem that I envisage.

5 In other words, if our state of the art is on
6 cognitive models, and our understanding of cognitive
7 models, which I estimate to be the distinction between
8 data and information requirements and as I understand
9 that the major need for a nuclear plant is not data
10 requirements but rather information requirements, and we
11 don't have any understanding about the cognitive
12 operations, which in fact define information
13 requirements, then what in hell's name do we have but
14 simply a radar system or a sensing system that is
15 supposed to react to some sort of program function, and
16 the complexity or problems of the situation are so
17 immense that I can't visualize that we will ever avoid a
18 safety problem.

19 In other words, I find it very, very ominous,
20 and the reason I make that statement is in the hope of
21 stirring some sense of priority in this area. I
22 certainly can appreciate that we have all sorts of these
23 display problems and management problems and so forth
24 and so on, but if in the final analysis when the chips
25 are down it is going to depend essentially on our

1 understanding of how the intellectual operates and how
2 the intellectual resources can be brought to the
3 situation, and if these resources are not available,
4 that we must have some contingency alternatives to deal
5 with those contingencies.

6 I don't believe we have an adequate safety
7 system. I am subject to argument on this, but I feel
8 very, very scared.

9 MR. BUCK: I would like to emphasize that
10 point that Tony has just made here. It seems to me if
11 this is a real problem we aren't very far along on these
12 cognitive things. Are we doing anything currently to
13 answer some of those questions? And if we aren't, I
14 think we ought to be, and I think this is precisely what
15 Dr. DeBons was talking about. If we are going to hold
16 back until '85 before we start looking at these things,
17 what is going to happen between now and then?

18 MR. NORBERG: I am sorry if you got that
19 impression. We are not holding back until '85 to look
20 at it. In fact, as Jim mentioned, we had a workshop at
21 MIT in August, and so this is 1982, and so it is not
22 that we are holding back until then. What we are
23 saying, or what I was saying, I think, is that we
24 anticipate it will be '85 and beyond before we fully
25 understand and start applying some of these models in a

1 regulatory way. Let's put it that way.

2 MR. BUCK: Which brings me back to the other
3 question I was going to ask, and I asked earlier. Of
4 all these things that Human Factors Society group looked
5 at and made recommendations about and that the NRC staff
6 made assessments about, are we going to start looking at
7 those before the day is over? I am looking at several
8 of these and trying to figure out what the answers are.

9 MR. NORBERG: I was not planning to address
10 that aspect. In my discussion with you, I was only
11 talking about the research beyond '85, and I was not
12 planning to address the interface between this plan and
13 the recommendations for the human factors society. I
14 think Hugh Thompson addressed this somewhat, but I
15 wasn't planning myself to address this.

16 MR. WARD: Yes, I think, Jim, maybe we could
17 entertain specific questions.

18 MR. BUCK: The question is when.

19 MR. WARD: Well, how about in just a minute?
20 There is one other item coming up here, too. Are you
21 finished?

22 MR. NORBERG: Yes.

23 MR. WARD: Let me address it now, before Mr.
24 Ryan gets up. I guess, Hugh, there are two other parts
25 of the program plan which we really didn't specifically

1 include in the agenda, and one is, in Part 2 you have
2 several issues mentioned on the issue of
3 regionalization, and the issue of the use of PRA, and I
4 think I have at least got a couple of questions on
5 those, and maybe some other people do, and then we have
6 the comparison with the Human Factors Society plan as
7 Jim Buck has just alluded to.

8 Some of us may have some questions there. Do
9 you think we could handle that just asking you to take
10 questions and take a few minutes for that before Mr.
11 Ryan's presentation? Or do you want to wait until after
12 that?

13 MR. THOMPSON: Well, since we have some staff
14 here, and they may want to leave, why don't we go ahead
15 and do that first?

16 MR. WARD: Mr. Ryan might want to leave, too,
17 but he can't.

18 (General laughter.)

19 MR. WARD: Let's see. Does anyone other than
20 Jim Buck and myself have questions on either of these
21 two areas? On either of these two things?

22 MR. MOELLER: Well, I had a general question
23 which maybe you plan to address at some point, and that
24 deals with the degree to which the human factors group
25 is aware of foreign research, and again, we have just

1 heard about the far out years, or extending into the
2 future. Well, I would think that it would be very
3 important there to begin now to benefit to whatever
4 degree we could by what is going on or what the planning
5 would be in various foreign countries.

6 MR. THOMPSON: Certainly I agree. I think we
7 have indicated earlier that we are monitoring the
8 foreign research efforts, and particularly we are
9 supporting the Halden research efforts. I know that we
10 have attempted to keep in touch with that research
11 effort through the Office of Research, as opposed to NRR
12 being a point of contact in that area.

13 MR. MOELLER: Now, are you in touch with or
14 cooperating with the Nordic Liaison Committee for Atomic
15 Energy?

16 MR. THOMPSON: Yes.

17 MR. MOELLER: You are, and you receive their
18 reports?

19 MR. THOMPSON: Yes.

20 MR. MOELLER: Thank you. Then you are not
21 duplicating what they are doing?

22 MR. THOMPSON: I am not aware of any specific
23 duplications. We do have programs, I think, that
24 address similar areas. The time frames may be
25 different. The depth in which the issue is going to be

1 addressed, as far as I know, is different, but I think
2 we are making efforts to ensure that the programs
3 complement each other, and when they are duplicating
4 each other it is by intent, because of the timing need
5 that we may have on our part. Carl, do you have a
6 comment?

7 MR. GAWLER: Coordination of human factors
8 research internationally is just one part of our effort
9 do that in all areas of research. I am not saying we do
10 it perfectly, but we certainly try. Another recent
11 example was a survey we conducted of foreign staffing
12 practices. I think a copy of that report was forwarded
13 to you, so in any and all areas where we think anything
14 can be gained or learned from overseas efforts or
15 activities, we certainly dig in and try to take
16 advantage of that, and in this area, human factors, as
17 in others, we are also under strong directions from our
18 director of research to cooperate and coordinate our
19 activities with them and try to minimize the resources
20 necessary on our part to be sure that we are not
21 duplicating efforts that are already going on
22 elsewhere.

23 MR. ZWOLINSKI: Dr. Moeller, you should also
24 be aware that in the technical assistance contract that
25 we have that runs through most of the program elements

1 with Battelle Pacific Northwest, we have on the order of
2 about two man years of work being performed in West
3 Germany by the Battelle Frankfurt organization, and they
4 are collecting a great deal of operational experience
5 for us, for example, in the role and responsibility of
6 STA. They have looked into certain managerial
7 practices, a number of issues that they have completed
8 surveys, and we have draft reports in-house on their
9 activities. We are going to put those into NUREG form,
10 and they will be forwarded, but it is an integral part
11 of a larger safety technology program to ensure we have
12 covered all the bases.

13 MR. MOELLER: Thank you.

14 MR. WARD: Okay, Jim. Did you want to ask
15 your questions then?

16 MR. BUCK: Yes. I was kind of hoping to kind
17 of bring this out in the open a little bit, to see what
18 I don't understand here anyway. I noticed on the -- it
19 says Nuclear Regulatory Commission Integrated Human
20 Factor Program Plan for FY '83 to '85, and going through
21 that, a number of issues or general human factors
22 problem areas were identified by the Human Factors
23 Society group, which we saw. We were given the more
24 detailed information here, and it states what the NRC
25 staff activities are here.

1 For example, status would be in place or
2 possible, not applicable, under way or pending, or
3 disagree. It is primarily the disagree ones that I am
4 trying to figure out why. Are we missing something
5 important here, or is there really a quite different
6 opinion as to what is important and what is unimportant,
7 or what is urgent and what is not urgent relative to the
8 research program, be it current or in the future?

9 For example, 4.2.7 says risk assessment and
10 human reliability status, disagree, and I don't
11 understand why there is a disagreement there. I
12 mentioned that before. There is another one here. It
13 says research emphasis should be shifted to design
14 analysis, disagree. That is 4.3.4A. And another one
15 back in here a little further that says disagree.

16 Could you go through some of these disagreed
17 particularly and kind of tell us why, or what were the
18 issues that the staff differentiates?

19 MR. THOMPSON: To the extent that I can, I
20 will be glad to do that. To the extent that more
21 detailed information can be provided by the individual
22 who is in charge of the research program, I may refer to
23 the staff.

24 MR. BUCK: Please go ahead on that basis.

25 MR. THOMPSON: I believe on the first one it

1 is C.4.2.7 which is the risk assessment and human
2 reliability. The proposal was that the ongoing effort
3 by the staff to collect data with respect to the human
4 probability or the human error probability or human
5 error rate was not an appropriate level of effort, that
6 we should just monitor the ongoing program that is in
7 existence in the industry right now.

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1 We have been working, I believe Research has
2 been working with Dr. Swain and you may wish to
3 elaborate on what my understanding is, but in order to
4 continue the probabilistic risk assessment effort and to
5 gather some data and attempt to have useful data, they
6 feel that that type of data should be attempted to
7 obtain, but I do not know that we can say that without
8 any doubt there is any question about its availability.

9 But I think it is a level of effort in
10 attempting to get data on this area that is the issue.
11 And after that I may ask Dr. Jones to give us his
12 perspective. He has recently joined my staff as a
13 senior human factors technical advisor, who has had some
14 experience also in this area. So I think maybe we will
15 ask Research. Jim, I think maybe you might want to make
16 a comment on that.

17 MR. JENKINS: Dr. Buck, there is a very
18 serious disagreement between the Staff and the working
19 group of the Human Factors Society on this one issue.
20 Frankly, the approach that they are suggesting is that
21 human error probability data is not obtainable. We
22 suggest that human error probability data can be
23 estimated with a certain amount of reliability and that
24 for the purposes for which it is obtained and used it is
25 a useful predictor of the adequacy of the system

1 design.

2 Now there are a lot of constraints on both
3 sides of the argument. That is, we are assuming that
4 there is a distribution which can be approximated as to
5 the nature of the error that that human error as a
6 function of design can be identified through event
7 tree-fault tree methods, as well as that the experience
8 of the analyst has some relevance to the adequacy of the
9 statements that he makes about the probability of
10 error.

11 I do not think you would find too much
12 disagreement that there is in fact error bounds around
13 that mean value, all of which, I have said, has been
14 repeated before in such conferences as Myrtle Beach I
15 and II, in the U.S. Navy Human Reliability Program,
16 which I happened to be the editor of that, and in other
17 documents related to human reliability.

18 I would like to read you what the Society
19 says, not the summation but their words, and this is in
20 Volume 1 of NUREG-CR-2833, which is the recent
21 publication of their recommendations. I regret I did
22 not bring the Volume 1, which is the page referenced in
23 the Staff report.

24 Programs that have attempted to obtain human
25 error probabilities have met with only limited success.

1 I think that is a value judgment. I do not think there
2 would be too much disagreement with it. I could state
3 that they have met with considerable success and
4 probably be equally correct.

5 Improvement of this deficiency would be
6 tremendously expensive. That is very much of a value
7 statement. I think you know the budget that we have in
8 our program. One could say that that is tremendously
9 expensive. One could say that it is not, either. And
10 validation of the resulting human error probabilities
11 is, while theoretically possible, practically
12 infeasible.

13 While the human reliability estimate process
14 is reasonable and logical for a well-trained analyst
15 and, parenthetically, I think they are referring to the
16 third technique used or developed by Dr. Swain, there
17 are in fact other techniques, as you are aware of. The
18 process seduces the user into believing that the
19 resultant probability values are valid in spite of the
20 non-validated input HEPs. Now that is quite an
21 emotion-laden statement there.

22 The present state and predicted future state
23 of nuclear power plant design and modification
24 disregards good system engineering, system integration
25 concepts, and, therefore, cannot make design use of

1 HEPs. I question the validity of that logic there.

2 If proven system design techniques associated
3 with human engineering of work stations, personnel
4 selection, operator procedures and age and training
5 systems are applied to nuclear power plant operations
6 and maintenance, then human error probabilities will be
7 minimized and human performance will be maximized. I
8 hope so.

9 That does not say that human error
10 probabilities are invalid, though. It simply says that
11 if you do a good design job, a good selection and
12 training job, and you have good procedures, then you
13 will have minimum error, and that is what we are
14 shooting for.

15 Under the circumstances, no future performance
16 are likely and predictions resulting from human error
17 probability becomes superfluous, even if generated from
18 an improved, valid human error data base. The potential
19 argument that probabilistic risk assessment might
20 distinguish between relative merits of two different
21 designs, each based on the same proven human factors
22 design techniques, is falacious.

23 For the PRA HEP data will always be less valid
24 or more noisy than will be tried in proven design
25 concepts based on empirical performance data. I do not

1 deny the greater accuracy of an empirical base, nor does
2 the human error probability program deny that that is a
3 very good source of data. But we cannot have
4 experiments for every design. It is just not possible.

5 This is not to say that PRAs are useless, for
6 precisely the opposite is true. Amen. Rather, we
7 suggest that PRAs which are heavily driven by invalid
8 HEP data may produce spurious results and in fact we
9 have a research program to do exactly that -- to
10 evaluate the adequacy of our current data, to go back
11 and look at what is in NUREG-1278, which documents the
12 third technique.

13 So we are doing our very best to take a
14 multi-method, multi-trade approach for identifying the
15 adequacy of the methods themselves which are used, the
16 adequacy of the data and an independent evaluation of
17 the specifics that are in these human error
18 probabilities.

19 That is our research program and that is why
20 we disagree with the Human Factors Society.

21 MR. GAWLER: I think in summary the point is
22 that PRA is, as we all know, becoming an increasingly
23 larger part of the regulatory business and, as was
24 brought out before, the PRA efforts to date have shown
25 that human factors represent a large part of the risk.

1 We cannot ignore this. We have to pursue it and go the
2 best that we can, and that is the reason we disagree
3 with the Society on that comment.

4 MR. BUCK: Thank you very much on that one. I
5 could also point out you could do the same thing with
6 motor design -- find disagreements.

7 MR. THOMPSON: I believe this item is 4.3.4(a)
8 and this is the research emphasis should be shifted to
9 design analysis. I believe that is the discussion in
10 the maintenance area. We generally do presently have
11 studies directed to the maintenance design analysis
12 under way in NRR, and I believe that this should be
13 complemented by the research effort in the error
14 modeling and risk assessment.

15 So disagree is probably not quite the right
16 term, as I understand the situation here. It is that we
17 think that a complementary program should be carried
18 forth, that the research effort does complement the
19 design effort that we have under way right now.

20 MR. BUCK: Where is the disagreement?

21 MR. THOMPSON: Well, the disagreement, as I
22 understand it, is that they believe that the research
23 effort itself should be shifted toward the maintenance
24 design, which we say they should continue that as a
25 complement to the ongoing effort that NRR has right

1 now. So we plan to continue both efforts.

2 MR. BUCK: So it is not really a
3 disagreement.

4 MR. THOMPSON: I understand. I was just
5 saying these were shorthands, that they will be
6 clarified in a couple of places. I think we were to
7 discuss the next one, which is we agree that the
8 recommendation is appropriate and should go forward, and
9 the industry is doing it, that NRC should not. It is
10 not an issue that we need to change our program plan on
11 is what, I guess, the disagreement is.

12 And I promise you this will be better stated.
13 As I said, this is a draft version here.

14 The next one again I think we discussed
15 earlier, which is 4.5.1(a), which is a validation of
16 current and new selection procedures. Likewise, on page
17 six is 4.5.5, factors affecting job satisfaction.
18 Again, this is one where it was a recommendation that
19 industry do it, and that industry does have ongoing
20 programs and NRC monitors.

21 They probably took a corollary and if industry
22 does not care anything about job satisfaction of the
23 operators, then we ought to do something. We do not
24 feel that our program right now needs to be modified in
25 this area for NRC to take up a job satisfaction

1 research, but that we are aware of two things. One, the
2 industries effort to identify their own job satisfaction
3 areas, and we also have to evaluate the impact on
4 regulatory decisions. We may, on job satisfaction of
5 operators and the potential retention.

6 So I think disagree there is an incorrect
7 characterization of the issue. The issue is we agree
8 that this area ought to be addressed and we feel that
9 industry is doing a good job right now addressing it.

10 MR. BUCK: Industry is doing it?

11 MR. THOMPSON: Certainly maybe not to the
12 extent that they are working on the selection process,
13 but industry, through INPO and their groups, are looking
14 at the job satisfaction area.

15 MR. SALVENDY: I wonder if you could show what
16 specifically industry is doing about job satisfaction,
17 because selection is not necessarily job satisfaction.

18 MR. THOMPSON: That is correct. One thing I
19 will tell you they are doing is that they are resisting
20 very strongly the NRC's effort to upgrade the
21 qualifications for SROs to have college degrees. They
22 have mounted a fairly extensive effort to in fact place
23 our upgrade requirements in a kind of status quo,
24 pending the job task analysis.

25 This is one of the major areas that the

1 operators have had concerns about. You know, what is my
2 future? Where is this going to go? They are trying to
3 establish a better correlation between the NRC
4 examination and the training program that they have and
5 what it takes to operate the plant.

6 Operators typically get very frustrated at
7 having to go through requalification training programs
8 that they say have absolutely nothing to do with helping
9 them run the plant. So those types of areas are the
10 ones where INPO is taking the lead in attempting to
11 focus the regulatory requirements into areas where the
12 operator says yes, that helps me do a better job.

13 Likewise, in overtime they are looking at some
14 of the overtime areas with respect to what type, how
15 many, what is the right staffing level. In fact, they
16 are going to now attempt to get a six-shift rotation in
17 many plants simply because of the need to eliminate some
18 of the unnecessary overtime for the job satisfaction
19 areas.

20 MR. SALVENDY: I had in mind something
21 different. My notion here was that one made the mention
22 of job satisfaction related to the job design, the basic
23 human factors research work you are doing in this task
24 analysis, and the design of the work place basically --
25 control room and so on -- and the notion as part of the

1 job design, job satisfaction is an ingredient part of
2 it.

3 That is the simplest possible example, that
4 you can enrich the person's job or you can simply -- I
5 mean, you can over-simplify this, but those are two main
6 dimensions that, say, behavioral scientists have argued
7 about the relative benefits in increasing the
8 satisfaction of workers. And I guess what one would
9 argue, since much of the effort that you have here goes
10 in the area of the work design and task analysis, that
11 it was in the context of that analysis, shouldn't one of
12 the variables, the particular variables, that you
13 consider be the satisfaction of workers?

14 I wondered if you recall in the previous
15 meeting of this subcommittee and, in fact, before the
16 Human Factors Society's report came out, in effect I
17 raised this notion of the satisfaction of workers in the
18 work place, because it is very well known that you can
19 have the best possible design in the world, the best
20 selection, and if your workers are dissatisfied their
21 quality will be real bad.

22 So the question of ignoring that component
23 completely, I do not know if it is really justified.

24 MR. THOMPSON: I am not aware. Carl, you may
25 have a comment or Ellis.

1 MR. MEERSHAW: Ellis Meershaw of Research.

2 The Oak Ridge Associated Universities were
3 hired by INPO to take a look at this area. They have
4 done a fairly intensive survey of the pool of operators
5 currently out there and the expected pool, both what is
6 needed and what can be expected to be available to the
7 industry through the next, I guess, ten years. And they
8 investigated reasons for high attrition rates, and job
9 satisfaction is one of them.

10 That has been published recently by INPO. I
11 think it was about six months or nine months ago, and a
12 revision to that will be published very shortly.

13 MR. THOMPSON: I am still not sure that they
14 are trying to redesign the operator's job.

15 MR. SALVENDY: Then the question would be if
16 the variables that identify what causes attrition, to
17 what extent you take it into your research when you deal
18 with the task analysis and the design of the control
19 room -- how much really this group takes that
20 information into consideration.

21 MR. GAWLER: I would specifically like to
22 answer the original question, which I think was why we
23 indicated we disagreed with this recommendation, and I
24 would like to supplement and complement what you said.

25 It was correctly pointed out that industry is

1 doing this work and that essentially makes their
2 recommendation moot. But even so, the correct answer is
3 that we disagree with the recommendation in that their
4 comment -- if you look at the full text -- says that if
5 industry does not take the lead in research leading to
6 the minimization of turnover and maximization of job
7 satisfaction among ROs and SROs they recommend that NRC
8 should do that research.

9 We do not agree. That is not a regulatory
10 function. But, more importantly, the entire
11 recommendation is made moot by the fact, as Hugh pointed
12 out, that industry is doing that. It is in their best
13 interest to do so.

14 MR. THOMPSON: Not to contradict fully my
15 colleague, there is, as I mentioned earlier, a balancing
16 that we do on the value impact. I do not think we want
17 to discount totally the impact that decisions we have
18 have on job satisfaction. We are sensitive to the fact
19 that, as Don talked about earlier, that we just do not
20 start changing our examination -- operator
21 examination -- process without some reason.

22 We just do not make willy-nilly changes. And
23 part of that is because these guys put a long time in
24 the training and educational process to become operators
25 and that is a very important and professional position

1 for them. I think the last thing we would want to do is
2 drive a lot of operators who have many years of
3 experience on these plants away simply because we were
4 not sensitive to some issues that are out there.

5 So I do not think I am charged with that as a
6 major responsibility, but I would not want to be
7 insensitive to the issue and we are very delighted that
8 INPO and other are doing that so I do not have to answer
9 the hard question.

10 MR. WARD: I think the last one was discussed
11 at length when we reviewed this.

12 MR. THOMPSON: Yes. I was hoping that I did
13 not rehash the SPDS, but that was, I think, the issue,
14 is again there the belief that the appropriate way to go
15 about determining the need for an SPDS is really a task
16 for a function analysis and 82-111 took another
17 approach, which we find is an alternative way to do
18 that, and we think that issue has recently been resolved
19 or at least been put to bed by the Commission in action
20 on SECY-82-111.

21 MR. BUCK: In other words, you do not think it
22 is an issue?

23 MR. THOMPSON: It is clearly an issue. They
24 clearly do not believe SPDSs should be mandated in a
25 priority effort prior to doing the detailed control room

1 review and the NRC Staff believes that there are
2 sufficient benefits from installing an SPDS with the
3 present level of our knowledge of SPDS designs, that
4 they should go ahead and have that installed at an early
5 date to complement the information that is provided to
6 the operating crew based on our judgment.

7 MR. BUCK: So it is a judgment call either
8 way.

9 MR. THOMPSON: I think it is a judgment call
10 on our part, and they are saying there is another way to
11 go about making that decision, and it is a systematic
12 approach to doing your task analysis and detailed
13 analysis, and they would not say from their professional
14 point of view that is the preferred way to go.

15 MR. BUCK: Thank you.

16 MR. WARD: Are there any other questions on
17 that appendix? I just had a couple of questions.

18 On the Section 2, the regionalization issue
19 comes up here in that the program plan says that in
20 several cases that more of this human factors review
21 work will go into the regional offices. And at a recent
22 Subcommittee meeting we had of the Reactor Operation
23 Subcommittee we talked a little bit about the
24 regionalization effort and there was some concern
25 expressed by Committee members that there may be too

1 much work planned to be pushed into the regions.

2 And one of the points of argument was a report
3 on the Committee's, the Special Committee's assessment
4 of FAA performance and concern that the regional
5 organization of the FAA was a serious weakness in its
6 makeup and making the point that certain functions are
7 best decentralized, and other functions are perhaps best
8 centralized.

9 Maybe there is some sort of a breakdown --
10 that a highly technical, highly complex thing should not
11 be decentralized because you need the central,
12 high-powered technical intellectual staff in order to
13 develop the concepts and deal with the people you are
14 trying to regulate at their level.

15 So I guess -- well, that is a long question.
16 I am sorry, but --

17 MR. THOMPSON: The answer is yes..

18 (Laughter.)

19 MR. WARD: I guess my question is are you
20 carefully considering or will it be carefully considered
21 just what is going to be regionalized in the human
22 factors program?

23 MR. THOMPSON: Yes.

24 (Laughter.)

25 MR. THOMPSON: Yes, we really have. For

1 instance, I think we tried to indicate that items like
2 the detailed control room review, where you apply a
3 fairly extensive expertise that your human factors
4 engineers and instrumentation and control group really
5 do need to be together, and I think those types of
6 reviews are best done in NRC headquarters and we would
7 see establishing going, in fact having most of those
8 type reviews referred to us by the regions through
9 basically a task action agreement, which presently
10 exists.

11 Other areas, such as training program reviews,
12 which INPO tends to, we will be looking at training
13 programs. We will look at training programs. Once we
14 get the guidelines and the information available and the
15 regions have some additional expertise on their own
16 staffs, and we would see that that type of review could
17 be done in the regions. They are doing training reviews
18 now. We would like to enhance those.

19 Operator licensing is one that is going toward
20 regionalization. We have been pleased at its success,
21 although we are very cautious that regionalization does
22 require, again, oversight. Don was talking about the
23 oversight aspects of it earlier. We are very sensitive
24 to that. We intend to monitor it carefully and we are
25 obviously concerned at trying to go to --

1 regionalization of five regions in about two years is a
2 fairly ambitious program just administratively to ensure
3 things are done systematically and with reliability,
4 particularly in an area that has changing requirements.

5 That is, as we try to upgrade and make
6 modifications to our program, we have a lot of people
7 that have to get the word and we hold annual meetings to
8 have all of these license examiners get together and
9 discuss the issues that are being identified as problems
10 and let them understand where our program is and where
11 it is going and how better to standardize those
12 efforts.

13 MR. CATTON: Do you have any qualifications
14 that the examiners must meet -- education, experience?

15 MR. THOMPSON: We have basically a training
16 program that they go through which requires them to
17 successfully pass our own kind of examination. That is,
18 they go through simulator training and they go through
19 the systems training. But with respect to specific
20 hard, firm fast -- like you have got to have a B.S.
21 degree, twelve years of experience, as Don said, those
22 people are very difficult to come about.

23 I would think most of our people have had
24 previous operating experience. There may be one or
25 two --

1 MR. CATTON: I just asked if you had
2 requirements and he said no. I think you really ought
3 to establish some.

4 MR. THOMPSON: I think it is certainly an
5 ideal goal.

6 MR. CATTON: And that maybe part of your
7 research ought to be directed toward what those
8 requirements ought to be.

9 MR. THOMPSON: Don, I do not know. Do we have
10 anything specifically?

11 MR. BECKHAM: Yes. We are specifically
12 addressing examiner qualifications and training and
13 certification in the program that we have ongoing.

14 MR. CATTON: Okay.

15 MR. GAWLER: Just to round out the answer on
16 regionalization, there is no plan, to my knowledge,
17 there is not even any thinking of regionalizing any
18 research activities or any standards development
19 activities.

20 MR. THOMPSON: I think that is true, and I do
21 not think any of us would support that. I think that is
22 the EPA approach, where they regionalized various
23 sections.

24 MR. MOELLER: A couple of questions before Mr.
25 Thompson leaves. The ACRS wrote a letter to the

1 Chairman of the NRC on August 18, 1982, concerning
2 control room habitability and when you talk about
3 control room design generally you are talking about the
4 man-machine interface and so forth.

5 MR. THOMPSON: That is correct.

6 MR. MOELLER: Are you giving any attention to
7 the environment of the control room, meaning whether it
8 is conducive to comfort, even the survival of the people
9 working there?

10 MR. THOMPSON: I will let Voss Moore answer.
11 The answer generally is yes. I do not know about the
12 survivability, which may be another area.

13 MR. MOORE: Other parts of the NRC cover the
14 survivability -- the toxic gases and that sort of
15 thing. We consider the comfort, the humidity,
16 temperature, noise -- that sort of thing -- and
17 lighting.

18 MR. MOELLER: So you look at it more for
19 normal operation, you might say, and others would look
20 at it for emergency?

21 MR. MOORE: That is correct, although we do
22 look at the emergency lighting. We feel that it happens
23 often enough that you lose offsite power and go to the
24 diesel and there is that transfer time. We do look at
25 the emergency lighting for the operability of the

1 plant.

2 MR. MOELLER: Will you be looking at the
3 Committee's letter or have you looked at it?

4 MR. MOORE: I read it, yes, sir, and I looked
5 at it specifically to see whether it was in our charter
6 or Roger Mattson's charter, and I think it is in his
7 charter.

8 MR. MOELLER: Fine.

9 MR. GAWLER: As I recall, Dr. Moeller, one of
10 the subareas that the Committee was particularly
11 interested in was air conditioning and all current
12 technical specifications in operating plants have
13 requirements on that, not because of the human
14 inhabitability aspects but because of the equipment,
15 particularly solid state equipment that is in the
16 control room, which will not function reliably if the
17 temperature goes above certain values

18 Those assure adequate comfort temperatures for
19 the human beings that would be in the control rooms as a
20 by-product.

21 MR. MOELLER: My other question -- and I hope
22 this is not out of order -- but if we were a
23 congressional committee and Mr. Thompson were appearing
24 before us, the first thing he would do is give us a
25 brief CV or biographical sketch, and you are a director

1 of the Division of Human Factors Safety.

2 MR. THOMPSON: That is correct.

3 MR. MOELLER: Could you briefly now or later
4 even send to the Committee a biographical sketch -- for
5 example, how long have you been in the area of human
6 factors and how long have you worked in this area?

7 MR. THOMPSON: I can go through that now or
8 give it to you later, whichever you prefer.

9 MR. MOELLER: It would be fine if you just
10 send us a brief sketch.

11 MR. THOMPSON: I will be glad to do that.

12 MR. MOELLER: Thank you.

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1 MR. WARD: Any other questions?

2 I had a question on the PRA and the safety
3 goal, and I think if I may quote, in talking about no
4 substantial improvements in the confidence of human
5 error rate assumptions used in PRA can be expected in
6 the near future, and therefore you don't expect a safety
7 goal to have much influence on the human factors program
8 or the human factors requirements in plants. That seems
9 like a very pessimistic conclusion.

10 I mean, if most of the PRA's conclude that
11 human error is a substantial contributor to the bottom
12 line risk in operation of the plant, and you are really
13 saying here that you don't think that the human error
14 can be adequately quantified to make a contribution to a
15 PRA, it seems like we've sort of got a problem about the
16 credibility of the whole PRA approach.

17 MR. THOMPSON: Maybe it's turned around, and
18 let me just tell you. I didn't see using PRA as an
19 approach to resolve the human factors issues. Maybe we
20 said it incorrectly the first go-round. That is, I
21 don't see being able to take control room reviews and
22 run a PRA through a control room review and decide you
23 don't need to do a control room review. So maybe we
24 need to refocus our language in there.

25 John, did you have a comment?

1 MR. ZWOLINSKI: Well, we looked at this pretty
2 hard, this PRA and safety goal, and I think we come down
3 more on the side of what he was saying is that that we
4 didn't see how we could use those documents and that
5 methodology to assess whether or not a control room
6 review had to be performed or training needed to be
7 upgraded or what have you.

8 I didn't know how to use it, and I'm not sure
9 any of the staff really knew how to use it. We are
10 looking more to the future, though. This says -- this
11 is one of the near-term now, over the next one, two or
12 three years. Research will be looking at this issue
13 over the longer haul as to the applicability of PRA in
14 this area.

15 MR. THOMPSON: But it doesn't mean that we
16 won't be sensitive to information that, where PRA may
17 say that feedwater systems produce a high degree of
18 operator errors. We can look at that for training
19 programs, we can look at those areas for operator
20 licensing examinations. But for us to be able to
21 resolve our problems, to say they go away using PRA, I
22 think we are not there yet.

23 MR. WARD: Thank you.

24 MR. DeBONS: I wondered, just for my own
25 education -- and I will expose my naivete on this

1 question -- how do these people define human error,
2 please? I mean, how does the Human Factors Society
3 define it and how are the opposing views defining human
4 error? What are we talking about when we talk about
5 human error?

6 MR. THOMPSON: Well, I guess I'm probably not
7 that much better off than you are, so I will let Jim
8 Jenkins or Dan Jones, either one, handle that.

9 MR. JENKINS: In our statement of human error
10 in the NUREG-1278, we are using it for cycle motor
11 error. We recognize that cognitive errors are errors of
12 decisionmaking. There is a topic that we do not
13 properly address at all and there is a gap in our
14 program. Hence, the research program.

15 The Human Factors Society does not give a
16 definition of human error.

17 MR. DeBONS: If they do not give a definition
18 of human error, then I feel -- and this is my own
19 judgment -- that 80 percent of their statement is
20 vacuous. I don't know what they're talking about. As
21 you say, there is a distinction between psycho-physical
22 error, and of course Tanner and Sweats made a big issue
23 of this 30 years ago, and cognitive error, and which we
24 don't know anything about.

25 So where do we stand on this whole dialogue

1 here? I mean, I'm not sure that we have a firm
2 intellectual stand, because it is my position, as I have
3 often stated, that the big problem here is not
4 psycho-physical error, that it is rather cognitive
5 error. And why should we dabble with psycho-physical
6 error?

7 I think there is plenty of evidence from
8 sensory data on the addition -- on the eyes, taste, and
9 all sorts of things about what the psycho-physical
10 function is, and when it deteriorates and under what
11 conditions, and so forth and so on. I'm just puzzled.

12 MR. THOMPSON: Dan, did you want to add
13 anything?

14 MR. JONES: I'm Dan Jones.

15 The use of human error rates worked very well
16 when we're talking about task equipment-related
17 activities. As you have just said, they are not much
18 good for cognitive, although the artificial intelligence
19 boys are working very hard to try to help some of our
20 solutions in those areas.

21 What we are doing here is looking primarily at
22 the task equipment-related areas. If we could figure a
23 way to do the cognitive errors, I would be very pleased
24 and I'm sure you would be, too. Right now we don't know
25 how. We don't have that much information.

1 MR. DeBONS: But do I understand correctly
2 that the Human Factors Society says that we can stand on
3 the psycho-physical error? They can't be doing that?

4 MR. JONES: No, I don't think so.

5 MR. DeBONS: So they recognize the
6 nebulousness of the cognitive error, is that right? Is
7 that how you interpret their statement?

8 MR. JONES: Yes.

9 MR. DeBONS: Thank you.

10 MR. WARD: Are there any other questions
11 before we go on to Mr. Ryan's presentation?

12 (No response.)

13 MR. WARD: Thank you.

14 Mr. Ryan, how long is your presentation?

15 MR. RYAN: About 50 minutes.

16 MR. GAWLER: And that's probably a very
17 optimistic 50 minutes.

18 (Slide.)

19 MR. RYAN: My name is Tom Ryan. I'm an
20 engineering psychologist in the Human Factors Branch at
21 the Division of Facility Operations at Research. And
22 per request, this presentation is a follow-up of the
23 program overview that was provided to the Subcommittee
24 on the 6th of July and a detailed presentation of the
25 program provided to Mr. Ken Kirby, staff member of the

1 Subcommittee, on the 15th of July.

2 And the purpose is to acquaint you in some
3 detail with a recently initiated human factors research
4 program, directed toward optimizing information on
5 management qualifications. To some extent it is an
6 expansion on the remarks made by Mr. Zwolinski here
7 under the agenda item II.G.

8 Currently involved in this program and
9 anticipated to be involved in the program shortly are
10 the Office of Research, NRR's Licensing Qualification
11 Branch, the Operating Reactor Program Branch of
12 Inspection & Enforcement, AEOD, and the Management
13 Information Branch of the Office of Resource Management,
14 all within NRC.

15 Additionally, representatives of INPO, EPRI,
16 two of the national labs, industry and academia are also
17 involved.

18 (Slide.)

19 The purpose of this program is to analyze the
20 nuclear facility from an organization or systems
21 perspective, with primary focus on management to
22 determine what impact both management and organizational
23 factors do have and, just as importantly or more
24 importantly, can have on plant and public safety.

25 Now, the purpose of the program is to develop,

1 quite frankly, performance assessment standards and
2 performance enhancement guidelines for organization and
3 management, termed here as safety assessment standards
4 and safety enhancement guidelines, respectively.

5 The short-term products of this research, and
6 confirmatory in nature, are to support current NRC
7 licensing analysis, inspection and enforcement
8 activities and to provide a technical base for future
9 NRC rulemaking, and in this sense exploratory research.

10 (Slide.)

11 The research responds to a variety of
12 requirements, recommendations and requests. Among these
13 are the TMI action plan, NRR requests for research in
14 this area, the NRC long-range research plan, and the
15 human factors society long-range plan that we have been
16 discussing earlier, primarily in Sections 4.2 through
17 4.6.

18 There are 14 of their recommendations that are
19 addressed by this research program, having to do with
20 things like systems integration, systems design and
21 training for non-licensed type people.

22 (Slide.)

23 As has been brought out to date, at least in
24 the research area our emphasis has been primarily on
25 individuals in the nuclear facility, basically the

1 reactor operators, senior reactor operators, auxiliary
2 operators and so on. This research is based on a number
3 of premises or suppositions:

4 First of all, that an organizational
5 perspective is required if we are really to understand
6 completely and are able to really influence in a
7 meaningful sort of way the overall operating
8 characteristics of the system to optimize plant and
9 public safety;

10 Secondly, that organizational effectiveness
11 depends in large measure, and in some instances the very
12 survival of an organization depends, on the behavior and
13 actions of their managers. In the present instance,
14 management provides organizational continuity during
15 nuclear facility design, construction, startup and
16 operation.

17 And finally, the significant accidents that
18 have occurred in the nuclear industry over the last ten
19 years have involved organizational as well as individual
20 personnel failures.

21 (Slide.)

22 I have mentioned that the objectives of this
23 research are directed at safety assessment standards and
24 safety enhancement guidelines, and I would like you to
25 keep in mind this research program has just started, so

1 that these are basically operating definitions. And
2 first of all, when we talk about a safety assessment
3 standard, we are directing it at the current
4 organizational structure, and basically they are
5 diagnostic statements, empirically derived and
6 validated, describing the relationships between clusters
7 of management and/or organizational practices and
8 clusters of safety-related indicators.

9 And let me point out, for the words that are
10 underlined, by "diagnostic" what we're really talking
11 about is a statement of the current situation. When we
12 talk about "validated," here we're talking about having
13 some supporting data that indicates that these things
14 are true. When we use the word "clusters" here, it is
15 common in complex organizations that it is very
16 difficult to use one factor to make judgments about
17 management, but what we are really usually required to
18 do is talk about patterns or clusters or groupings of
19 activities.

20 When we talk about organizational or
21 management practices, here we're talking about
22 activities, formal or informal, that help define the
23 system: What kind of reactor are we going to have,
24 where are we going to locate it, and the training we're
25 going to have; establishing practices and procedures,

1 and then finally carrying out those procedures.

2 When we talk about "management," here we talk
3 about usually establishing or defining, whereas when we
4 talk about "organizational activities" we are talking
5 about actually carrying these things out.

6 When we talk about "safety-related"
7 indicators, here we're talking about the performance
8 criteria, and we are taking a look at everything from
9 nuclear-related accidents, general industrial-related
10 accidents, safeguards back through indicators such as
11 personnel matriculation and things of that sort.

12 When we talk about safety enhancement
13 guidelines, we're talking about the advanced
14 organization, the "what-if." And basically, here we're
15 talking about prescriptive statements, empirically
16 derived and quantitative, describing the potential
17 relationships between clusters of management and
18 organization, alternative practices and safety-related
19 indicators.

20 And basically, here we are talking about what
21 we hope to derive through our enhancement modeling
22 effort is better ways to run the railroad.

23 (Slide.)

24 What do we hope to get out of this research in
25 the short-term? In the short-term -- and I'm talking

1 about basically FY '83 -- we're developing information
2 to support the validation of NUREG-0731: What are the
3 relevant guidelines that are contained in that document,
4 how can we make them more objective, which ones should
5 we eliminate, which ones should we expand on?

6 Secondly, data to support NRR's review of the
7 ISEG or the Independent Safety Engineering Group's
8 functions in the nuclear facility;

9 And finally, to develop criteria to be used in
10 NRR's, or generally NRC's, review of the SEE-IN Program
11 concept, that is the INPO program where they take LER's
12 and they tap interesting events and go out and prepare
13 other kinds of reports.

14 So that is basically the short-term thing, FY
15 '83. In the long range, and this gets us more into the
16 exploratory research area, basically criteria and
17 guidelines to enhance the review procedures that are
18 currently contained in the NUREG-0800, the standard
19 review plan, to support IE enhanced evaluation
20 techniques.

21 And finally, down here we get into the more
22 advanced concepts: Can we reorganize the organization,
23 management structure, through role allocation, function
24 allocation, prerogatives, and responsibilities, and
25 getting into some of these inter- and

1 intra-organizational communications networks that we
2 talked about earlier today.

3 After this we get into things like management
4 qualifications, career progression: Should a manager
5 have more of an academic background in the nuclear
6 industry, as opposed to a certain number of years of
7 experience, those kinds of issues; and also into several
8 systems integration type issues.

9 MR. WARD: Wait a minute, Tom. So I
10 understand the first, the upper part there, confirmatory
11 research. You were saying that the 0731 and the
12 Independent Safety Engineering Group, those define your
13 clusters of management and organizational practices.
14 And then the SEE-IN Program is defining the
15 safety-related indicators? Am I relating these
16 properly?

17 MR. RYAN: Well, basically what we're talking
18 about up here is practices and safety-related indicator
19 combinations that can be used for criteria, as criteria
20 for validating 0731: Is the guidelines document looking
21 at relevant practices and safety outcomes? Where do we
22 need to more further define these things on an objective
23 basis, and that kind of thing.

24 MR. WARD: But on your previous chart, what
25 you were attempting to do there was to try to get some

1 relationship between clusters of management and
2 organizational practices and clusters of safety-related
3 indicators. And is that what you are talking about
4 here, relating organization and performance?

5 MR. RYAN: Right.

6 MR. WARD: The SEE-IN Program is how you're
7 getting data on performance?

8 MR. RYAN: Right. And we are using some of
9 the work we are doing on the performance criteria in
10 looking at the proper kinds of things or things that are
11 of interest to us, based upon the outcomes of this
12 research. What we're looking at here in terms of the
13 ISEG's are appropriate roles, relevant roles for them:
14 Are they necessary, or what criteria should we use to
15 assess the value of the ISEG?

16 When we talk about things down here in the
17 exploratory area, of course we are taking a look -- we
18 are taking a view toward the advanced type of
19 organization, what if or what could be.

20 MR. WARD: All right.

21 (Slide.)

22 MR. RYAN: What I would like to discuss this
23 evening is basically what we have in mind for the
24 basically FY '83 through FY '85 time frame. And
25 basically the program is broken up into two themes or

1 two thrusts: One directed at the safety assessment
2 standards, the other at safety enhancement guidelines.

3 What we have already initiated or will
4 initiate are two projects that cover the period up to
5 the end of basically FY '84. The first project, the
6 first task there or the first set of tasks, is to define
7 the units of interest: What is the organization we're
8 talking about, what is the management structure in terms
9 of the configuration, dynamics and so on, what should we
10 be studying? Are we going to be limited to the nuclear
11 power plant or can we, when we talk about management's
12 relationship to safety, or do we start looking -- or do
13 we have to look at the corporate level or utility
14 level?

15 Based upon those findings, which we hope to
16 have promptly by the end of October, this will drive the
17 next part of that project, and that is the development
18 of assessment approaches for operating plants: How do
19 we operate the operating plants. It will also be a
20 point of departure for us to develop a technical base
21 concerning organization and management during design,
22 construction and startup and operation, and a point of
23 departure later on to start the enhancement modeling
24 effort, and also to guide us in developing assessment
25 approaches for earlier stages of the power plant

1 development, getting into the construction phase and
2 startup phase and things that we were talking about
3 earlier.

4 As I mentioned, there are two parallel
5 projects involved here.

6 (Slide.)

7 The first project involves the development of
8 management organization safety assessment approaches.
9 It is a two-year effort with Battelle Pacific Northwest
10 Laboratories, more specifically the Human Affairs
11 Research Center at Seattle. And it began in June of '82
12 and should end in May of '84.

13 Two related projects. The second project I'm
14 going to talk about today, and also a utility management
15 and organization guidelines effort that NRR has ongoing
16 which, amongst other things, has revised 0731.

17 (Slide.)

18 The objective of the first project, as you can
19 see, is to develop and field validate new innovative
20 approaches, techniques and methods for assessment
21 nuclear facility management and organizational
22 effectiveness in matters crucial to safety during power
23 plant operations. Now, when I talk about an approach
24 here, basically it is a technique or a method for
25 viewing the organization.

1 The safety assessment standards that I have
2 talked about hopefully are the details, the content,
3 here are the measures you're going to make in order to
4 actually do the assessment.

5 So the approach is, how do we view the
6 organization and are we going to look at management in a
7 horizontal fashion or a vertical fashion or some
8 cross-sectional fashion, how are we going to look at the
9 organization. Again, the safety assessment standards
10 are the meat of that: What are the measures? What are
11 the things that we're going to try to correlate, and so
12 on?

13 The other thing to remember here is we are
14 talking about just the operating power plant. We're not
15 talking about any stages prior to that time.

16 (Slide.)

17 The products of this project, of course, are
18 hopefully several of the assessment approaches which
19 have been validated and which have valid standards, and
20 also a technology base to support improved nuclear
21 facilities management and organization. Obviously,
22 going through this exercise, we are going to come out of
23 it with some ideas of a better way to do things.
24 Obviously, we're going to come up with safety indicators
25 which are probably the practices going on, and we're

1 also going to find organizations doing a lot of things
2 that really may or may not have any relevance to safety
3 as we define them.

4 (Slide.)

5 I would like to very quickly go over some of
6 the terms of interest here. I know when we go through
7 these projects we get stuck on some semantics, and
8 basically here what we are talking about is the current
9 organization. And again, I'm not sure right now, and so
10 probably later in October -- whether we're talking about
11 -- whether we can relegate ourselves to a nuclear power
12 plant or whether we're going to talk about the utility
13 level or the corporate level in order to make some
14 meaningful relationships between organization and
15 management practices to some kind of safety-related
16 outcome.

17 Again, the operating facility, one that is up
18 and operating -- I guess I'll mention again quickly the
19 organization practice, and certainly that is informal or
20 formal activity that helps define the organization and
21 establish some policy or procedure or actually to carry
22 one out. And again, the distinction we make between
23 management and organization activities: the managers,
24 pure managers, individually and as groups, define and
25 establish; organizational elements carry things out.

1 The safety-related indicators again are the
2 criteria that we use to define safety, ranging all the
3 way from the various kinds of accidents back to more
4 soft things like personnel matriculation, turnover and
5 that kind of thing.

6 MR. WARD: But there you would be looking at
7 things like the SALP evaluations?

8 MR. RYAN: Right. I had a task here I was
9 going to get into in a minute, because in that whole
10 issue of criterion development, and some of the things
11 that we're trying to deal with in that particular area
12 -- again, the safety assessment approach is the method
13 or technique that we're going to use to view the
14 organization for the purposes of evaluating it. And
15 when I talk about safety assessment protocols, what
16 we're talking about here are what are the administrative
17 procedures for doing it, what do the data collection
18 forms look like, how much data do you collect, who
19 collects them, that kind of thing.

20 Concurrent field validation or phase two of
21 this project, basically the second year; we are going
22 through a validation effort. Obviously, we cannot go in
23 and impact the utilities in the way that they are
24 currently operating. So basically what we're going to
25 have to do is collect data on the practices and on the

1 safety-related indicators, and do an a posteriori kind
2 of analysis, because basically what we have is a
3 concurrent validation rather than any kind of predictive
4 thing where we have control groups and that kind of
5 thing.

6 Finally involved in this project and the other
7 project I'm going to talk about, our research review
8 group. We feel in this area we need a lot of help, so
9 we are putting together a research review group, which
10 includes Research, NRR, probably IE. And we are going
11 to have people from INPO, EPRI, academia, the utilities,
12 in addition to the current contractor.

13 And as you will see, as we go through this
14 project we are going to bring that group together to
15 make some decisions about which approaches to pursue and
16 which protocols to attempt to validate.

17 So those are just basically some terms you'll
18 see used in here and I just wanted to get through them
19 quickly.

20 (Slide.)

21 The first phase of the project basically is 12
22 months long, and it has three primary tasks: First, to
23 develop the safety assessment approaches. And this has
24 a series of subtasks, which I will go through each one:
25 A literature review taking a look at related type

1 organizations and how they do their performance
2 assessment, what we are doing currently in the NRC and
3 the industry; the development of the performance
4 criteria; and finally, the development of the safety
5 assessment approaches.

6 Under task 2, for those approaches that we
7 want to pursue development of -- and by the way, the
8 first task, 2.A, is the selection of those -- then we
9 will develop the protocols, the actual administrative
10 procedures to actually implement them.

11 And at the end of phase one is the technical
12 report, which reports on everything we have done and
13 provides us with all of the materials we need.

14 And now I will start talking about the
15 validation.

16 (Slide.)

17 Going into the task fairly briefly, first of
18 all, task 1.A, the literature review. Basically, here
19 we're interested in organization, management and safety
20 typologies. And basically what I mean by that are what
21 are the characteristics, structure and dynamics of this
22 organization that is called a nuclear facility: How
23 open or closed is it, how much an impact do stockholders
24 and unions and people from the outside have on the
25 deliberations of the organization, what are the

1 boundaries of the organization.

2 And again, I go back to, are we just talking
3 about the power plant or are we just talking about some
4 higher-level corporate and utility entity. What are the
5 relationships between what we look at as operations
6 versus safeguards, and that is the physical security of
7 the plant and things like that.

8 And an even bigger issue for us is: Is there
9 anything such as a generic organization? We've got 74
10 licensees out there and from what you can see on the
11 surface they operate in a lot of different ways? Is
12 there any way to come up with one or two or three
13 generic organizations to fit this industry?

14 The same thing goes for management, the same
15 kind of considerations. When we talk about safety
16 typology, we're talking about what do we mean by safety,
17 what are the physical events and how are they
18 interrelated, and who is involved in them?

19 So basically, at the end of this task what we
20 are looking for are some units of entrance: what is the
21 organization that we're going to try to deal with out
22 there from an organizational perspective, what is the
23 management structure that we're going to try to deal
24 with? And by the way, when I talk about management, we
25 talk about anybody above the shift supervisor. The

1 shift supervisor on down we're not going to deal with.

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1 MR. MOELLER: Will your literature review not
2 look at what else has been done in the field?

3 MR. RYAN: Yes, sir, it is. That is going to
4 be part of the process, going into organizational
5 psychology literature and other literature, management
6 literature, to try and permit us to get some kind of
7 handle on this organization, how do we operationally
8 define the organization and the management structure so
9 we can study this in some systematic fashion.

10 MR. WARD: You have mentioned two or three
11 times what seems to be a question whether the
12 organization is -- what is that -- the plant, or
13 includes the corporation headquarters or something? If
14 you come to some conclusion other than that it ought to
15 include the corporation headquarters, I will be, I do
16 not know what, scientifically opposed or something.

17 MR. RYAN: I will be surprised if we do not
18 also. But Battelle has been working on this project
19 since the first of the year, and as I dsaid, hopefully,
20 toward the end of October we will be at a point where we
21 can get a handle on that.

22 (Slide.)

23 Task I.B, the next step once we have a handle
24 on that piece that we are trying to deal with, we are
25 going to try to capitalize on what has been done. And

1 please bear with me. These are illustrative examples.
2 This whole list may change by the time we get the
3 results of Task I.A.

4 But basically, the thought here was that we
5 are going to try to take a look at some similar
6 organizations, similar in management structures, to see
7 how other industries, if you will, address the whole
8 business of trying to assess performance. And anything
9 we can capitalize on we are certainly going to do it.
10 And by the way, part of the literature review task will
11 enable us getting into some of these things also.

12 MR. DEBONS: There is an implication in this
13 chart that the problem is a unit problem. For example,
14 when you talk about aircraft control and warning, that
15 is a unit concept. When you talk about antisubmarine
16 warfare, that is a unit concept. You have given
17 undoubtedly attention to the systems problem -- for
18 example, C³, command, control, and communications --
19 which is much more pertinent to the nuclear problem than
20 just the control of an aircraft. Is that true?

21 MR. RYAN: Well, again, I go back, this list
22 is only illustrative and these are just some of the
23 organizational types that are mentioned in the same
24 breath.

25 MR. DEBONS: I understand that. I was just

1 suggesting that probably there is considerable
2 literature in the command-control-communications area
3 that could be helpful.

4 MR. WARD: I do not expect you to be
5 overlooking them. There are other hazardous
6 manufacturing industries. I mean some chemical
7 explosives manufacturers and that sort of thing, in
8 which I think there might be some insights.

9 MR. RYAN: Well, again, this is just short of
10 a one-man's list.

11 (Slide.)

12 The next step, of course, is to take a look at
13 what we are doing in the NRC and the industry. And this
14 gets us to the point in this research where we think
15 that we can begin to make a contribution to the 0731
16 questions. At this time, while we are not going to have
17 any validated standards or anything like this, we are
18 going to have some information that we feel will be
19 useful to NRR in revising 0731 and making some other
20 decisions about this whole issue of review assessment.

21 This also involves, obviously, the outputs of
22 Task I.A and I.B and certainly keys on the typologies
23 that come out of Task I: what is the kind of
24 organization we are trying to deal with? And again,
25 this is just preliminary data that we feel would be

1 useful to have.

2 (Slide.)

3 This brings us to probably one of the most
4 difficult, if not the most difficult issue that we are
5 facing, and that is the whole problem of criterion
6 development. And again this list is illustrative of
7 some of the kinds of things we are taking a look at. We
8 are presently working with IE, AOD, INPO in trying to
9 put together and amass all the kinds of information
10 generated from the plants so we can subject them to
11 certain reviews to see if there is, in fact, anything in
12 there that is relevant to this issue, any of these data
13 that are fairly reliable.

14 We are trying to deal with the bias issues,
15 and the LERs are a perfect example of reports being
16 fraught with all kinds of biases in terms of what goes
17 into them and when they are actually prepared. We are
18 taking a look at the practicality issues, how difficult
19 is it to get some of this information, how many of these
20 are quantitative in any kind of way or can be scaled in
21 any kind of way that would be meaningful to us. And
22 finally, any of them that could be generalized beyond
23 the particular instances that they were generated from.

24 As I say, we have a fellow working full-time
25 and has been working for the last 2-1/2 months, working

1 with the various agencies and NRC and also at INPO to
2 try and deal with this whole performance criteria issue.

3 And we are also taking a look at some of the
4 work that has been done. You will notice on the bottom
5 there it says "Other studies." There was a study done a
6 few years ago but was not published in the agency, and
7 we tried to take a look at some performance factors,
8 organizational performance factors using data from
9 1976. And they sort of did not finish their data
10 collection, and used descriptive rather than any kind of
11 inferential statistics to look at the information. And
12 we are trying to gain from that.

13 I do not know if you are familiar with the
14 Tectronics report. This company that did an analysis
15 some time ago, and again theirs is just sort of a
16 descriptive statement about what some utilities do and
17 others do not. And we are trying to capitalize on that.

18 But we recognize this is a very critical
19 issue, and as in most other situations --

20 MR. KEYSERLING: I would also suggest you look
21 at some industries at occupational safety as opposed to
22 general public safety, such as workers compensation data
23 from the OSHA log and so forth and so on, not that these
24 values are specifically related to public safety but
25 they may give some indication of what the management's

1 attitude --

2 MR. RYAN: Are you talking about
3 industrial-type accidents?

4 MR. KEYSERLING: Yes.

5 MR. RYAN: Well, we are trying to look at
6 three things. First of all, the nuclear-related
7 accidents, the loss-of-coolant radiation release,
8 burst-type of thing. We are also looking at
9 industrial-related accidents, how many people fall down
10 the steps on the job and all these other things. We are
11 also looking at safeguard events, anywhere from any kind
12 of a penetration of facility by a nonauthorized
13 individual to attempts at sabotage, that whole kind of
14 thing.

15 So we see those three areas as areas that
16 might be relevant to what we are trying to look at.
17 Again I am just trying to stress here that this is a
18 very difficult kind of thing to do, especially when you
19 are trying to deal with indicators rather than having a
20 nice array of actual things that happen.

21 Obviously, the significant accidents do not
22 happen that much to be able to yield ultimate criteria,
23 so we have this problem of trying to use intermediate
24 indicators that we can all agree on and is reliable and
25 free from bias.

1 MR. WARD: What about performance during
2 construction?

3 MR. RYAN: Keep in mind what we are attempting
4 to do here is just deal with the operators.

5 The other project that I was going to get into
6 was going to lay the framework for dealing with these
7 kinds of issues at stages prior to the operating of the
8 plant.

9 (Slide.)

10 The final subtask under Task I basically is
11 the development of the safety assessment approaches
12 themselves. And basically here what we are talking
13 about is classifying safety-related indicators,
14 hardware-oriented and event-oriented and
15 personal-oriented, and then cluster them.

16 And I get back to the statement I made
17 earlier: our anticipation is that we are probably not
18 going to be able to talk about a one-on-one type things
19 but we are going to have to start looking at groupings
20 or clusters and patterns rather than just
21 individual-type measures.

22 The same thing for the facility practices in
23 terms of classifying them and clustering them, making
24 decisions about the management and organizational
25 individuals and groups that we are going to address

1 ourselves to. And then, of course, bringing the three
2 of them together: individual or group A practicing
3 practice C leads to safety indicator E kind of thing.
4 But more of a clustering or grouping.

5 And what we are talking about there at the end
6 of Task I is probably somewhere between eight or ten
7 approaches, ways of looking at the organization and
8 management or variations on the theme.

9 Obviously, we do not have the time or
10 resources right now to develop all of them. And that
11 brings us to the second task, and certainly the first
12 part of this task where we bring together this research
13 review group that I mentioned a little bit earlier.

14 (Slide.)

15 And we are going to have to make some
16 decisions about the approaches, maybe the two or three
17 or whatever, that it turns out that we can afford that
18 we will pursue. One of the reasons that we want to
19 bring together a wide range of people to participate in
20 this decision process are some things we are going to
21 have to consider. And again, this list is sort of
22 illustrative. We are going to have to worry about
23 practical considerations: how much does it cost to
24 develop this, what are the logistics involved in doing
25 this kind of an approach.

1 Secondly, what is acceptable to the government
2 or industry. There are obviously going to be things
3 that might be very enticing from our point of view that
4 the industry is not going to stand for us to come in
5 there, especially when you are talking about the
6 high-level managers.

7 The third thing is certainly our estimate of
8 the potential for the success of the thing actually
9 being validated. Other considerations having to do with
10 our NRC needs. It may be determined collectively that
11 while one area might be very promising, you have got a
12 fire drill over here, and in terms of prioritizing,
13 maybe we have to go in this direction.

14 Funding availability, I mentioned that we
15 probably would not be able to pursue all of these. So
16 that will be a determination as to how many we can
17 pursue.

18 And finally, and as far as I am concerned, a
19 very important thing, which is not on this frame, and
20 that is generalizability. If we have got an approach
21 that we can address ourselves to a number of plants and
22 a number of settings, obviously that might have
23 precedence over one that is very plant-specific. So
24 those are the kinds of considerations.

25 We plan to bring the people together for a

1 3-day period: the first day to review everything that
2 we have done up to that point; the second day to develop
3 the criteria that we weill use to make these choices;
4 and the third day actually making the choices as to what
5 we are going to pursue.

6 (Slide.)

7 Task II.B here is developing the protocols.
8 And basically, as I mentioned earlier, these are the
9 administrative procedures for actually doing it: what
10 are the measures, what are the pairings, what are the
11 instruments that we have to use to collect the data,
12 what are the procedures that we use to draw out the data?

13 In some cases here we may be able to use
14 secondary data, we might not have to go into the plant.
15 But we do anticipate that there will probably be some
16 primary data collection of some kind. What kind of
17 sampling requirements: do we go to one plant, 10
18 plants, 30 plants? I do not know.

19 The analysis procedures when we get the data,
20 how do we compile it, how do we analyze it, what
21 statistics do we apply to it?

22 And finally, probably one of the most
23 important things is how do we present the validation
24 indices? Are we talking about components, composites,
25 matrix? How do we present the data?

1 At the end of Task II, which concludes the
2 first year, we are talking about a formal briefing to
3 the NRC. And then, of course, the technical report
4 gives us all of the materials.

5 (Slide.)

6 The second year is basically pretty
7 straightforward. What is not shown here, of course, is
8 bringing together our research review group once again
9 to make decisions about which of the protocols we use.
10 It may be necessary because of time and funding
11 availability that we might not be able to go out and
12 actually do a validation study at all. So these people
13 will be brought together.

14 The other part of Task I is a validation
15 plan. That is how they are going to tell us their
16 schedules and everything, exactly how they are going to
17 do it, collect the data, do the statistical analysis,
18 and then present us with the final report for the
19 project.

20 And I will quickly go through this.

21 MR. SALVENDY: Excuse me. I am not quite sure
22 how you validated this. I wonder if you could indicate
23 how you validated this.

24 MR. RYAN: Basically, what we are going to do
25 is a concurrent validation. Once we have developed the

1 practices safety indicator groupings, we are going to
2 take data from plants, current data, into an a posteriori
3 type of analysis, how well did these things correlate.

4 MR. SALVENDY: So then it will be a
5 correlation validation rather than a construct validity
6 whether you really measure what you want to measure?

7 MR. RYAN: It could be some of that, too, but
8 basically a concurrent.

9 MR. SALVENDY: How do you do the construct
10 validity?

11 MR. RYAN: Are you talking about internal
12 consistency here?

13 MR. SALVENDY: No; just to be sure that what
14 you think you measure you actually measure.

15 MR. RYAN: I am not sure we really can do
16 that. I may come back and reverse myself here in 3
17 months. It looks like right now basically this is about
18 what we are going to be able to do because we are not
19 going to have any control over what goes on out there.
20 And so I would say this is about what we are going to be
21 able to do.

22 Task I.A is again bringing the group together
23 that I mentioned earlier.

24 (Slide.)

25 We are going to take the same kind of

1 considerations, the same kind of criteria apply with
2 probably one exception: the first meeting, we will not
3 have as much knowledge of the information as we did
4 here. Here we are going to be talking about how many
5 data collectors you need and how many pieces of data and
6 all that. So this will permit us to have more knowledge
7 because we will have more details of things we actually
8 need to do.

9 But basically, it may or may not be necessary
10 to pare down the number of approaches and protocols that
11 we validate.

12 (Slide.)

13 The field validation plan preparation, of
14 course, this is a discussion of the protocols, the data
15 sampling plan, the support requirements, how many people
16 you need to do this, NRC, industry, contractors, and
17 what are the schedules for doing those? Is this going
18 to be a snapshot-type thing or is it going to go on? If
19 you use the data for 6 months or 1 month are those kinds
20 of questions.

21 A formal briefing to the NRC, obviously we
22 have got to concur in the plan. And finally, Task II is
23 pretty much self-evident. The field validation data
24 collection.

25 (Slide.)

1 Task III, which involves actually the indices
2 preparation, and this is the statistical analysis, the
3 representation, the statements about the
4 generalizability. And something that I think is very
5 important here is the practical application, and here is
6 where we tell NRR how they or IE or whoever might use
7 this stuff.

8 The other thing is we are going to attempt to
9 develop some meaningful user materials. I am sure you
10 are all aware of the research reports and all kinds of
11 information that somebody has to sit down for 6 months
12 to figure out how to try to use it. We are going to try
13 to shortcircuit that and come up with something that is,
14 in addition to a technical report, actually usable as it
15 is by NRR. And hopefully, it is a two-page pamphlet or
16 something that gets you right down to the nitty-gritty
17 to make some extrapolation from all of the research
18 reports. That basically ends the project.

19 And what we hope to get out of it -- I do not
20 have a slide here -- is basically diagnostic information
21 on nuclear facility organization dynamics: what is the
22 organization, what does it look like, how does it
23 operate? The same thing for the management structure.
24 We want to have some information about what is possible
25 in terms of safety-related indicators. We may not be

1 able to use all of them that we have identified earlier
2 in this particular validation effort.

3 The same thing for the practices. And two
4 things which I think are very important. One is what I
5 call "missing practices;" and that is, we come up with a
6 safety-related indicator, something that is obvious
7 where we can find something that would prevent that kind
8 of thing. And by the way, this is really common. Even
9 more common is missing indicators. As I mentioned
10 earlier, we have a lot of energy being expended doing a
11 lot of things that bears no relation to anything. And
12 this is something that happens quite frequently, and I
13 would not be at all surprised if we run into that kind
14 of thing. And certainly this is of value to people like
15 John over here with 0731. Do we have these people
16 engaging in an awful lot of things that have no apparent
17 relationship to anything that we can judge as safety?

18 And then, of course, we have the validative
19 approaches which include this kind of thing. And
20 basically, what I was talking about, very quickly to go
21 back to this frame I had here --

22 (Slide.)

23 -- the project I described is a 2-year project
24 which deals with units of interest and assessment
25 approaches for the operating plants. During fiscal year

1 1985 the intent is utilizing a process similar to this,
2 start taking a look at assessment approaches for the
3 plant that is in the design stage, construction phase,
4 and startup phase, utilizing the same kind of
5 information.

6 Okay, I would like to turn to the second
7 project.

8 (Slide.)

9 And this is one that we hope to get off the
10 ground on the first of October. And this is the initial
11 work in the area of the enhancement guidelines. And
12 basically, what the purpose of this project is is not to
13 develop the guidelines but to develop the technical base
14 from which we will generate the guidelines.

15 It is being conducted over a 2-year period.
16 Idaho National Engineering Laboratory is involved, and
17 the related research projects have to do with the crew
18 task analysis that Jim Jenkins is involved in. A job
19 skills analysis for the health physics technician and
20 the safety assessment approaches development project I
21 just talked about.

22 And the reason I mention those other two
23 projects, one of the things we are doing here is we are
24 doing some data base management. We are not just doing
25 a lot of task analyses independent of one another. What

1 we are doing in each one of these projects is attempting
2 to format the data in such a way that we can put it in a
3 large data base so that we can start taking a look at
4 some of these functions within the context of an
5 organization.

6 (Slide.)

7 The objective of this project, as indicated
8 here, is to perform analyses and establish enhancement
9 modeling requirements for organization and management
10 functions in roles critical to safety during nuclear
11 power plant design, construction, startup, and operation.

12 (Slide.)

13 The products of this research, first of all, a
14 technology base, hopefully, a comprehensive data base
15 about what goes on from an organizational and management
16 perspective right through the life cycle of a plant; and
17 secondly, some requirements for modeling, and I will get
18 into that. What are the mechanisms we are going to use
19 to take that information and do something with it in
20 terms of enhancing plant and public safety from a
21 management organizational perspective, because the
22 functional analysis data itself is nice data and it
23 tells you all about things that might be going on, but
24 the real key is what do we do with it?

25 (Slide.)

1 All right. As in the other project, I would
2 just like to take a minute to go through some terms of
3 interest here. The first set had to do with
4 organizational or system-oriented function inventory.
5 And again, when we talk about a function, it is a
6 synonym for the activity that is an activity which
7 defines the structure of the organization or establishes
8 a policy or a procedure or from an organizational point
9 of view one that carries out.

10 And here I am talking about things like
11 deciding whether or not we are going to be a PWR or a
12 BWR or deciding where we are going to locate and whether
13 or not we are going to have sustainment training rather
14 than just qualification and requalification training.
15 And by the way, I think that is a very important
16 variable when it comes to this kind of thing versus the
17 actual carrying out of an activity.

18 Now, in the sense that we talk about an
19 organizational activity here, we talk about an activity,
20 while it may involve the whole control room, it also
21 involves a manager and an active participation of the
22 tasks. So that there are a set of activities that might
23 go on in a control room that involve just the crew in
24 the control room that we might not take a look at
25 because they might not involve somebody from the

1 management structure.

2 What is a function inventory? Basically, that
3 is a list of the tasks or the functions that must be
4 performed by the organization from design right through
5 operation. When we talk about a function analysis, we
6 have used that term here instead of "task analysis"
7 because "task analysis" has the connotation of
8 time-and-motion study, following someone around with a
9 stopwatch. We did not mean that kind of an analysis.
10 We are talking about questionnaires, interviews,
11 observations, documentation reviews and that kind of
12 thing.

13 Case histories, when we talk about function
14 enhancement modeling, we are talking about function
15 engineering. How do we do the activity without too much
16 interest right now we are focusing on the individuals,
17 but how can the task be structured?

18 When we talk about these other terms, "role
19 analysis," that is synonymous or like the job analysis
20 for the operator. When we talk about roles here,
21 collection of activities that are directed at some
22 individual, group, or group of individuals. Also we use
23 the term "role" here because we get into the situation
24 where managers fulfill more than one role.

25 We also get into management styles, as someone

1 brought up here, where we have the Jimmy Carter on the
2 one side that gets involved in all of the details, and
3 the Ronald Reagan on the other side who just wants to
4 make the big decisions and those kinds of things.

5 We talk about role enhancement modeling here.
6 We also talk about how can we engineer the job or the
7 role to make it more efficient. So basically, those are
8 the terms.

9 (Slide.)

10 And lastly, one I did not go over here is the
11 research review group, the same function as in the other
12 project.

13 Quickly, just an overview of the project.
14 Five tasks involved over a 2-year period. The first
15 three tasks are in fiscal year 1983 are basically:
16 project planning, develop the function inventory, and do
17 the function analysis.

18 You will see a box up here with broken lines
19 that says "Data Base Management." Obviously, we are not
20 going to be able to do a detailed analysis of somewhere
21 between 3,000 and 5,000 functions we anticipate would
22 show up on an inventory. We do not want to use the
23 data, so it goes into a data base.

24 The same thing is true when we select those
25 roles that we are going to do an analysis of. We may

1 not be able to involve all of the functions we did the
2 detailed analysis on. We want to be able to save the
3 information.

4 A reason for going through the sequence, and I
5 mentioned it at the earlier briefing, is that we never
6 want to look at anybody, be it an individual or group,
7 in anything but the context of the organization. We do
8 not want to fine-tune anybody in isolation without a
9 clear understanding of what that does to the overall
10 organization. That is what this structure intends to
11 provide.

12 A final task, Task V, is, as I mentioned,
13 requirements for modeling. And I will get into that.

14 (Slide.)

15 Task I is the project plan development,
16 operational definitions, functions, roles, and so on.
17 Safety-critical criteria, we are going to have to make
18 some decisions about which functions are really critical
19 to safety and those which are not. The methodologies
20 for doing the function inventory and the function
21 analysis. Data base management, how we are going to
22 deal with storage. Data requirements both technical and
23 administrative, where does it come from, data sources,
24 project schedules and project milestones. And then a
25 briefing. And certainly, or hopefully, our concurrene

1 in the plan.

2 (Slide.)

3 Task II, function inventory. This is a list,
4 not an analysis. And this is some of the information
5 that we expect to receive, basically a statement of the
6 function of the activity. The plant life-cycle that it
7 is associated with, whether it is design, construction,
8 startup, or operation; whether or not it is critical to
9 safety; is it a function that is critical and frequently
10 or not critical 90 percent of what we do, that kind of
11 thing.

12 The facility setting, when this kind of thing
13 versus the normal operations, emergency operations,
14 transient-type operations, is it impacted by the type of
15 plant, the vendor, the vintage, the utility, the plant
16 location, those kinds of things. Type of function, is
17 it individual or group? What are the performance
18 requirements, information gathering, decision making and
19 so on.

20 The parent cluster, what functions occur just
21 before and just after or simultaneous with it, and who
22 is involved in it?

23 (Slide.)

24 Task III starts, of course, with bringing
25 together our people and making a selection of the

1 functions out of this very long list that we are
2 actually going to be looking at in detailed analysis.
3 And we are going to go through the same kind of exercise
4 we did with the other review group.

5 Once we have selected those particular tasks,
6 then we will, of course, go ahead with the function
7 analysis, and I would like to make a statement about the
8 data presentation and that there are a lot of ways of
9 presenting function analysis tasks and analytic data.

10 If you are really interested in engineering
11 the function itself, operational sequence diagrams are
12 the way to go. If you are talking about engineering
13 roles, various kinds of matrices are important where you
14 can put in cells the number of times a certain kind of
15 thing is done, and maybe maximize the time a certain
16 individual does it and that kind of thing. So this part
17 of the Task III is going to be very important.

18 Then a briefing to the NRC, the technical
19 report, and, of course, taking care of the data
20 management tasks. Now, that wraps up the first year of
21 this project.

22 (Slide.)

23 The second year involves the role analysis,
24 and again we have to bring the group together to make
25 some decisions about which roles do we want to do our

1 detailed analysis from the individual or group
2 pererspective. And, of course, this will be followed by
3 data collection and data management, data analysis, and
4 again the presentation of the data and the data base
5 management.

6 (Slide.)

7 Finally, in Task V, we come to the role, the
8 function enhancement for modeling. And again, we are
9 going to have to make some decisions about which roles
10 and functions we may want to model. We still may have
11 such a large group that it is impossible to because of
12 resources to look at everything.

13 The next thing that will be done is to take a
14 look at the data from the function versus the role
15 analysis and then ask the question is the organization
16 and the activities the way it is portrayed to us by
17 management or by the documentation from the
18 organization, how close does that match with what people
19 tell us they actually do?

20 And one of the things that is important for us
21 here, we want to start as a point of departure from that
22 which really happens, and this is something that happens
23 quite frequently. So that is one of the steps.

24 The next thing is the enhancement modeling
25 guidelines: what is it we are trying to do and

1 accomplish in this modeling effort? Are we trying to
2 save time, maximize safety, maximize efficiency?

3 What is it we are trying to gain? Cut down
4 the number of people that have to be in a plant? Maybe
5 there are too many people. One of the reasons things
6 are unsafe is we have got too many cooks, too many
7 people flipping knobs and turning valves and things like
8 that. So what is it that we are really trying to
9 achieve here?

10 The next thing gets us into media selection.
11 This gets back to what Jim Jenkins was getting into with
12 cognitive modeling, what kind of modeling are we doing?
13 Are we talking descriptive models, very quantitative
14 mathematically oriented models? Are we going to try to
15 deal with some of the cognitive aspects of behavior?
16 What are the kinds of media?

17 We get all the information we have that might
18 be open to us to support our modeling effort.
19 Preliminary function and role structure, and this has to
20 do with what our limitations are. There may be some
21 limitations that say, hey, you cannot redesign the whole
22 industry, that might be a nice thing to do, but there
23 might be some parameters within which we have to work.

24 And that is the intent here. So basically,
25 when that task is finished, we hope to have the basic

1 requirements that it will have to be implemented in the
2 following year to start doing the modeling process.

3 Finally, project outcomes, what do we have
4 when we get finished with this project.

5 (Slide.)

6 Well, we have data, methodologies to support
7 plant and public safety through improved organization
8 and management, and the ability to start dealing with
9 some of these reallocating functions, roles. We are
10 talking about prerogatives and responsibilities,
11 policies and procedures, communications networks. Also,
12 we get into things like management qualifications,
13 career progression, getting back to this
14 academic-versus-experiential type background and certain
15 types of systems interactions.

16 So very quickly here, to wrap this up, going
17 back to our original frame --

18 (Slide.)

19 -- basically, the project I just told you
20 about is this one right here, developing the technical
21 data base, establishing the modeling requirement, and
22 going on into fiscal year 1985 we are going to,
23 hopefully, begin the actual modeling process which will
24 result in the performance enhancement guidelines.

25 MR. WARD: That was a very impressive

1 program. Let us see, I never once heard you say the
2 words "management attitude."

3 MR. RYAN: Well, I guess I was alluding to
4 that a little bit when I talked about management styles,
5 the Jimmy Carter versus Ronald Reagan type of thing.
6 And certainly, that has to do with a manager's attitude
7 toward the way that the organization should work, the
8 number of roles that he assumes, things like that.

9 We would very much like to get into some of
10 these things like job satisfaction and attitudes and
11 morale. I think if you noticed up there, one of the
12 little bullets under the performance criteria had to do
13 with morale. And to what extent we can get into some of
14 that, I really do not know now.

15 A lot of the material that I have had to
16 present since we have just gotten started is kind of
17 illustrative. I would hope that we would get into some
18 of those kinds of things.

19 MR. WARD: One other point I still did not
20 quite get. It was really the point that Ivan Catton
21 made earlier. And you know, at least one task that the
22 Staff and the Commission has to do is at the time of the
23 operating license review is make some judgment about
24 whether the organization is ready to operate a power
25 plant. And from this study, some of these

1 characteristics that are desirable or shown to be
2 successful in operating other plants, you would be able
3 to measure, observe, or whatever.

4 MR. RYAN: I think we would be able to
5 accommodate some of that with the work that we do here.
6 But although we are taking a look at operating plants
7 that are in those kinds of factors that have resulted in
8 safe or unsafe operations.

9 MR. WARD: Yes. I mean there are some
10 characteristics of operating plants, but among the
11 characteristics might be their performance during the
12 construction phase. Does that get in here somehow?

13 MR. RYAN: The first time around, the best we
14 are going to be able to do is to take the operating
15 plants and maybe near-operating plants. When you start
16 talking about getting back into the construction phase,
17 that is certainly what we are going to be addressing
18 ourselves to in fiscal year 1985.

19 MR. CATTON: I think what I was referring to
20 is when you are at the OL stage and you have to make the
21 decision, are there any things you should look for in
22 that particular group's performance during construction
23 that would help you to come to a conclusion; and what
24 are they? There is a 10-year history there.

25 MR. RYAN: Again, this program has been laid

1 out to be as responsive as quickly as possible to lead t
2 some immediate needs.

3 MR. CATTON: Well, I think that is an
4 immediate need first off.

5 MR. WARD: It just seems like those are some
6 available pertinent data which somehow could be part of
7 this.

8 MR. RYAN: Well, let me take you to the point
9 in time when we start talking about which assessment
10 approaches we are going to develop. We have a lot of
11 information on a lot of things at this stage of the
12 game. It may be decided by the review group that, hey,
13 instead of taking five of these approaches that would
14 apply just to the operational phase, let us take five,
15 two of which could also be applied to construction-type
16 considerations.

17 MR. CATTON: As a matter of fact, a lot of the
18 plants that are around now probably spend more time in
19 construction than in operation.

20 MR. GAWLER: I would like to add an important
21 postscript to this. This is our plan. As I am sure you
22 detected, it is totally dependent upon getting
23 information from licensees. The plan is to get this on
24 a voluntary cooperative basis. We have had some
25 experience in this area in the past. This is a very

1 sensitive area where people make the decisions as to
2 whether they are going to cooperate and participate in
3 these kinds of plans.

4 The past experience is that they are not
5 interested. We are optimistic. We are going to
6 approach them. We are going to try to point out the
7 advantages to them. But there is a big question mark in
8 my mind whether we are going to be successful,
9 particularly as we are having more and more problems in
10 this regard on other research programs that we have
11 under way or planned to require licensee cooperation and
12 participation.

13 In this regard, if the ACRS can assist us in
14 any way, it would be welcomed help.

15 MR. WARD: What do you have in mind?

16 MR. GAWLER: An indication of the value and
17 importance of this program and of the necessity of
18 licensing participation. As I said, the initial effort
19 is going to be to try to get this on a voluntary
20 cooperative basis. But there are other ways.

21 MR. CATTON: It is probably never going to
22 happen on a voluntary basis.

23 MR. GAWLER: That is probably right. To do it
24 any other way would probably require Commissioners
25 action. Again, indications in the recent past are that

1 they are somewhat reluctant to require this kind of
2 participation.

3 MR. CATTON: Does EPRI have any similar
4 studies under way? They usually get quit a bit of
5 cooperation from the utilities.

6 MR. RYAN: There really is neither INPO
7 effort. INPO nor EPRI are looking at this problem. I
8 have been talking to TVA, and they have a limited task
9 analysis or task analysis they are doing with managers
10 within TVA. As a matter of fact, one of the people we
11 would like to have on the review is from TVA.

12 MR. GAWLER: That is one of the ways that we
13 are going to try to get participation is through these
14 grups. But after all, those are representatives of the
15 licensees of the utilities. By working through them,
16 perhaps we can get them to see the bigger picture to
17 work out some kind of program whereby we can get that
18 kind of cooperation.

19 It would also help to perhaps surmount another
20 problem that is inherent in this kind of thing: the
21 "why me" attitude approach. Particularly, if you
22 approach a particular utility, you might think it is a
23 good idea, but, "Why me? Why do you not go next door?"

24 MR. CATTON: You are picking him because he is
25 either very bad or very good.

1 MR. GAWLER: I want to emphasize that in this
2 program you are talking about reviewing and possibly
3 coming out with derogatory conclusions about the very
4 people, the individuals that are going to decide whether
5 they are going to cooperate.

6 MR. CATTON: In the study, one of the things
7 that I have always wondered about is, for example, if
8 you have a training organization and it is at the plant
9 and it reports to the plant superintendent, is that
10 better or worse than having a training organization that
11 is separate and reporting to somebody at the corporate
12 level?

13 MR. RYAN: I do not know how to respond to
14 this.

15 MR. CATTON: Will that come out of this, other
16 things like review groups? Plants have all kinds of
17 review groups they report to, all kinds of people and of
18 all of kinds of different makeup.

19 MR. RYAN: That might be an organizational
20 practice. We have a review group. Do we score higher
21 or better than another plant?

22 MR. CATTON: Will judgment with respect to the
23 different way of organizing come out of your study?

24 MR. RYAN: Yes. Well, you take a data base of
25 information and a status quo, and I can play with it in

1 a lot of ways, especially if I have a computer and I
2 have some modeling tools that I can use and I can play
3 all kinds of "what if" games. And certainly, when I was
4 with the military, we did this all the time to develop
5 both management -- well, command and troop complements
6 and things like that and control centers and things like
7 that.

8 Starting with, in this case, the function
9 analysis and using that as input to different kinds of
10 modeling, that is one of the reasons why the Task V is a
11 rather extensive one, establishing some of the
12 requirements. We will be trying to look at what are the
13 limitations, what are the media that we can use, what
14 are the guidelines, what is it we are trying to
15 accomplish?

16 MR. WARD: Okay. Thank you very much.

17 Let us see, there are two things we have left
18 to do. One, I would like to get comments, summary
19 comments, from each of the consultants. And second, I
20 would like to talk with Hugh about the presentation on
21 Friday morning.

22 Now, can you wait? I would rather do that
23 after this. But can you wait?

24 MR. THOMPSON: Sure.

25 MR. WARD: Do you want to start off, Ivan?

1 MR. CATTON: In many respects, I think what
2 they are trying to do is a tough order of business. And
3 it sort of reminds me of a study that was done by the
4 Los Angeles Police Department. They were interested in
5 knowing the relationship between response time and
6 convictions. All they found out was that quicker is
7 better. Then the Rand Corporation redid the study and
8 they confirmed it, that quicker is better.

9 I will make some comments with respect to each
10 one of the areas. Under the staffing and qualifications
11 research, I think a part of that ought to be a study to
12 see what kind of numbers of personnel are going to be
13 available, because there is not going to be enough. And
14 I think the result is that quality is going to have to
15 reduce if all of the plants are going to be staffed in
16 the future. And what does this mean? What do you have
17 to do to your training programs to make up for that?

18 Under training research --

19 MR. WARD: Should that come out about the
20 colleges and the Navy?

21 MR. CATTON: I think the whole business. And
22 there are certain things that if you know it is going to
23 be bad, that there are a lot of schools around now that
24 are decommissioning the research reactors -- myself
25 being one of them. If there was interest by utilities,

1 you would just fire the thing up and it could run itself
2 as a teaching tool, as a research tool. They are
3 finished and they are all over the coutry.

4 Under training research, I think training
5 research should focus, in part, at least, on what the
6 training should be. I saw none of that in the things
7 that were discussed. More work of the type conducted by
8 EPRI, I think, should be carried out where you could
9 give an operator various kinds of specialized training
10 and then test how well he performs. A simulator is a
11 good tool for this.

12 If you do not do that, I think all you are
13 doing is just auditing the training harder and harder,
14 and you are really not changing it. And more and better
15 audits I do not believe are necessarily helpful.

16 The third one they talked about is examination
17 research. Exams are a tremendous incentive for learning
18 when the rewards are high. I think anybody who teaches
19 knows that. The way they are going after the topic kind
20 of bothers me. I think the educational community has
21 been interested in it for years, and there have been
22 studies galore, and none of them have really done very
23 much.

24 The bottom line is one just has to take the
25 exam writing seriously and spend the time to do it

1 right. And this leads to requirements for an examiner.
2 I think a set of requirements for the examiner position
3 are needed. He will be the key in much that they want
4 to do. If it is not done right at this point, it is
5 just not going to be done.

6 I had a long talk with one of the training
7 people at one of the reactors that I visited. And what
8 he made was a plea for this. They were having a lot of
9 trouble in convincing their operators that they needed
10 to know more about thermohydraulics. He said, if they
11 had asked these questions on the exam, they would; as
12 long as they do not ask it, they will not take it
13 seriously even when we tell them they have to.

14 And NRC itself has to make a shift. And again
15 that is why I bring up the point about the examiners. A
16 lot of the examiners are from the old schools, still a
17 little too physics-oriented. There needs to be a shift.

18 Under procedures and testing research, I think
19 this area of research has to be integrated with training
20 and control room factors along with knowledge gained
21 from experimental studies about what signatures are seen
22 for a given transient. And I think you have to do this
23 before you try to figure out how to put it on a
24 simulator.

25 It is probably the most important of the six

1 items because this is what runs your reactors is your
2 procedures. And I think again the EPRI approach using a
3 simulator and teams of real operators is probably the
4 only means that is credible. You surely cannot go
5 through these things on a reactor.

6 Under man-machine interface, some of the items
7 sound rather far-fetched. The automation studies sound
8 like a good area of research. And the studies of human
9 performance using new control room devices will probably
10 be very rewarding.

11 Under management and organization, I think the
12 best approach to determine how well a given management
13 functions is to look carefully at their construction
14 record. And again, by the time they come to OL, they
15 typically have 9 or 10 years under their belt. And if
16 you think about the ones that we have seen come through
17 here, good management seems to have a good construction
18 record.

19 I did not see maintenance culled out anywhere
20 specifically. And then if you recall that a majority of
21 human errors in the maintenance area, I think it should
22 be. And not just it is part of this particular piece of
23 the program.

24 MR. WARD: Thank you.

25 MR. SALVENDY: I would like to share some

1 generalizations. Basically, I am quite impressed with
2 the presentation and the content of the human factors
3 research. But I am skeptical on the potential impact
4 that it will have on the industry. And I want to share
5 with you a number of major concerns.

6 One, although the research basically was very
7 well presented, and I was quite impressed, there are no
8 objective measures to evaluate their effectiveness. So
9 if we come back here and we sit in this room in 3 years'
10 time and we want to see how well those fellows have done
11 in the research what they said they would do, we have no
12 way to tell whether they really have done what they plan
13 to do. I am not sure what they plan to do, because
14 there are no operational measures to assess where they
15 want to be in some quantitative operational way.

16 I realize it is pretty tough, but on the other
17 hand, what they are doing is not basic research,
18 although there is a lot of know-how and we could predict
19 what the impact should be.

20 This leads me to the second concern. If I
21 look on the National Science Foundation, they spend 10
22 percent of their total budget, roughly, on behavioral
23 science. The Nuclear Regulatory Commission spends about
24 5 percent of their budget on human factors
25 behavioral-related. Yet, in the document, it is

1 indicated that one-half of the problems, health and
2 safety problems, associated with nuclear power plant
3 operations are human factors-related.

4 It would seem to me that somebody is doing a
5 very bad marketing. It would seem to me that with the
6 amount of money available, which is a very dismal
7 amount, all the programs that you want to achieve, it is
8 impossible. It is like if I give my wife \$100 and ask
9 her to buy all of the fur coats, jewelry and everything,
10 and then she comes back with a lot of low-quality
11 products. None of them are satisfactory.

12 So I just wonder again whether with the money
13 available you really can do it. From my experience in
14 the university, what research money buys you cannot do
15 all that is planned here. I do not know anybody who can
16 carry out all the programs that you planned here with
17 that very limited amount of budget. I think that is a
18 very serious concern.

19 Another item, although it is not
20 research-related, let me be optimistic for a moment, let
21 me assume that all the research will come out the best
22 possible way. Currently, we have a tremendous acute
23 shortage of human factors personnel. With the research
24 coming up, you must have competent human factors
25 personnel to be able to implement what comes out.

1 You currently do not have what would seem to
2 me a very kind of logical step to take, is to establish
3 a few centers with the relatively nominal budget amount
4 that would train specifically human factors people for
5 the nuclear industry.

6 Otherwise, if you have all of the research
7 coming up, I realize we are discussing today research,
8 but what we really want to see is the impact, and you
9 need to be knowledgable to take research results and
10 implement it in the real-world situation.

11 My last concern is that much of the research,
12 although it is planned maybe 7 or 8 years down the
13 road, seems to me very short-sighted. If we look in
14 terms of the human factors program, the most rewarding
15 area to use is to apply some current knowledge in human
16 factors and apply it to a new area, say, pick up some
17 information we know on color displays from a different
18 environment and apply it.

19 So basically, the transfer of knowledge from
20 one situation to another is the most economical thing to
21 do in research. It leaves us with the position that
22 there is a lot of basic generic problems occurring
23 currently in the nuclear industry, and with the
24 increased acceleration of automation and computer use,
25 there are more and more problems around of human nature

1 to which we currently do not have human factors
2 knowledge. It does not exist anywhere in the literature.

3 I do not see anywhere in the presentation
4 today that there is any indication that we are trying to
5 look in the future and contribute to areas where
6 currently we do not have knowledge. In effect, we seem
7 to be shying away from it. There seems to be the
8 problem, for example, raised with cognitive, the
9 cognitive problems in human-computer interaction,
10 cognitive problems in the work place. Much of the
11 emphasis seems to be the physical one where the current
12 knowledge, for example, is available.

13 Because knowledge is not available, it does
14 not mean that we cannot embark upon some research
15 program in that area.

16 MR. WARD: Could I ask you a follow-up
17 question? The need to establish centers to provide some
18 nourishment. Let me just ask. It looks to me like most
19 of the research that is being placed is at the national
20 laboratories rather than at universities. Is that a
21 problem? I mean, if more of this research were being
22 placed at universities?

23 MR. CATTON: Let me say that we had a
24 committee just on the Three Mile Island and the
25 Engineering Council appointed a committee where each

1 engineering society was represented. In that one I
2 represented industrial engineering.

3 And one of the things that came out from that
4 committee's recommendation -- as a matter of fact, a
5 very short report, although we studied it for 1 year, we
6 came up with a 10-page recommendation -- and one of the
7 main things was that there were huge shortages and that
8 was for two reasons. one, there was a general shortage
9 in human factors; and second, the people in the
10 universities, the majority of them, are not really
11 involved currently so heavily in nuclear
12 regulatory-related research, because the research, to be
13 honest, is too applied.

14 I, for example, have not applied for the
15 research the last 5 or 6 years. I had applied for a
16 generic-type research in 1974. I was turned down. The
17 research that is being issued, it does not excite me. I
18 can get better money to do better research.

19 Also, the universities are extremely good at
20 doing long-term basic research. It is very bad at doing
21 very short-time projects where you have to go out to the
22 industry and collect data. It is not really very well
23 equipped. The little consulting outfits around the
24 highway here are much better equipped to handle that
25 type of activity. At least, Purdue is not equipped, and

1 the universities I am familiar with.

2 And I think if you were going to the more
3 basic research area, I think a lot of universities would
4 jump on it. I am sure now some universities will jump
5 on it. Some people jump on any money, I mean, you know,
6 as long as it is green. But I mean, if you want to be a
7 little selective, you want to pick up the projects that
8 would lead to significant publications in major journals.

9 I am not sure if that is helpful.

10 MR. WARD: That is very good.

11 MR. CATTON: And making engineers attend a few
12 short courses in human factors, I think, would be
13 extremely helpful.

14 MR. SALVENDY: I tried to sell that to
15 Purdue. It was a deviation from the subject. I tried
16 to sell the notion of human factors to the nuclear
17 engineers that they should be acquainted and should at
18 least take an introductory course in our program -- of
19 course, with complete failure.

20 MR. WARD: Thank you.

21 Bob.

22 MR. NERTNEY: Well, I am the new kid on the
23 block, and I am getting acquainted with how things work
24 here. And I had a few observations, mostly basic
25 structural things. I think the program is looking real

1 good. I was a little concerned that it appeared that
2 there might be some trouble if we looked at this as an
3 implementation program with the coordination between the
4 actual doing of regulations and the research that leads
5 to support them.

6 And that brings me to my basic feeling here is
7 that the problem, the real problem, is going to be
8 getting true integration in this effort. The
9 organization does not appear to be structured to provide
10 a clear-cut leadership management role. That point was
11 brought up earlier. And as I see it, most of what we
12 have been talking about here is eventually going to go
13 into regulations of one level or we go to guidelines at
14 another level, and it will go into criterion that the
15 field people will use at still a lower level.

16 And the thing that I missed -- and maybe it
17 exists somewhere, I had to make my own -- and that is
18 the basic model for what are we looking at here? When
19 we look at a guide embedded in an organization, what are
20 the things we look at?

21 And to make just a basic primitive model, and
22 what we need to look at then, we look at providing the
23 adequate manpower pool and the selection criteria, your
24 maintenance criteria, basic training and drill, basic
25 examination, certification. And we have to look at the

1 plant operability which separates out in the man-machine
2 allocations and actual hardware design, which gets clear
3 back into the habitability thing.

4 Then behavioral climate that we sort of tended
5 to kind of hit and run. This thing of morale,
6 motivation, managerial vigor, an example. And then
7 finally, the communications-control thing that was
8 brought up earlier. And I really -- and this gets into
9 task assignment, once we have got the people, we do not
10 have the qualified -- well, we are actually running a
11 crane, that kind of thing.

12 Training and drill, the communication-control
13 inputs and feedbacks from people, procedures. The oral
14 instruction. And finally, the machine inputs and
15 feedback. And I really think we need a model like that
16 to really get everything in place, one of the things we
17 have to do to achieve desired behavior. And once we
18 have the model, I think then we can look and say that,
19 then we can begin to coordinate some of these things
20 because they are all interrelated. If somebody charges
21 ahead making selection criteria for the plant, somebody
22 else comes up with another reg on man-machine or
23 allocations, somebody else comes up with some hardware
24 design criteria, and then somebody else comes up with
25 some training criteria.

1 If those things are not all meshed, we are
2 going to be in big, big trouble if we start writing a
3 lot of regs -- and I am seeing that is where this is
4 going -- before we have really thought about what the
5 whole system looks like.

6 And so I guess my feeling is that there may be
7 a tendency to run ahead with regulations before we have
8 really looked at the whole system and how these things
9 interrelate.

10 And there is going to be a real, real risk, I
11 think, in NRC's structure, the way the Staff is
12 structured, where we have a lot of people and a lot of
13 different jobs and somebody up here has to ask somebody
14 over there what is going on in one of these areas. And
15 that is a dangerous situation to be in.

16 So I guess that is my comments. The work when
17 the thing is done down at the task level, at the project
18 level, I think there is a lot of talent, and it is very
19 well directed. The only thing I am worried about is
20 when we start to pull all of this together, all of the
21 things I have heard today together, that we do not get
22 crossways with each other.

23

24

25

1 MR. WARD: Very good.

2 Jim?

3 MR. BUCK: I have a few comments. First of
4 all, I think I see a lot of progress made over the last
5 couple of years. I can even spell "human factors" right
6 today.

7 There is one concern I have. I keep hearing
8 all of these comments about Halden, INPO and EPRI and
9 all these other organizations, and I know Dr. Moeller
10 was concerned about duplication. I'm a little bit
11 concerned about the other side of the coin: Is
12 everybody going to say, well, we've got all these
13 organizations doing something, therefore somebody must
14 be doing it and I don't have to?

15 I'm a little worried about that. I am
16 concerned about adequate progress in computerized job
17 performance aids. I heard a lot of discourse. I didn't
18 hear any particulars necessarily.

19 I think we need to know how to put this into a
20 large data bank system eventually, so maintenance can
21 help operating personnel and operating personnel can
22 help maintenance. And part of your integration here --
23 and we really need to know better how computers can help
24 in the whole operation, and it seems to me that we've
25 got computers all over industry today doing just that.

1 I don't see where the real problem seems to be in not
2 bringing computers in and bringing them in effectively,
3 even if they are in parallel.

4 I think we have a need for more basic
5 cognitive research, because I think this is at the
6 forefront of everything else we are trying to do here.
7 And I am surprised that we don't see if we can run some
8 parallel basic stuff, or at least basic compared to
9 what. Much of the operations I heard could be started
10 and I think it would fit very nicely in Gabe's idea of
11 some university -- and of course I've got some biases
12 there, so I won't pursue that much further.

13 I am still concerned about the concept of
14 function allocation. In the old days of human factors,
15 it used to mean fixed function allocation, and I think
16 we're seeing all kinds of models today where we are
17 concerned about variable function allocation, in other
18 words, as the operations go on the roles will change,
19 and so one time you might have an operator do it, the
20 other time you might have a computer programmer, hand it
21 off to a computer programmer to do it, as long as the
22 person is somewhat of a control function.

23 So in other words, I don't see any research
24 along those lines to know to what extent we should be
25 doing this and to what extent we should not be doing

1 it. The organizational research looks like it has got a
2 very good start and I think the direction seems to be
3 reasonable. It looks very ambitious. However, I think
4 there may be more dimensions of difference than
5 organizations that could possibly be put under study.
6 And I'm a little bit concerned about a degrees of
7 freedom problem there.

8 I noticed the term in a lot of literature
9 coming out, "finalized," and this must be out of
10 Washington. I'm not sure if it means this work will be
11 done in final form until changed or this work will
12 finally be done.

13 (Laughter.)

14 MR. BUCK: Whichever way, I wish them
15 success.

16 Now, I also have a report here from Dick
17 Pearson that he handed me on his way out, and it is
18 somewhat lengthy. I can either read it or give it to
19 you or I can hand it to somebody else to read, whichever
20 way you want it.

21 MR. WARD: Well, I will just take it, unless
22 you would like to summarize it.

23 MR. BUCK: I think I will just give it to
24 you.

25 MR. WARD: We can incorporate that into the

1 record.

2 Okay, Tony?

3 MR. DeBONS: Well, my colleagues have done a
4 remarkable job, really, of saying everything I wanted to
5 say. I think you've all said it.

6 Maybe what I probably will do is to indicate
7 some of my biases, if I would be allowed to do that.
8 First of all, of course, I agree with my colleagues that
9 that is an impressive program and an ambitious one. But
10 I sense there is a lack of a touch of leadership in it.
11 In other words, when a collective group of people say at
12 the operational situation, hey, these things are darn
13 serious, I think we ought to pay more attention. We
14 will pour more money on these things and make a
15 commitment to that, and I don't sense that there is in
16 that whole area of expression that sense of commitment.

17 I don't want to single out the last program,
18 but of course the last program is always clearly in your
19 mind. And one of the things that I sense, at least
20 probably from my understanding of the literature and in
21 the area of organizational management and also from
22 institutional experience over the last 40 years, that
23 the most catastrophic or the most essential and most
24 important element in organizational management is the
25 communications system to support it and how it breaks

1 under.

2 You look at all of the command and control
3 systems. As a matter of fact, I think military history
4 is probably a great supporter of this set of
5 convictions, that you look at all wars and the wars have
6 all been generated by lack of communication, that the
7 tail doesn't know what the head is doing and the head
8 doesn't know what the tail is doing.

9 And Jim Egan from, I believe, MIT made that
10 statement some time back, and I am a firm believer in
11 what he is saying, is that a lot of these things that
12 occur really are not human factors, but sometimes pure
13 communications.

14 I would like to see the communication aspect a
15 little bit more, perhaps, stressed. So, communications
16 important.

17 Now, on cognitive research -- and of course,
18 that's been my hangup Jim and I and others have been
19 stressing. I would like to somewhat suggest possibly
20 that the avenue of research in this area should not look
21 too much at artificial intelligence. I was very much
22 involved in artificial intelligence in the military for
23 20 years and I don't see very much that has happened in
24 artificial intelligence in the last 10 years; as a
25 matter of fact, a lot of talk. We just had a conference

1 in Pittsburg on that.

2 I think where cognitive research could benefit
3 more is probably a more penetrative look at education,
4 and that is the communicative and the intellectual
5 processes combined. I think that is a little bit more
6 fruitful.

7 But in my view, as much as teaching in a way
8 depends on the ability to actually realize what the
9 cognitive process is and the ability to put media in
10 confrontation with that process -- and that's education
11 -- that is not artificial intelligence.

12 So that for the people who are interested in
13 cognitive research, I would like to see them expand
14 their view from the AI approach to the more fundamental
15 approaches of education.

16 Let's see. One of the things that I
17 experienced from reading the literature here is that
18 there seems to be someone -- now, I may not be able to
19 defend myself in this position, but there seems to be an
20 isolation of this Committee or the human factors program
21 from the general spectrum of the whole research activity
22 of NRC. In other words, it seems that they are fairly
23 isolated from the metals group or whatever group, the
24 power group and whatever.

25 I mean, is there enough communication among

1 the various committees of NRC to the human factors
2 group? Listening to some of the people speaking today,
3 I sensed that there was that kind of relationship, but I
4 don't feel totally confident that there is a good
5 intelligence system among this group here to be able to
6 know what these other people are doing, what they are
7 thinking, and so forth and so on.

8 MR. CATTON: Are you referring to us?

9 MR. DeBONS: Yes. The human factors people in
10 NRC, are they being fed information from other groups?
11 Now, there are other groups in Research, are there not,
12 various other -- there are about 14 or 15 other
13 different subcommittees.

14 MR. WARD: Yes, there is the other 95
15 percent.

16 MR. DeBONS: And I imagine that's a terribly
17 difficult thing to achieve, but I sense that it would be
18 good to get an understanding of what the other
19 committees are doing and what their particular concerns
20 are in various areas. That is just a general idea,
21 though.

22 There is an emphasis on reporting, but not
23 sufficient attention to the definition of the problems
24 and their resolution. In other words, there's a report
25 here and there's a report here and a report here, but

1 what are the crucial problems and the definition of the
2 problems and what is the essential resolution of them,
3 or at least what is the hypothetical resolution of the
4 problems?

5 That's about it. I think the other things I
6 might mention have been said.

7 MR. WARD: Thanks, Tony.

8 Dade and Jerry, I guess I would like in
9 particular to ask you if you have anything you would
10 like to say about what we ought to take to the full
11 Committee and whether we should be writing a report to
12 the Commission on this subject?

13 MR. RAY: My own reaction, with the allocation
14 necessary, I don't see what kind of presentation by the
15 staff would be useful. So at the most it would be to
16 prepare a report and read it to them: That is the
17 Subcommittee's consensus, and that's it.

18 MR. WARD: We could take more than an hour if
19 we need it.

20 MR. RAY: Absolutely.

21 MR. WARD: No, I mean if you think it would be
22 better to have an hour and a half or two hours or
23 something, we could do that.

24 MR. RAY: Do you mean with the staff
25 participation?

1 MR. WARD: Yes. Do you think that that would
2 be better?

3 MR. RAY: I think you're definitely going to
4 need more than an hour. Now, whether it's two hours or
5 three hours would be questionable. I'm inclined to
6 think myself to give a real understanding, to convey a
7 real understanding of what this program is about -- and
8 it doesn't come through in the report to me, the written
9 document -- it is going to take four hours.

10 I mean, you recognize the questions that are
11 going to come out, Dave. You spent almost six hours
12 today on it.

13 MR. WARD: Of course, you know, the part of
14 the agenda from here on out really wasn't dealing with
15 the plan. I mean, Mr. Ryan's presentation and Jim
16 Norberg's presentation.

17 Well, wait a minute. I mean, the plan covers
18 -- the plan really just covers the three years.

19 MR. THOMPSON: Well, the presentation of the
20 document called the "NRC Integrated Human Factors
21 Program" includes that section, the out years, as well.

22 MR. RAY: So you would run through just items
23 I and II.A through G?

24 MR. WARD: Well, they're saying actually item
25 III also.

1 MR. RAY: You have to have III at least,
2 because that's the implementation.

3 MR. WARD: But Roman IV, we specifically asked
4 for an expanded discussion.

5 MR. RAY: Well, Roman IV seemed to me to be
6 the more -- the best organized part of the effort.

7 MR. WARD: Well, you heard in more detail
8 about the one particular element.

9 MR. RAY: Well, I don't think you need to go
10 into that much detail.

11 MR. WARD: I guess our immediate task is what
12 to report on the human factors program plan. I don't
13 know. Dade, do you have any thoughts?

14 MR. RAY: Well, that would be items I, II and
15 III.

16 MR. WARD: That's right.

17 MR. RAY: I think you would have to have at
18 least two hours.

19 MR. WARD: Dade, what do you think?

20 MR. MOELLER: I think, speaking with the
21 Subcommittee hat on, the primary job of the Committee is
22 to review and comment on the plan, and we could
23 comment. I mean, the consultants have provided us with
24 real good thoughts about details within the plan. But I
25 find that what I would suggest at this moment -- and

1 maybe I will think differently tomorrow -- is that we
2 write a rather short letter and say that the plan, the
3 written plan, needs considerable work.

4 I tried reading it and I came to the third
5 sentence and I got bogged down. It says, "The TMI-2
6 accident emphasized the need for increased consideration
7 of the human in the regulation of nuclear reactors." I
8 don't think that is the point at all. It isn't in the
9 regulation. It is in the safe operation of. And it
10 isn't reactors; it is nuclear power plants.

11 So I couldn't go through the report. The
12 report needs considerable work, and there is no way in
13 my opinion that they can meet any September the 15th
14 deadline. They need to develop a report or a plan that
15 states their objectives very clearly, not in confused
16 form. They need to identify the tasks that need to be
17 completed to attain these objectives, and they need to
18 describe how they're going to go about performing those
19 tasks.

20 And I can't find that in here. So I think the
21 consultants' remarks in terms of, what is it, beneficial
22 criticism -- I forget the words -- constructive
23 criticism; they have offered constructive criticism of
24 individual projects and tasks that have been described
25 to us. And I agree with Dr. Buck, they have come a long

1 way. It is so much better than it was a year or so
2 ago.

3 But they need now, having heard what we've
4 said, to go back and rewrite this whole document, and
5 next month try again. If they could finish it in two or
6 three weeks and get it to us, we could then read it
7 again and come back. But we don't have -- the product
8 that is before us is not ready for critiquing, to be
9 polished. There is nothing here to polish. It needs a
10 total overhaul and come back, and then we will talk
11 about polishing it.

12 So my report would be rather short, just
13 that: that we enjoyed the meeting; these notes we
14 looked at, take them, go back and write a plan based
15 upon hopefully the constructive criticism they've heard
16 here; come back to us with a revised plan that confronts
17 or takes into account an overview of our criticisms; and
18 then we will go on from there.

19 MR. GAWLER: Could I ask a question, where
20 perhaps you collectively could help us? Somehow we
21 finally did miss the boat in presenting this
22 information, because what we presented was an NRC action
23 plan, of which research was a part, but only a part.
24 Yet you referred to some document that you saw last year
25 and that we have come a long way since then.

1 There was no document last year. I don't know
2 what you're talking about.

3 Also, I noticed that the consultants spoke
4 about research, research, research, as we went around
5 the table. Somehow if we didn't -- I guess we didn't
6 present this as clearly as we should have. There's a
7 lot more to this action plan than research.

8 MR. MOELLER: Well, let me respond. I did not
9 mean to imply -- and I was totally in error if I did --
10 that I saw a plan a year ago and this is a better plan,
11 no. I just meant what we heard today in terms of plans
12 for individual research projects was far better than
13 anything I've heard before.

14 We did hear primarily research today. I think
15 that for me the oral presentations were far superior to
16 the written document.

17 MR. THOMPSON: Let me comment, since I have to
18 take some thoroughly strong responsibility for the
19 document. It is one which we had to try to reduce in a
20 number of ways. It has gone from 600 pages. Rather
21 than having a duplication of the human factors program
22 plan, which is three volumes and hundreds of pages, we
23 tried to focus it down sufficiently that one would be
24 able to read it.

25 And I think you are saying we cut too much

1 out, or we didn't structure it right. I guess I would
2 like as detailed comments when we start expanding it
3 back up, because the thing can -- as you heard, we spent
4 one hour on two tasks. These are hundreds of tasks that
5 are involved in here, and that type of presentation
6 clearly brings you to the Human Factors Society level of
7 report.

8 We're clearly trying to strike a balance. I
9 guess from your viewpoint we have missed that balance,
10 and to the extent that what happened was -- well, one of
11 the things that happened, one of the individuals who was
12 trying to break it down became sick and he was
13 unavailable. So someone else stepped in to take his
14 place.

15 If it is an editorial job, that is one thing.
16 If we really need to make some fundamental changes in
17 what we're doing, I think that is another source of
18 information that you could give us. And to say
19 generally, you're kind of heading in the right direction
20 here, but refine here or refine there, or your program's
21 sounds -- we always seem to be able to say our program
22 sounds a lot better than it reads. We're able to
23 discuss it considerably better than we seem to be able
24 to write it down. It has happened on a number of
25 occasions.

1 We had human factors professionals writing in
2 their terminology, where they are communicating with
3 other human factors people, and then you've got
4 engineers reading it who feel that the information level
5 they want is, well, what is the content of the exam and
6 how are you going to give it, rather than having a
7 validated exam with a subject matter content.

8 I mean, it gets to the extent that you can
9 give us, if that is the decision of the Committee, be as
10 specific as you can or give us your detailed comments,
11 and we can certainly take the editorial comments and
12 work wonders with those. That is the one thing we have
13 managed to do, is to turn those things around fairly
14 promptly. But to the extent that you can, I certainly
15 would appreciate that.

16 MR. MOELLER: Well, I don't think it needs to
17 be longer. Certainly, you prejudice a reader, though,
18 immediately by not numbering the pages. So I have
19 trouble even making notes to myself and knowing what I'm
20 referring to. So the first thing I did was to number
21 the pages. That would have helped a lot.

22 I would say mainly -- or that a lot could be
23 done editorially. A good editing would help. You must
24 have told me four times that you were going to later
25 look at the rest of the fuel cycle. In fact, I almost

1 got tired of reading that same paragraph.

2 There could be consolidation. I would not
3 call for, personally, for any expansion. I would call
4 for consolidation, just better organization and better
5 presentation of what you are talking about.

6 MR. RAY: In addition to that consolidation,
7 however, I do think, and the point has been made several
8 times tonight or today, that the structure of your
9 organization to implement this program and control it
10 and administer it is unnoticeable. It isn't there,
11 really.

12 MR. THOMPSON: You mean it's not described
13 there or it doesn't exist?

14 MR. RAY: Well, I think it should be in the
15 program.

16 MR. MOELLER: In the plan.

17 MR. RAY: That's right, it should be part of
18 the plan. Otherwise, one gets the impression that
19 you've got horsemen galloping off in all directions and
20 no one's controlling how the troop of cavalry is going
21 to perform in the conduct of the battle.

22 MR. THOMPSON: We were planning to address
23 that specific area in the Commission paper that
24 transmitted down with other things, such as the budget,
25 how would it fit with our budget constraints. We

1 recognize that that portion of it could clearly be put
2 in the plan itself.

3 MR. RAY: Well, I agree with Dr. Moeller that
4 it should be in the plan. Otherwise, one gets the
5 impression that the plan isn't controlled. It isn't a
6 plan, in other words; it is just a description of what a
7 lot of different elements in your organization are going
8 to do, and the interrelation and correlation and so on
9 is completely omitted.

10 I think I concur with Dade that, as to what
11 you would want to accomplish, I think no presentation by
12 the staff would be better than improvising with a
13 minimum of time and maybe commenting in the form of a
14 brief letter to formalize what has been said here today
15 about the need for reconstruction of the document that
16 the Committee is asked to comment on. I don't think the
17 Committee can comment on that document constructively
18 except as influenced by your report to them.

19 MR. WARD: Well, I don't know. I mean, I
20 think the sort of comment you are suggesting is that the
21 plan needs to be rewritten and it isn't just a matter of
22 technical writing, but some of the features of a good
23 plan aren't in there.

24 I don't know, do you think the Committee is
25 going to want to write a letter without some input? I

1 mean, this group has reached that conclusion, but how is
2 the Committee going to reach that conclusion to write a
3 letter?

4 MR. RAY: Maybe it's because of my background,
5 because I've been absent, but was not the Committee
6 requested formally to comment? And that was in the form
7 of a letter from whom to whom, something to Fraley?

8 MR. WARD: Do you know, Dave?

9 MR. FISCHER: I believe the letter was from
10 Mr. Kramer to myself, suggesting that I forward it to
11 the Committee for their review.

12 MR. THOMPSON: We were trying to keep you
13 currently and fully informed.

14 MR. RAY: So I don't read into this a request
15 for the Committee to comment, if that is the only
16 document that came forward. So therefore there isn't
17 any reason to write a letter at this stage.

18 MR. MOELLER: I would agree now with Jerry
19 that at the full Committee meeting you as Subcommittee
20 Chairman should report and enter into the record the
21 fact that we met here today and that the Subcommittee's
22 conclusion was that the document was not ready to bring
23 to the full Committee, and that we suggested to the
24 staff they go back and do considerable rewrite and come
25 back to us with a revised plan or document.

1 And then it will be in the minutes, and when
2 we transmit to Chairman Palladino the highlights and the
3 action items from the meeting that will be in there,
4 that the Subcommittee reported on this and made the
5 following recommendation. And we can even ask for
6 Committee concurrence, just as a part of our meeting.

7 MR. WARD: Does that seem a reasonable
8 approach to you, Jerry?

9 MR. RAY: Sure, it's fine. But I do think,
10 however, that at some point -- well, let me put it this
11 way. How can -- or is there a need for a formalization
12 of the collection of comments that were made by the
13 consultants here today? I think they are very, very
14 good.

15 MR. WARD: Well, they are in the record and we
16 will make a summary of them in the report.

17 MR. RAY: So that the staff gets the benefit
18 of those from the record.

19 MR. WARD: Right. And there will be minutes,
20 not just the record but a meeting summary.

21 MR. MOELLER: And you've requested individual
22 written reports from each consultant, so they have a lot
23 of information.

24 MR. BUCK: Have you requested those?

25 (Laughter.)

1 MR. MOELLER: I thought you did. I's sorry.

2 MR. WARD: I haven't yet. I generally do.

3 MR. CATTON: I thought our verbal inputs.

4 MR. SALVENDY: One item just very quickly. I
5 think a very good item was raised by the people here,
6 the human factors group, that really, if we are really
7 to rewrite it, I don't think we have given them
8 sufficient constructive comment. If I would be sitting
9 back there behind you, I really would be at a complete
10 loss to go back tomorrow morning in the office and meet
11 with my staff, and I don't know exactly what I would
12 tell them besides correcting the grammar and correcting
13 the syntax and putting the page numbers on.

14 I just wonder whether maybe a couple of
15 minutes may be useful to give some type of constructive
16 comment. Let me just offer myself, for example. For
17 me, it would be very, very helpful -- first of all, a
18 small thing: How about a list of contents? I don't
19 know where to find what.

20 How about, for example, a chart, a flow chart,
21 that I would see how the various projects that you have
22 during that report interrelate. I don't mind, I can
23 open it. I have a big floor at home, a big table. A
24 big chart where I would see all of the components
25 interrelated. That would be very nice for me. I would

1 be delighted to have it.

2 Now, if I go then to the separate components,
3 I would be quite interested to see the percentage effort
4 in areas that you plan to assign. You see, it is not
5 clear. The budget is really so bad, I hate to press it
6 and I know you cannot control it. You would like more
7 money, too.

8 But it is so small and when you talk about
9 different projects -- you see, my comment didn't address
10 the report I gave out. Similar to you -- I didn't
11 follow you today, but my point was, whatever I read I
12 would have wanted to know. If you don't put dollar
13 amounts, put percentage commitment.

14 Then if I go a step further, I would like to
15 be in a position really on the report that if I meet
16 here in two years time ago and one has to say, well, how
17 did we really meet the objective, we spent so much time
18 on the program? A lot of the projects in research you
19 have are such that one can hypothesize -- speculation we
20 will call it in business; in academia we call it
21 hypothesize -- on the type of results that would be
22 coming out and the significance of them.

23 So if I would be going to the main Commission
24 I wouldn't want to bore them with the details. I would
25 want to know, with all of this research, what is the

1 bottom line; how much can I elevate the safety in power
2 plants; and how this bottom line of the number that
3 comes out, half a percent here, five percent here, ten
4 percent, I can increase -- I know you can't say it
5 exactly. I am in the business, too. But you can say it
6 better than you said: I think it can be, certain
7 potential improvements in the system can be
8 hypothesized.

9 I would argue that if you can't hypothesize an
10 improvement in the system, don't do the work. If you
11 don't have a good rationale to predict what improvement
12 would occur and how much improvement you would get, why
13 do it?

14 And one way to decide on the allocation of
15 funds in this area is the cost-benefit ratio. If I know
16 that I have a project, but I have a potential of
17 increasing the safety or reducing the errors by 50
18 percent, I will put more money there than in another
19 area where I can reduce the total error only by two
20 percent.

21 And you see, you can make projects in areas
22 that indirectly lead to this end result, but you see, I
23 don't see how they fit in. So my point would be, even
24 if you say you have a project that could improve by a
25 certain percentage, that would be nice, but I want to

1 see how the improvement of that system by a certain
2 percentage improves.

3 I, for example, if I would have just these
4 items, plus maybe a little red pencil, I would be
5 delighted from my point of view. I wouldn't want
6 anything else.

7 My comment -- the question that you asked the
8 consultants, I did not think that you wanted us to
9 comment on the report. I thought you wanted us to
10 comment on the program, and my initial comments
11 addressed the program rather than the report.

12 MR. WARD: I think you raise a good point,
13 that we seem to have a problem at least with the report,
14 if not with the program, and with the perhaps controls
15 on the program. I think we owe the staff comments as
16 specific as we can get them. So let me do two things:

17 First, I will ask the consultants to provide
18 Dave Fischer with a written report in addition to the
19 oral one you've given me, and we will pass those on to
20 the staff and they will be food for thought. There will
21 be a meeting summary which will attempt to give you some
22 sort of consensus of the opinion of the Subcommittee.

23 And then if, after the report to the full
24 Committee on Friday, in which we won't ask for a
25 presentation from you, but after the Subcommittee

1 reports if the full Committee in its wisdom has anything
2 further to add to the Subcommittee report, then we will
3 get that to you in one form or another.

4 MR. RAY: Do you think there would be any
5 benefit in having some members of the staff, key men in
6 this effort, there on Friday?

7 MR. WARD: Absolutely.

8 MR. RAY: In order to respond if there are any
9 questions.

10 MR. WARD: I think that would be very
11 desirable.

12 MR. MOELLER: In addition to what Jerry has
13 said about how are you going to implement it, how is it
14 going to be directed, organized administratively and
15 directed, and then Dr. Salvendy's comments which he just
16 made, it seems to me the other one, which I will repeat,
17 of mine, the most important is to give right at the
18 beginning, what are the objectives or the goals of the
19 report. You do have them, but then say -- say it
20 clearly. Don't tell me two pages later what the purpose
21 of the report is and confuse me, because you've told me
22 on the first page what the goals are, and I don't know
23 the difference in goals and purposes.

24 But give me the overall goal and then tell me,
25 we are going to achieve it through carrying out or

1 conducting the following tasks or something, and name
2 your six things or how they are going to fit into
3 achieving that goal and what each one of them
4 contributes. That would help it a lot.

5 The basics are there. It just needs some
6 work.

7 MR. RAY: The program overall seems very
8 comprehensive.

9 MR. BUCK: I hope you don't need those reports
10 until next week.

11 MR. WARD: That would be fine.

12 Okay, the meeting is adjourned.

13 (Whereupon, at 7:50 p.m., the Subcommittee was
14 adjourned.)

15 * * *

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NUCLEAR REGULATORY COMMISSION

This is to certify that the attached proceedings before the

in the matter of: ACRS/Subcommittee on Human Factors

Date of Proceeding: September 7, 1982

Docket Number: _____

Place of Proceeding: Washington, D. C.

were held as herein appears, and that this is the original transcript thereof for the file of the Commission.

Ray Heer

Official Reporter (Typed)

Ray Heer

Official Reporter (Signature)

U. S. NUCLEAR REGULATORY COMMISSION
INTEGRATED HUMAN FACTORS PROGRAM PLAN

FOR

FY 1983 - FY 1985

PRESENTED TO

ACRS SUBCOMMITTEE ON HUMAN FACTORS

BY

STAFF OF THE OFFICE OF NUCLEAR REACTOR REGULATION

SEPTEMBER 7, 1982

HUMAN FACTORS PROGRAM PLAN

OBJECTIVES

- I. ESTABLISH TECHNICAL BASIS
 1. RESOLVE TMI ACTION PLAN ISSUES
 2. RESPOND TO HUMAN FACTORS SOCIETY RECOMMENDATIONS
 3. OTHER HUMAN FACTORS ITEMS
- II. ENSURE INTEGRATED PROGRAM EXISTS

HUMAN FACTORS PROGRAM PLAN ELEMENTS

STAFFING AND QUALIFICATIONS

TRAINING

EXAMINATION

PROCEDURES AND TESTING

MAN-MACHINE INTERFACE

MANAGEMENT AND ORGANIZATION

STAFFING AND QUALIFICATIONS
OBJECTIVES

- ESTABLISH STAFFING MINIMUMS
- UPGRADE TECHNICAL QUALIFICATIONS
- ESTABLISH LIMITS TO CONDITIONS OF SHIFT WORK
- ENSURE PHYSICAL AND PSYCHOLOGICAL FITNESS

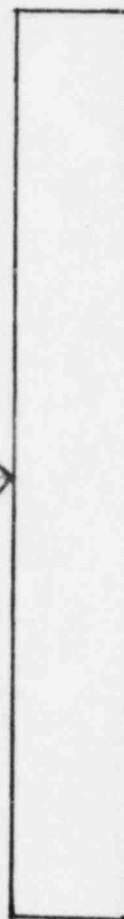
ACTIVITIES

- JOB/TASK ANALYSIS (RES)
- DEVELOP MANPOWER ALLOCATIONS MODELS (NRR/RES)
- SIMULATOR EXPERIMENTS (RES)
- DETERMINE ROLE OF ENGINEERING EXPERTISE ON SHIFT (NRR)
- HUMAN PERFORMANCE AND RELIABILITY RESEARCH (RES)
- FEASIBILITY OF LICENSING OTHERS (NRR)
- ASSESS RELATIONSHIP BETWEEN QUALIFICATIONS AND
JOB PERFORMANCE (RES)
- ESTABLISH BASES FOR FITNESS FOR DUTY REQUIREMENTS (RES)
- EVALUATE CONDITIONS OF SHIFT WORK (NRR/RES)

INPO
JTA
STAFFING SURVEYS

EEI
STAFFING SURVEYS'
SELECTION BATTERY

ANSI/ANS
ANS 3.1



NRR
MANPOWER MODELING
ENGINEERING EXPERTISE
LICENSING OF OTHERS
SHIFT WORK

RES
JTA
SIMULATOR EXPERIMENTS
MANPOWER MODELING
FITNESS FOR DUTY
SHIFT WORK
QUAL. VS PERFORMANCE
PERFORMANCE AND
RELIABILITY

RULES &
GUIDANCE



CURRENT AND NEAR-TERM RESEARCH APPLICABLE TO STAFFING AND QUALIFICATIONS

SHIFT STAFFING REQUIREMENTS

- o IDENTIFY CURRENT PRACTICES AND ASSESS ADEQUACY OF SHIFT STAFFING AND FUNCTIONAL ALLOCATION.
 - o DEVELOP MANPOWER PROJECTION/ALLOCATION MODELS.
 - o REVISE 10 CFR PART 50.54 TO IMPLEMENT THE SHIFT STAFFING RULE (SECY 82-286)
-

MINIMUM QUALIFICATION REQUIREMENTS AND FITNESS FOR DUTY

- o APPLY SIMULATOR EXPERIMENTS AND JOB TASK ANALYSES TO ESTABLISH REVISED MINIMUM QUALIFICATION REQUIREMENTS OR TO CONFIRM CURRENT REGULATIONS.

- o ASSESS RELATIONSHIPS BETWEEN EDUCATION, TRAINING AND EXPERIENCE REQUIREMENTS AND JOB PERFORMANCE.

 - o CONDUCT HUMAN PERFORMANCE AND RELIABILITY STUDIES.

 - o ESTABLISH TECHNICAL BASES FOR FITNESS FOR DUTY REQUIREMENTS.

 - o IMPLEMENT THE INTEGRATED PLAN ON SHIFT CREW QUALIFICATIONS THROUGH REVISIONS TO 10 CFR PART 55 AND REG. GUIDE 1.8.

 - o REVISE 10 CFR PART 50.54 TO INCLUDE FITNESS FOR DUTY AND REVISE 10 CFR PARTS 50 AND 70 WITH RESPECT TO ACCESS AUTHORIZATION, PAT DOWN SEARCH, VITAL AREA DESIGNATION, KEY AND LOCK CONTROL, AND PSYCHOLOGICAL ASSESSMENT ("INSIDER" RULE).
-

LIMITS AND CONDITIONS OF SHIFT WORK

- o EVALUATE THE EFFECTS OF SHIFT DURATION, SHIFT ARRANGEMENTS AND SHIFT ROTATIONS ON OPERATOR PERFORMANCE.

- o REVISE REG. GUIDE 1.33 TO INCORPORATE OVERTIME CRITERIA.

PRODUCTS/IMPLEMENTATION

● RULES

- STAFFING FOR LICENSED OPERATORS
- FITNESS FOR DUTY
- SHIFT CREW QUALIFICATIONS

● POLICY GUIDANCE

- CONDITIONS OF SHIFT WORK

● REGULATORY GUIDE 1.8

● ANSI/ANS 3.1

● TECHNICAL REPORTS

- STAFFING FOR NON-LICENSED PERSONNEL
- LICENSING/CERTIFICATION OF OTHERS
- TECHNIQUES FOR MANPOWER MODELING

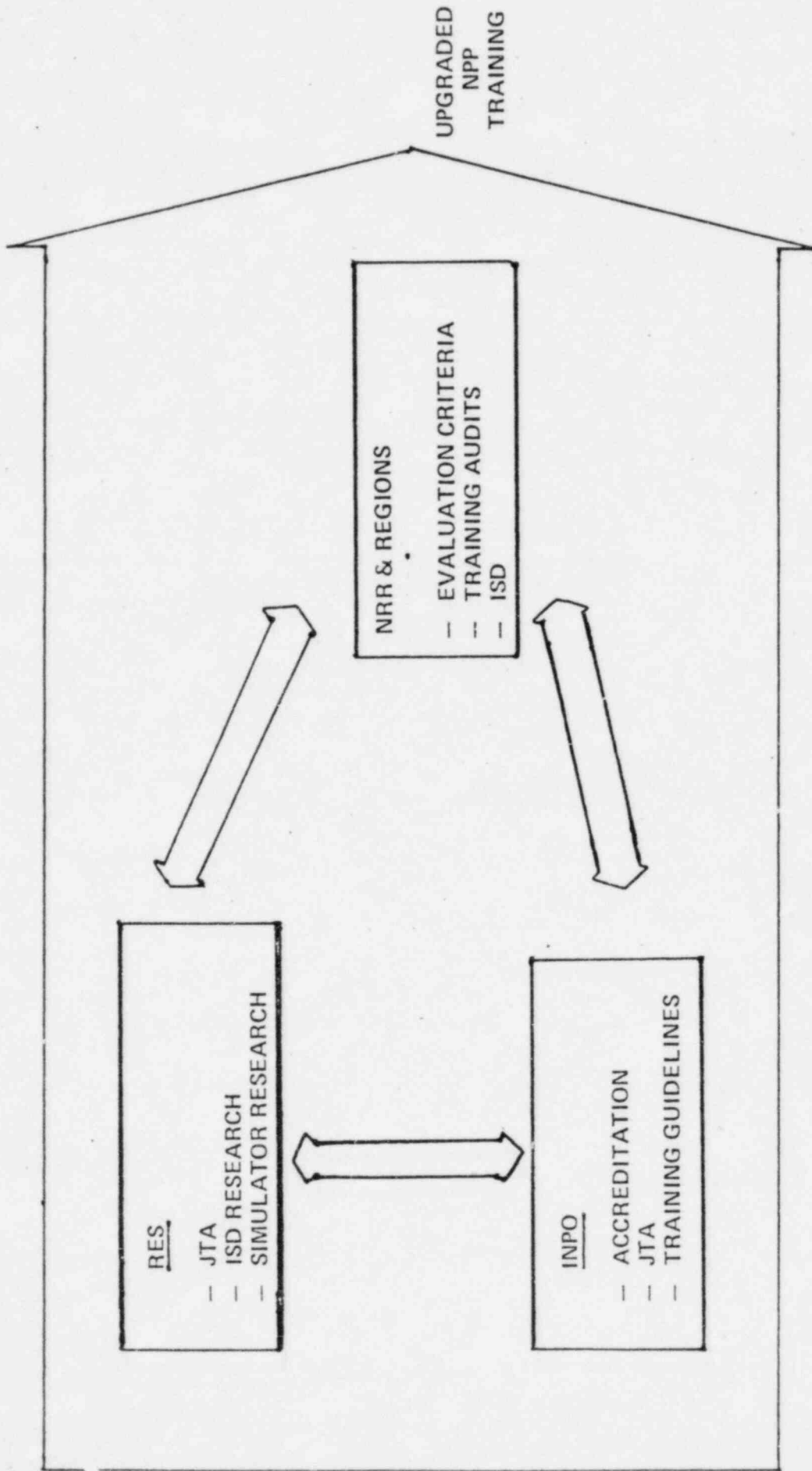
TRAINING ELEMENT
OBJECTIVES

• UPGRADING OF NPP TRAINING

• TECHNICAL BASIS FOR TRAINING EVALUATION

ACTIVITIES

- ACCREDITATION PROCESS
- DEVELOP/TEST TRAINING EVALUATION CRITERIA
- DETERMINE ROLE OF SIMULATORS IN TRAINING
- PROMOTE INSTRUCTIONAL SYSTEM DEVELOPMENT (ISD) PROCESS IN NPP TRAINING



CURRENT AND NEAR - TERM RESEARCH APPLICABLE TO
TRAINING

DEVELOPMENT OF TRAINING GUIDANCE AND CRITERIA

- o DEVELOP A SYSTEMATIC APPROACH FOR NRC ASSESSMENT OF UTILITY PERSONNEL SELECTION PROCEDURES AND TRAINING EFFECTIVENESS.
- o REVISE 10 CFR PART 55 TO IMPLEMENT MINIMUM TRAINING REQUIREMENTS FOR NPP OPERATORS
- o REVISE REG. GUIDE 1.8 TO INCORPORATE REVISED MINIMUM TRAINING REQUIREMENTS
- o CONDUCT TRAINING AND JOB SKILLS RESEARCH FOR NON-OPERATING PERSONNEL
- o CONDUCT SIMULATOR EXPERIMENTS TO SUPPORT A REGULATORY POSITION WITH RESPECT TO THE USE OF SIMULATORS IN TRAINING, AND EVALUATE THE OPTIMUM USES OF SIMULATORS IN NPP OPERATOR TRAINING

PRODUCTS/IMPLEMENTATION

- REVISED:

- REG GUIDE 1.8
- REG GUIDE 1.149
- ANS/ANSI 3.1
- ANS/ANSI 3.5
- SRP 13.2.1
- SRP 13.2.2
- IE INSPECTION MODULES

- FINALIZED TRAINING EVALUATION CRITERIA

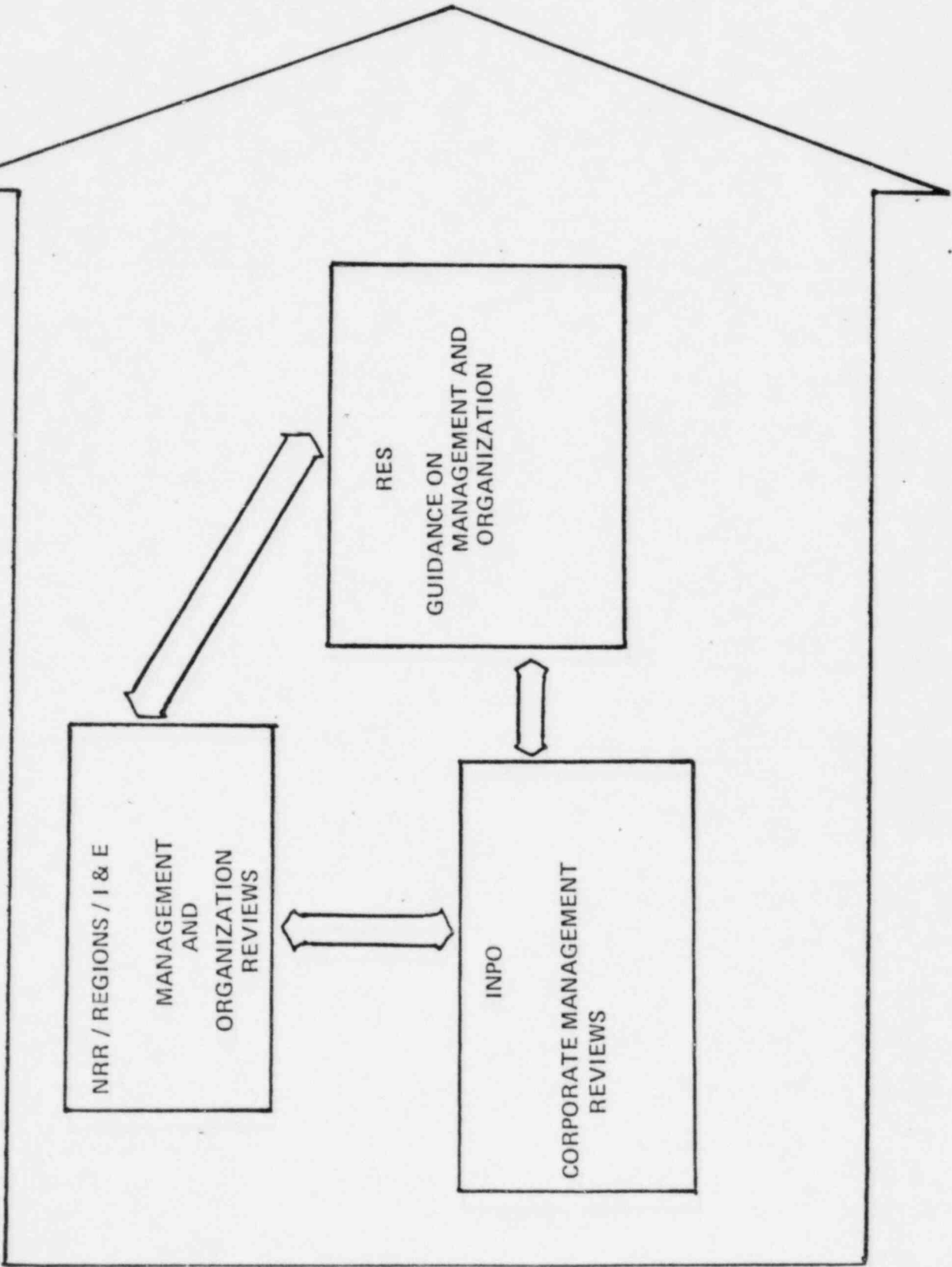
MANAGEMENT AND ORGANIZATION
OBJECTIVES

- ENSURE ADEQUACY OF UTILITY MANAGEMENT AND ORGANIZATION
- DEVELOP GUIDELINES FOR MANAGEMENT AND ORGANIZATIONAL PRACTICES
- DEVELOP AND IMPLEMENT RELIABLE AND CONSISTENT NRC ASSESSMENT PROCEDURES

ACTIVITIES

- PREPARE AND PILOT TEST M & O GUIDELINES
- INDUSTRY REVIEW OF GUIDELINES
- DEVELOP NRC ASSESSMENT PROCEDURES
- REVISE SRP
- INVESTIGATE RELATIONSHIP OF M & O ELEMENTS AND SAFETY-RELATED PERFORMANCE OUTCOMES
- IDENTIFY ALTERNATIVE M & O STRUCTURES

INTERACTIONS



UPGRADED
UTILITY
MANAGEMENT
AND
ORGANIZATION

NRR / REGIONS / I & E
MANAGEMENT
AND
ORGANIZATION
REVIEWS

RES
GUIDANCE ON
MANAGEMENT AND
ORGANIZATION

INPO
CORPORATE MANAGEMENT
REVIEWS

CURRENT AND NEAR - TERM RESEARCH APPLICABLE TO
MANAGEMENT AND ORGANIZATION

DEVELOPMENT OF MANAGEMENT AND ORGANIZATION GUIDELINES

- o INVESTIGATE ORGANIZATIONAL AND MANAGEMENT ELEMENTS AND OVERALL CORPORATE STRUCTURE WITH DIRECT OR INDIRECT RELATIONSHIPS TO PLANT SAFETY.
- o INVESTIGATE RELATIONSHIPS BETWEEN ORGANIZATIONAL AND MANAGEMENT ELEMENTS AND SAFETY-RELATED PERFORMANCE OUTCOMES.
- o IDENTIFY INNOVATIVE WAYS IN WHICH NPP ORGANIZATION AND MANAGEMENT CAN BE STRUCTURED TO ENSURE SAFE PLANT OPERATION.

PRODUCTS

- MANAGEMENT AND ORGANIZATION GUIDELINES
- REVISE SRP CHAPTER 13
- ASSESSMENT PROCEDURES FOR NRC REVIEWERS

IMPLEMENTATION

• M & O REVIEWS — OLs

• PAT — ORs

• SALP — ORs

• INCIDENT REVIEWS — OLs AND ORs

RO AND SRO LICENSING EXAMINATION DEVELOPMENT AND VALIDATION

OVERALL OBJECTIVES:

- 1) DEVELOPMENT OF VALID AND RELIABLE RO AND SRO EXAMINATIONS TO ENSURE THE ADEQUACY OF TRAINING AND THE CAPABILITY OF CANDIDATES TO SAFELY OPERATE MPP'S;

- 2) DEVELOPMENT AND IMPLEMENTATION OF A STANDARDIZED EXAMINING PROCESS THAT WILL ENSURE CONSISTENCY, RELIABILITY AND EFFICIENCY ACROSS EXAMINERS, REGIONS, AND FACILITIES.

CURRENT ACTIVITIES

- 1) IDENTIFICATION OF PROPER EXAMINATION CONTENT USING JOB/TASK ANALYSIS PRODUCTS. . .
- 2) DEVELOPMENT OF MODIFICATIONS TO EXISTING EXAMINATION AND EXAMINATION PROCESS, STAYING WITHIN BOUNDS OF CURRENT EXAMINATION SYSTEM.
- 3) EVALUATION/VALIDATION OF MODIFIED EXAMINATION PROCESS USING AVAILABLE ON-THE-JOB PERFORMANCE MEASURES, AS APPROPRIATE.

FUTURE ACTIVITIES

- 1) IDENTIFICATION OF STATE-OF-THE-ART ADVANCES IN TESTING AND MEASUREMENT, LICENSING, AND VALIDATION APPLICABLE TO NPP OPERATOR EXAMINATIONS.
- 2) DEVELOPMENT OF NEW STRATEGIES OF LICENSING RO'S AND SRO'S.
- 3) VALIDATION OF THE NEW EXAMINATION PROGRAM.

MAN/MACHINE INTERFACE (MMI)

OBJECTIVES

- DEVELOP TECHNICAL BASIS FOR ASSESSING MAN/MACHINE INTERFACES
- DEVELOP REGULATORY POSITIONS, E.G., NEW REQUIREMENTS OR NEW GUIDANCE TO IMPLEMENT EXISTING REQUIREMENTS, WHERE NEEDED
 - NEW DESIGNS
 - MODIFICATIONS TO EXISTING PLANTS
 - ASSESSMENT OF OPERATING EXPERIENCE AND INCIDENTS

ACTIVITIES

- MAINTENANCE (NRR & RES)
- LOCAL CONTROL STATION INTERFACES (NRR, RES, INPO, EPRI)
- EMERGENCY RESPONSE FACILITIES AND PREPAREDNESS (I&E & NRR)
- ANNUNCIATORS (NRR & RES)
- COMPUTERS (NRR, RES, EPRI, HALDEN)
- ADVANCED CONTROLS AND DISPLAYS (RES, HALDEN)
- FUNCTION ALLOCATION (RES)
- SAFETY SYSTEM STATUS INDICATION (NRR)

INTERACTIONS

MAINTENANCE

NRR
RES
INPO
EPRI

COMPUTERS
RES
NRR
EPRI
HALDEN

ADVANCED CONTROLS
AND DISPLAYS
RES
HALDEN

FUNCTION ALLOCATION
RES

MMI

LOCAL CONTROL STATION
RES
NRR

ERFs AND PREPAREDNESS
OIE
NRR
RES

ANNUNCIATORS
RES
NRR
EPRI
HALDEN
SEABROOK
SAVANNAH RIVER

SAFETY SYSTEM
STATUS INDICATION
NRR
RES

PRODUCTS

1. REPORT ON DESIGN-FOR-MAINTAINABILITY (FY 1984)
2. REPORT ON GENERAL MAINTENANCE (FY 1985)
3. REPORT ON LOCAL CONTROL STATIONS AND AUXILIARY OPERATOR INTERFACES (FY 1984)
4. EMERGENCY RESPONSE FACILITIES (ERF) REVIEW PROCEDURES (FY 1983) AND ERF REVIEW REPORTS (THROUGH FY 1985)
5. ANNUNCIATOR GUIDELINES FOR NEAR-TERM IMPROVEMENTS (FY 1983) AND LONG-TERM IMPROVEMENTS (FY 1984)
6. REPORT ON CONTROL ROOM INFORMATION MANAGEMENT DURING SEVERE TRANSIENTS AND ACCIDENTS (FY 1984)
7. A REPORT ON THE USE OF COMPUTERS FOR DATA AND INFORMATION MANAGEMENT IN CONTROL ROOMS (FY 1984)
8. A REGULATORY GUIDE ON INFORMATION MANAGEMENT METHODS (FY 1984)
9. IMPLEMENTATION OF A PROGRAM PLAN FOR INVESTIGATION FUNCTION ALLOCATION (FY 1983 - 1984)

IMPLEMENTATION

- REGULATORY POSITIONS
 - MAINTENANCE 1984
 - LOCAL CONTROL STATIONS 1984
 - COMPUTERS 1984

- CONSIDER BACKFIT
 - ANNUNCIATOR UPGRADES 1983
 - SAFETY SYSTEM STATUS INDICATION 1985

- IMPROVED GUIDANCE
 - ADVANCED CONTROLS AND DISPLAYS 1984
 - FUNCTION ALLOCATION
 - SAFETY SYSTEM STATUS INDICATION 1984
 - EMERGENCY RESPONSE FACILITIES 1983
 - ANNUNCIATORS 1984

PROCEDURES AND TESTING

OBJECTIVES

- UPGRADE PLANT PROCEDURES
 - DEVELOP GUIDANCE FOR PREPARING PROCEDURES
- INCREASE UNDERSTANDING OF PLANT BEHAVIOR

MAJOR ACTIVITIES

- DEVELOP EOP GUIDELINES (NRC/INDUSTRY)
 - GENERIC TECHNICAL GUIDELINES (OG/INPO/VENDOR/NRR)
 - NUREG 0899 (NRR)
 - WRITERS GUIDES (INPO/OG)

- IMPLEMENTATION OF EOP GUIDELINES
 - EVALUATE METHODS OF IMPLEMENTING EOPs (NRR)
 - REVIEW PROCEDURES GENERATION PACKAGES (NRR)
 - AUDIT EOPs AT SELECTED ORs (NRR)
 - AUDIT EOPs AT REMAINING ORs (REGIONS)

MAJOR ACTIVITIES (CONTINUED)

- DEVELOP PROGRAM FOR UPGRADING OTHER PROCEDURES
(COOPERATIVE EFFORT)
- DEVELOP GUIDELINES FOR OP-MP (NRC)
 - REVIEW EXISTING DATA BASE
 - DEFINE CURRENT INDUSTRY PROCEDURE, PRACTICES, PROBLEMS
AND INDUSTRY STANDARDS
 - IDENTIFY PROCEDURE PROBLEMS
- IMPLEMENTATION
 - PUBLISH NUREG

SECTION IV

LONG RANGE HUMAN FACTORS RESEARCH

PRESENTED TO

ACRS SUBCOMMITTEE ON HUMAN FACTORS

BY

STAFF OF THE OFFICE OF NUCLEAR REGULATORY RESEARCH

U. S. NUCLEAR REGULATORY COMMISSION

SEPTEMBER 7, 1982

OBJECTIVES OF HUMAN FACTORS RESEARCH BY NRC

- o IMPROVE OUR BASIC UNDERSTANDING OF
 - THE IMPACT HUMANS HAVE ON NUCLEAR SAFETY
 - THE FACTORS AFFECTING HUMAN PERFORMANCE

- o PROVIDE TECHNICAL DATA NECESSARY TO DEVELOP DEFENSIBLE REGULATORY POSITIONS RELATED TO HUMAN FACTORS

- o REDUCE HUMAN CONTRIBUTION TO RISK TO AN ACCEPTABLY LOW LEVEL

WHAT ISSUES ARE WE ADDRESSING

PERSONNEL QUALIFICATIONS (HOW AND WHEN TO UPGRADE)

- 0 INDIVIDUAL ROLE DEFINITION
- 0 EDUCATION AND TRAINING REQUIREMENTS
- 0 SIMULATOR CAPABILITIES AND USE

COMPUTER UTILIZATION (HOW FAR HOW FAST?)

- 0 FUNCTIONAL REQUIREMENTS
- 0 SAFETY CATEGORIZATION
- 0 SOFTWARE AND HARDWARE RELIABILITY
- 0 OPERATOR ACCEPTANCE
- 0 RISK REDUCTION POTENTIAL

PROCEDURES (NATURE AND EXTENT OF REGULATORY REVIEW)

- 0 CRITERIA FOR ACCEPTABILITY
- 0 INFORMATION NEEDS OF OPERATING PERSONNEL
- 0 EVENTS OUTSIDE DESIGN BASIS

DESIGN REQUIREMENTS FOR FUTURE PLANTS (WHAT SHOULD THEY BE?)

- 0 PROCEDURES FOR INTEGRATING HUMAN FACTORS INTO DESIGN
- 0 MAN-MACHINE FUNCTIONAL ALLOCATION
- 0 REDUCING INFORMATION OVERLOAD
- 0 DESIGNING FOR MAINTAINABILITY

ORGANIZATION AND MANAGEMENT (HOW TO EVALUATE THEIR IMPACTS ON SAFETY)

- 0 SAFETY FUNCTION AND ROLES
- 0 ATTITUDES AND PRACTICES
- 0 COMPETENCY FOR SAFE DESIGN, CONSTRUCTION, OPERATION

RES/HUMAN FACTORS BRANCH

ORGANIZATION OF HUMAN FACTORS RESEARCH AREAS

- o HUMAN FACTORS ENGINEERING
 - o TASK ANALYSIS
 - o FUNCTIONAL ALLOCATION
 - o COMPUTERIZED AIDS

- o LICENSEE QUALIFICATIONS
 - o OPERATOR SELECTION & TRAINING
 - o SIMULATORS

- o MANAGEMENT/ORGANIZATION

- o PLANT PROCEDURES

- o HUMAN RELIABILITY

LONG RANGE RESEARCH FOCUS

FY 1986 - 1989

- o APPLICATION OF ALL TASK ANALYTIC DATA GATHERED ON OPERATIONS, MAINTENANCE AND MANAGEMENT FUNCTIONS.
- o VALIDATION OF HUMAN PERFORMANCE MODELS AND CRITERIA/GUIDELINES DEVELOPED THEREFROM
- o DEVELOPMENT OF TECHNICAL BASIS FOR HUMAN FACTORS REGULATORY ACTIONS FOR ADVANCED LWRs.
- o CONDUCTING HUMAN FACTORS RESEARCH ON NON-LWR REACTORS.
- o CONDUCTING HUMAN FACTORS RESEARCH ON FUEL CYCLE FACILITIES INCLUDING FABRICATION, STORAGE, REPROCESSING AND WASTE MANAGEMENT.

STAFFING AND QUALIFICATIONS RESEARCH

DESCRIPTION: INFORMATION, DATA, METHODS AND STANDARDS RELEVANT TO EVALUATING THE QUALIFICATIONS OF PLANT PERSONNEL FOR LWR'S ADVANCED REACTORS AND FUEL CYCLE FACILITIES.

ISSUES

- o CHANGING QUALIFICATIONS REQUIREMENTS
- o FUEL CYCLE AND WASTE MANAGEMENT
- o PERSONNEL QUALIFICATIONS MEASURES
- o CREW PERFORMANCE MEASUREMENT AND ENHANCEMENT

TRAINING RESEARCH

DESCRIPTION: SYSTEMATIC ANALYSIS AND VALIDATION OF GUIDELINES/CRITERIA FOR TRAINING OF PERSONNEL.

ISSUES

- o TRAINING REQUIREMENTS FOR ADVANCED TECHNOLOGY SYSTEMS
- o VALIDATION OF PERFORMANCE MEASURES
- o NEW APPLICATIONS TO FUEL CYCLE, WASTE MANAGEMENT AND ADVANCED REACTORS

LICENSING EXAMINATION RESEARCH

DESCRIPTION:

INFORMATION, DATA, METHODS AND STANDARDS RELEVANT TO LICENSING/
CERTIFICATION OF PERSONNEL

ISSUES

- o EXAMINATION METHODOLOGY AND VALIDATION
- o CHANGING SKILL, KNOWLEDGE, AND ABILITY (SKA'S)
REQUIREMENTS ASSOCIATED WITH ADVANCED REACTORS

PROCEDURES AND TESTING RESEARCH

DESCRIPTION:

RESEARCH AND STANDARDS RELEVANT TO DEVELOPING AND
IMPLEMENTING SOUND PROCEDURE SYSTEMS

ISSUES

- o PROCEDURE ANALYSIS FOR TECHNICAL SUPPORT FUNCTIONS
- o EVALUATION OF NEW METHODS OF DATA/INFORMATION PRESENTATION
- o ADVANCED REACTOR REQUIREMENTS
- o FUEL CYCLE FACILITY REQUIREMENTS

MAN-MACHINE INTERFACE RESEARCH

DESCRIPTION: INFORMATION, DATA, METHODS AND STANDARDS RELEVANT TO EVALUATING
THE DESIGN OF THE MAN-MACHINE INTERFACE

ISSUES

- o MAN-MACHINE INTERFACES FOR NEW TECHNOLOGY APPLICATIONS
- o OPERATOR ROLES IN ADVANCED REACTORS
- o DESIGN CRITERIA AND GUIDELINES FOR MAN-MACHINE INTERFACE
IN FUEL CYCLE AND WASTE MANAGEMENT
- o COGNITIVE MODEL APPLICATIONS AND VALIDATION

MANAGEMENT AND ORGANIZATIONAL RESEARCH

DESCRIPTION: INFORMATION, DATA, ASSESSMENT METHODS AND STANDARDS RELEVANT TO EVALUATION OF ORGANIZATIONAL SAFETY EFFECTIVENESS IN DESIGN, CONSTRUCTION AND OPERATIONS OF NUCLEAR POWER PLANTS AND FUEL CYCLE FACILITIES.

ISSUES

- o MANAGEMENT AND ORGANIZATIONAL REQUIREMENTS FOR FUEL CYCLE FACILITIES AND WASTE MANAGEMENT
- o ADVANCED NON-LWR POWER REACTOR MANAGEMENT AND ORGANIZATIONAL REQUIREMENTS
- o AWAY FROM REACTOR MANAGEMENT AND ORGANIZATIONAL REQUIREMENTS

ORGANIZATION AND MANAGEMENT
RESEARCH PROGRAM PRESENTATION

TO THE

ACRS SUBCOMMITTEE ON HUMAN FACTORS

7 SEPTEMBER 1982

THOMAS G. RYAN, PH.D
HUMAN FACTORS BRANCH
DIVISION OF FACILITY OPERATIONS
OFFICE OF NUCLEAR REGULATORY RESEARCH
US NUCLEAR REGULATORY COMMISSION

ORGANIZATION AND MANAGEMENT RESEARCH PROGRAM

CONDUCT:

ANALYSES AND MODELING OF ORGANIZATION AND MANAGEMENT ELEMENTS INVOLVED IN DESIGN, CONSTRUCTION, START-UP AND OPERATION OF A NUCLEAR FACILITY.

ACHIEVE:

IMPROVED ORGANIZATION AND MANAGEMENT SAFETY ASSESSMENT STANDARDS AND SAFETY ENHANCEMENT GUIDELINES.

SUPPORT:

CURRENT NRC LICENSING, ANALYSIS, INSPECTION AND ENFORCEMENT ACTIVITIES, AND FUTURE ORGANIZATION AND MANAGEMENT RULE MAKING ACTIONS, TO OPTIMIZE PLANT AND PUBLIC SAFETY.

ORGANIZATION AND MANAGEMENT RESEARCH PROGRAM

RESEARCH RESPONDS TO:

- o TMI ACTION PLAN, NUREG-0660, TASK I.B.1.1.,
"ORGANIZATION AND MANAGEMENT LONG TERM IMPROVEMENTS"

- o NRR REQUESTS FOR RESEARCH RR-NRR-81-1 AND 81-5,
ITEM 5., "ORGANIZATION AND MANAGEMENT"

- o NRC LONG RANGE RESEARCH PLAN, NUREG-0740, SECTION 7.,
"ORGANIZATION AND MANAGEMENT"

- o HUMAN FACTORS SOCIETY LONG RANGE PLAN, NUREG/CR-2833,
SECTIONS 4.2 THROUGH 4.6

ORGANIZATION AND MANAGEMENT RESEARCH PROGRAM

RESEARCH BASED ON SUPPOSITIONS THAT:

- O ORGANIZATIONAL PERSPECTIVE REQUIRED TO UNDERSTAND AND INFLUENCE THE STRUCTURE AND OPERATING DYNAMICS OF A NUCLEAR FACILITY.

- O ORGANIZATIONAL EFFECTIVENESS DEPENDS, IN LARGE MEASURE, ON THE ACTIONS AND BEHAVIOR OF MANAGEMENT.

- O MANAGEMENT PROVIDES ORGANIZATIONAL CONTINUITY DURING NUCLEAR FACILITY DESIGN, CONSTRUCTION, START-UP AND OPERATION.

- O "SIGNIFICANT" NUCLEAR ACCIDENTS HAVE INVOLVED ORGANIZATIONAL AS WELL AS INDIVIDUAL PERSONNEL FAILURES.

ORGANIZATION AND MANAGEMENT RESEARCH PROGRAM

RESEARCH DIRECTED AT ACHIEVING:

- o SAFETY ASSESSMENT STANDARDS (CURRENT ORGANIZATION)

DIAGNOSTIC STATEMENTS, EMPIRICALLY DERIVED AND
VALIDATED, DESCRIBING THE RELATIONSHIP(S) BETWEEN
CLUSTER(S) OF MANAGEMENT AND/OR ORGANIZATION
PRACTICES AND CLUSTERS OF SAFETY RELATED INDICATORS

- o SAFETY ENHANCEMENT GUIDELINES (ADVANCED ORGANIZATION)

PRESCRIPTIVE STATEMENTS, EMPIRICALLY DERIVED AND
QUANTITATIVE, DESCRIBING THE POTENTIAL RELATIONSHIP
BETWEEN CLUSTER(S) OF MANAGEMENT AND/OR ORGANIZATION
ALTERNATIVE PRACTICES AND SAFETY RELATED INDICATORS

ORGANIZATION AND MANAGEMENT RESEARCH PROGRAM

SUPPORTS MANAGEMENT AND ORGANIZATION DEVELOPMENT THRU:

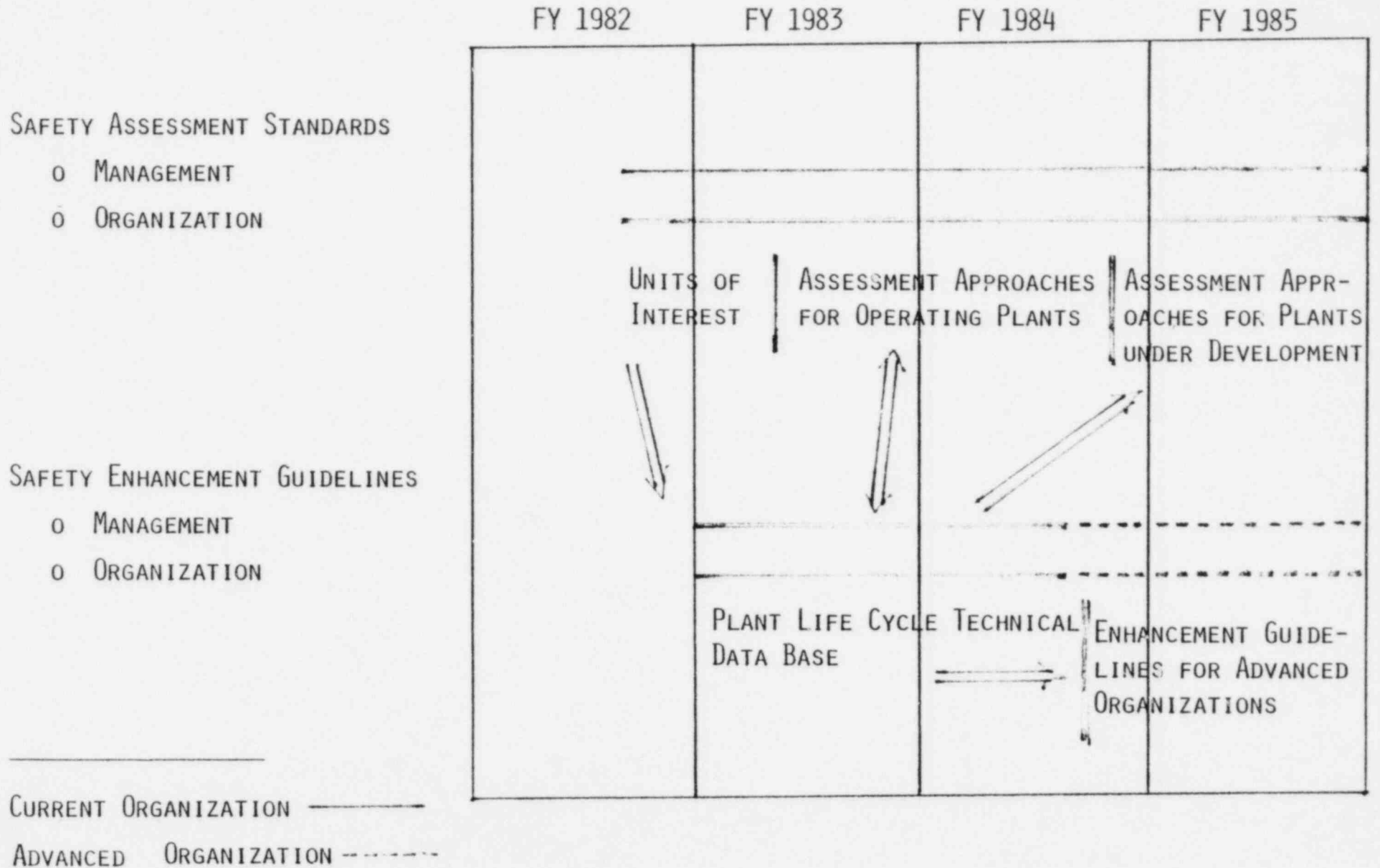
O CONFIRMATORY RESEARCH

- UTILITY GUIDELINES, NUREG-0731, VALIDATION
- INDEPENDENT SAFETY ENGINEERING GROUP CONCEPT REVIEW
- SEE-IN PROGRAM CONCEPT REVIEW

O EXPLORATORY RESEARCH

- ENHANCED EVALUATION TECHNIQUES FOR BOTH PRE-OPERATING AND OPERATING PLANTS
- ENHANCED REVIEW GUIDELINES PER STANDARD REVIEW PLAN, NUREG-0800
- ADVANCED CONCEPTS
 - ROLE ALLOCATION
 - FUNCTION ALLOCATION
 - PREROGATIVE AND RESPONSIBILITIES
 - INTER/INTRA ORGANIZATION COMMUNICATION

ORGANIZATION AND MANAGEMENT RESEARCH PROGRAM



DEVELOPMENT OF MANAGEMENT AND ORGANIZATION
SAFETY ASSESSMENT APPROACHES

(SAFETY ASSESSMENT STANDARDS)

FIN: B-2457

CONTRACTOR: BATTELLE PACIFIC NORTHWEST LABORATORY
(HUMAN AFFAIRS RESEARCH CENTERS)

SITE: RICHLAND AND SEATTLE

STATE: WASHINGTON

DURATION: 24 MONTHS (JUN '82 - MAY '84)

FUNDING: FY 1982 \$212K
FY 1983 \$300K

RELATED NRC RESEARCH: ANALYSIS OF MANAGEMENT AND ORGANIZATION
FUNCTIONS AND ROLES (FIN: A-6319)

RELATED NRR ACTIVITY: UTILITY MANAGEMENT AND ORGANIZATION
GUIDELINES (FIN: B-2360)

DEVELOPMENT OF MANAGEMENT AND ORGANIZATION
SAFETY ASSESSMENT APPROACHES

(SAFETY ASSESSMENT STANDARDS)

OBJECTIVE:

DEVELOP AND FIELD VALIDATE NEW, INNOVATIVE
APPROACHES, TECHNIQUES AND METHODS FOR
ASSESSING NUCLEAR FACILITY MANAGEMENT AND
ORGANIZATIONAL EFFECTIVENESS IN MATTERS
CRUCIAL TO SAFETY DURING POWER PLANT
OPERATIONS.

DEVELOPMENT OF MANAGEMENT AND ORGANIZATION
SAFETY ASSESSMENT APPROACHES

(SAFETY ASSESSMENT STANDARDS)

PRODUCTS:

- 0 SEVERAL MANAGEMENT AND ORGANIZATION SAFETY ASSESSMENT STANDARDS FOR USE BY NRC LICENSING, INSPECTION AND ENFORCEMENT ACTIVITIES, AND THE UTILITIES

- 0 TECHNOLOGY BASE TO SUPPORT IMPROVED NUCLEAR FACILITY MANAGEMENT AND ORGANIZATION

DEVELOPMENT OF MANAGEMENT AND ORGANIZATION
SAFETY ASSESSMENT APPROACHES

(SAFETY ASSESSMENT STANDARDS)

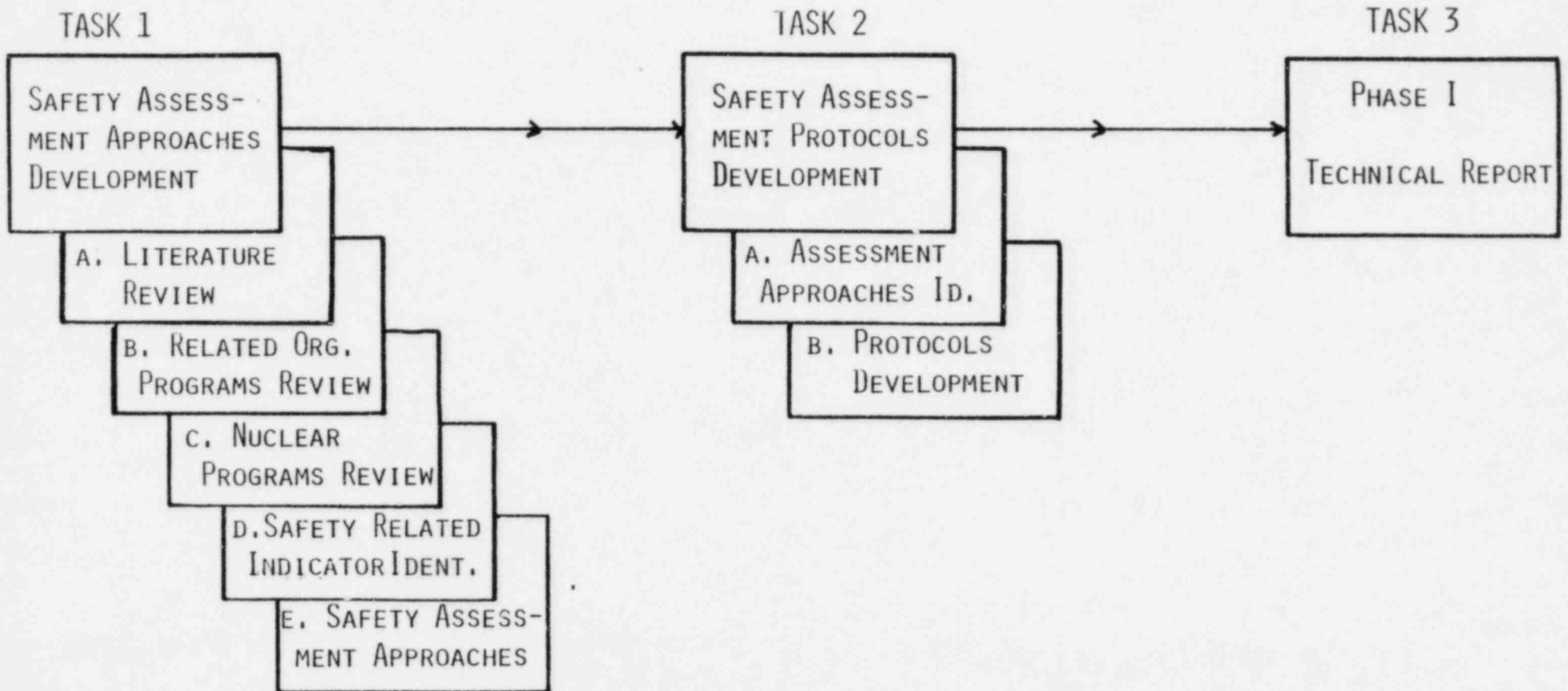
TERMS OF INTEREST:

- o ORGANIZATION (CURRENT)
- o OPERATIONAL FACILITY
- o MANAGEMENT
- o ORGANIZATION PRACTICE
- o SAFETY RELATED INDICATOR
- o SAFETY ASSESSMENT APPROACH
- o SAFETY ASSESSMENT PROTOCOL
- o CONCURRENT FIELD VALIDATION
- o RESEARCH REVIEW GROUP

DEVELOPMENT OF MANAGEMENT AND ORGANIZATION
SAFETY ASSESSMENT APPROACHES

(SAFETY ASSESSMENT STANDARDS)

PHASE I PROJECT FLOW DIAGRAM:



DEVELOPMENT OF MANAGEMENT AND ORGANIZATION
SAFETY ASSESSMENT APPROACHES

(SAFETY ASSESSMENT STANDARDS)

TASK 1.A - ORGANIZATION/MANAGEMENT LITERATURE REVIEW

- o ORGANIZATION TYPOLOGIES

- o MANAGEMENT TYPOLOGIES

- o SAFETY TYPOLOGIES

DEVELOPMENT OF MANAGEMENT AND ORGANIZATION
SAFETY ASSESSMENT APPROACHES

(SAFETY ASSESSMENT STANDARDS)

TASK 1.B - RELATED ORGANIZATION PROGRAMS REVIEW

- o AIR FORCE AIRCRAFT CONTROL & WARNING
- o NAVY ANTISUBMARINE WARFARE
- o FEDERAL AVIATION ADMINISTRATION
AIR TRAFFIC CONTROL
- o NON-NUCLEAR ELECTRICAL UTILITIES
- o OTHER SELECTED SERVICE INDUSTRIES (POLICE,
NON-ELECTRICAL UTILITIES, MEDIA)

DEVELOPMENT OF MANAGEMENT AND ORGANIZATION
SAFETY ASSESSMENT APPROACHES

(SAFETY ASSESSMENT STANDARDS)

TASK 1.c - NUCLEAR UTILITY PROGRAMS REVIEW

- o NRC GUIDELINES (NUREG 0731)
- o UTILITY SAFETY ASSESSMENT PROGRAMS
(NRC, INPO, UTILITIES)
- o TASKS 1.A AND 1.B COMPARATIVE ANALYSIS
- o NUCLEAR FACILITY TYPOLOGY (MANAGEMENT
AND ORGANIZATION)

DEVELOPMENT OF MANAGEMENT AND ORGANIZATION
SAFETY ASSESSMENT APPROACHES

(SAFETY ASSESSMENT STANDARDS)

TASK 1.D - SAFETY RELATED INDICATORS DEVELOPMENT

- o LICENSEE EVENT REPORTS (LERs)
- o PERSONNEL TRAINING/PERFORMANCE
- o PERSONNEL RETENTION
- o MAINTENANCE SCHEDULES
- o OPERATING EFFICIENCY
- o RADIATION INCIDENTS
- o CIVIL ACTIONS
- o MORALE
- o OTHER STUDIES

DEVELOPMENT OF MANAGEMENT AND ORGANIZATION
SAFETY ASSESSMENT APPROACHES

(SAFETY ASSESSMENT STANDARDS)

TASK 1. E - SAFETY ASSESSMENT APPROACHES DEVELOPMENT

- o SAFETY RELATED INDICATORS CLASSIFICATION
- o SAFETY RELATED INDICATORS CLUSTERING
- o FACILITY PRACTICES CLASSIFICATION
- o FACILITY PRACTICES CLUSTERING
- o MANAGEMENT AND ORGANIZATION CLUSTERING
- o SAFETY ASSESSMENT APPROACHES

-
- o FORMAL BRIEFING TO THE NRC

DEVELOPMENT OF MANAGEMENT AND ORGANIZATION
SAFETY ASSESSMENT APPROACHES

(SAFETY ASSESSMENT STANDARDS)

TASK 2. A - SAFETY ASSESSMENT APPROACHES SELECTION FOR
FURTHER DEVELOPMENT

- o PRACTICALITY
- o ACCEPTABILITY
- o POTENTIAL FOR SUCCESS
- o NRC NEEDS
- o FUNDING AVAILABILITY

DEVELOPMENT OF MANAGEMENT AND ORGANIZATION
SAFETY ASSESSMENT APPROACHES

(SAFETY ASSESSMENT STANDARDS)

TASK 2. B - SAFETY ASSESSMENT PROTOCOLS DEVELOPMENT

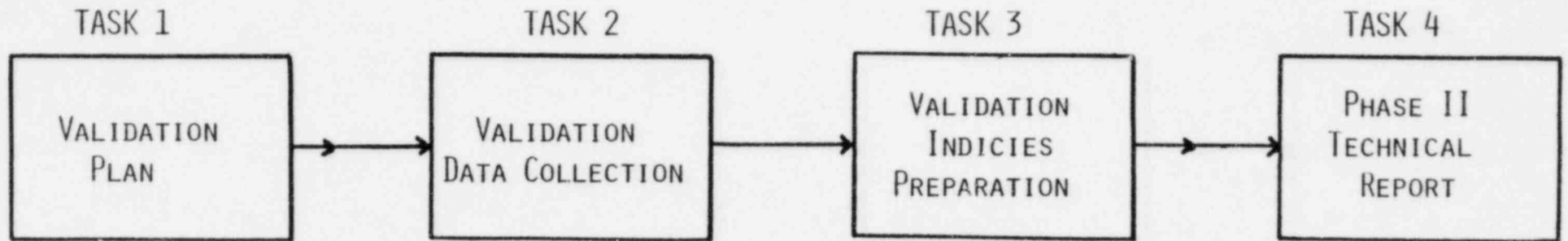
- o SAFETY RELATED INDICATOR MEASURES
- o FACILITY PRACTICE MEASURES
- o INDICATOR/PRACTICE PAIRINGS
- o DATA COLLECTION INSTRUMENTS/PROCEDURES
- o DATA SAMPLING REQUIREMENTS
- o DATA ANALYSIS PROCEDURES
- o VALIDATION INDICIES PRESENTATION

-
- o FORMAL BRIEFING TO THE NRC
 - o TECHNICAL REPORT TO THE NRC

DEVELOPMENT OF MANAGEMENT AND ORGANIZATION
SAFETY ASSESSMENT APPROACHES

(SAFETY ASSESSMENT STANDARDS)

PHASE II PROJECT FLOW DIAGRAM:



DEVELOPMENT OF MANAGEMENT AND ORGANIZATION
SAFETY ASSESSMENT APPROACHES

(SAFETY ASSESSMENT STANDARDS)

TASK 1.A - SAFETY ASSESSMENT PROTOCOLS SELECTION FOR FIELD
VALIDATION

- o PRACTICALITY
- o ACCEPTABILITY
- o POTENTIAL FOR SUCCESS
- o NRC NEEDS
- o FUNDING AVAILABILITY

DEVELOPMENT OF MANAGEMENT AND ORGANIZATION
SAFETY ASSESSMENT APPROACHES

(SAFETY ASSESSMENT STANDARDS)

TASK 1.B - FIELD VALIDATION PLAN PREPARATION

- o PROTOCOL DESCRIPTIONS
- o DATA SAMPLING PLAN
- o SUPPORT REQUIREMENTS
- o SCHEDULE(S)

-
- o FORMAL BRIEFING TO THE NRC
-

TASK 2. - FIELD VALIDATION DATA COLLECTION

DEVELOPMENT OF MANAGEMENT AND ORGANIZATION
SAFETY ASSESSMENT APPROACHES

(SAFETY ASSESSMENT STANDARDS)

TASK 3. - FIELD VALIDATION INDICIES PREPARATION

- o STATISTICAL ANALYSES
- o STATISTICAL REPRESENTATION
- o GENERALIZABILITY
- o PRACTICAL APPLICATION



- o FORMAL BRIEFING TO THE NRC
- o TECHNICAL REPORT TO THE NRC
- o USER MATERIALS

DEVELOPMENT OF MANAGEMENT AND ORGANIZATION
SAFETY ASSESSMENT APPROACHES

(SAFETY ASSESSMENT STANDARDS)

PROJECT OUTCOMES:

- o DIAGNOSTIC INFORMATION ON;
 - NUCLEAR FACILITY ORGANIZATIONAL DYNAMICS
 - NUCLEAR FACILITY MANAGEMENT DYNAMICS
 - SAFETY RELATED PRACTICES
 - SAFETY RELATED INDICATORS
 - MISSING PRACTICES
 - MISSING INDICATORS

- o VALIDATED SAFETY ASSESSMENT APPROACHES

ANALYSIS OF MANAGEMENT AND ORGANIZATION
FUNCTIONS AND ROLES

(SAFETY ENHANCEMENT GUIDELINES)

FIN: A-6319

CONTRACTOR: IDAHO NATIONAL ENGINEERING LABORATORY
(EG&G IDAHO INC.)

SITE: IDAHO FALLS

STATE: IDAHO

DURATION: 24 MONTHS (OCT '82 - SEP '84)

FUNDING: FY 1983 \$350K
FY 1984 \$500K

RELATED RESEARCH: CONTROL ROOM CREW TASK ANALYSIS
(FIN: B-7491)

HEALTH PHYSICS TECHNICIAN JOB SKILLS
ANALYSIS (FIN: A-3243)

SAFETY ASSESSMENT APPROACHES
DEVELOPMENT (FIN: B-2457)

ANALYSIS OF MANAGEMENT AND ORGANIZATION
FUNCTIONS AND ROLES

(SAFETY ENHANCEMENT GUIDELINES)

OBJECTIVE:

PERFORM ANALYSES AND ESTABLISH ENHANCEMENT
MODELING REQUIREMENTS FOR ORGANIZATION AND
MANAGEMENT FUNCTIONS AND ROLES CRITICAL TO
SAFETY DURING NUCLEAR POWER PLANT DESIGN,
CONSTRUCTION, START-UP AND OPERATION.

ANALYSIS OF MANAGEMENT AND ORGANIZATION
FUNCTIONS AND ROLES

(SAFETY ENHANCEMENT GUIDELINES)

PRODUCTS:

- 0 TECHNOLOGY BASE ON CURRENT FUNCTIONS AND ROLES PERFORMED BY ORGANIZATION AND MANAGEMENT DURING NUCLEAR FACILITY DESIGN, CONSTRUCTION, START-UP AND OPERATION

- 0 REQUIREMENTS FOR MODELING ORGANIZATION AND MANAGEMENT FUNCTIONS AND ROLES TO OPTIMIZE PLANT AND PUBLIC SAFETY

ANALYSIS OF MANAGEMENT AND ORGANIZATION
FUNCTIONS AND ROLES

(SAFETY ENHANCEMENT GUIDELINES)

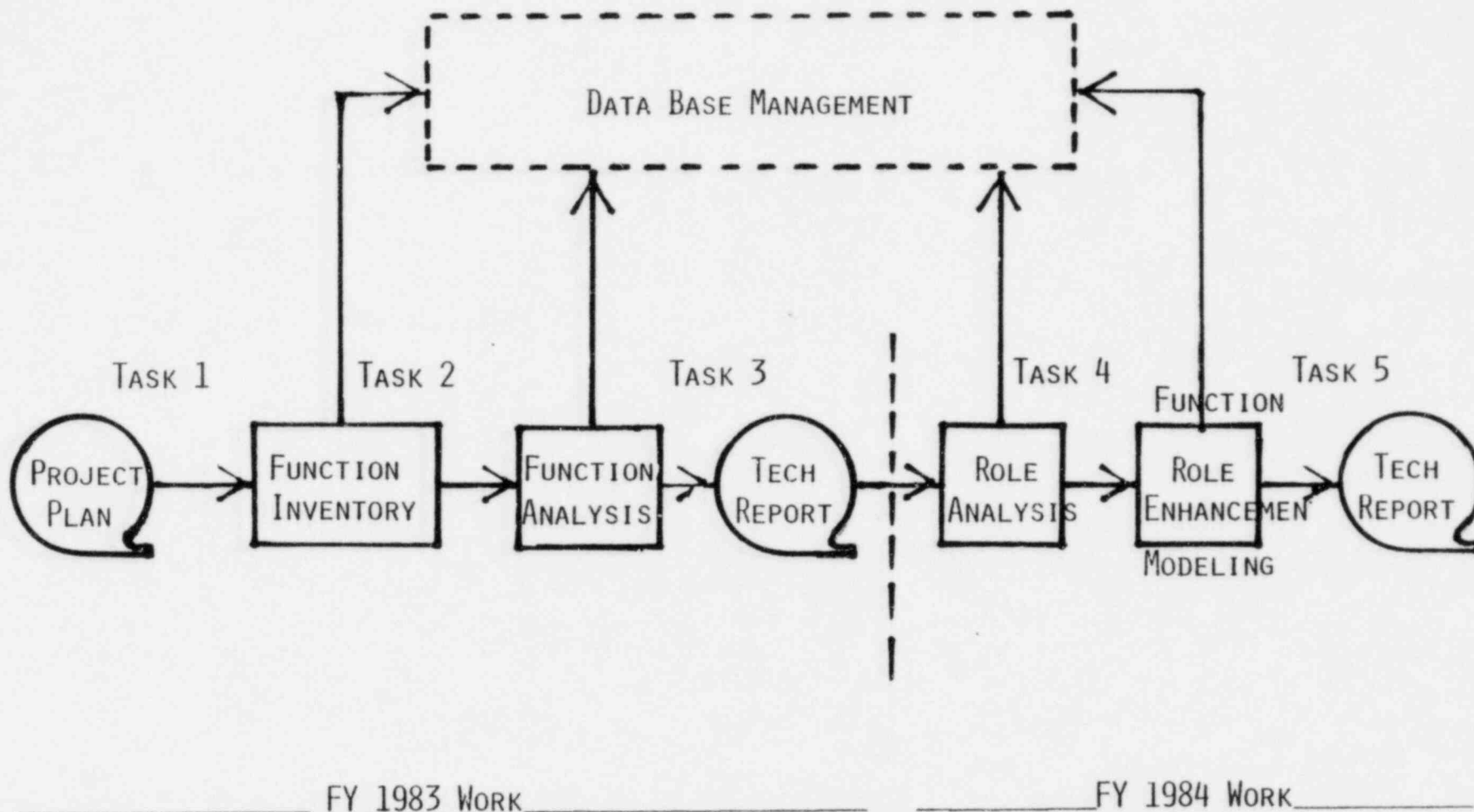
TERMS OF INTEREST:

- O ORGANIZATION (SYSTEMS) ORIENTED
 - FUNCTION INVENTORY
 - FUNCTION ANALYSIS
 - FUNCTION ENHANCEMENT MODELING
- O MANAGEMENT (HUMAN SUB-SYSTEM) ORIENTED
 - ROLE ANALYSIS
 - ROLE ENHANCEMENT MODELING
- O RESEARCH REVIEW GROUP

ANALYSIS OF MANAGEMENT AND ORGANIZATION
FUNCTIONS AND ROLES

(SAFETY ENHANCEMENT GUIDELINES)

PROJECT FLOW DISGRAM:



ANALYSIS OF MANAGEMENT AND ORGANIZATION
FUNCTIONS AND ROLES

(SAFETY ENHANCEMENT GUIDELINES)

TASK 1. - PROJECT PLAN DEVELOPMENT

- o OPERATIONAL DEFINITIONS
- o SAFETY CRITICAL CRITERIA
- o FUNCTION INVENTORY AND ANALYSIS METHODOLOGIES
- o DATA BASE MANAGEMENT
- o DATA REQUIREMENTS
- o DATA SOURCES
- o PROJECT SCHEDULE(S)
- o PROJECT MILESTONES

-
- o FORMAL BRIEFING TO THE NRC
 - o FORMAL PLAN TO THE NRC

ANALYSIS OF MANAGEMENT AND ORGANIZATION
FUNCTIONS AND ROLES

(SAFETY ENHANCEMENT GUIDELINES)

FUNCTION INVENTORY (LIST NOT AN ANALYSIS)

FUNCTION: (Select, Establish, Prepare, Carry-out)

PLANT LIFE CYCLE: (Design, Construction, Start-Up, Operation)

CRITICALITY TO SAFETY: (Yes/No), (Frequent/Non-Frequent)

FACILITY SETTING: (Normal Operations, Transient Operations, Emergency
Operations, Plant Type, Vendor, Vintage, Utility,
Plant Location)

TYPE OF FUNCTION: (Individual/Group)

PERFORMANCE REQUIREMENTS: (Information Gathering, Decision Making,
Monitoring, Motor Response)

PARENT CLUSTER: (Other functions occurring immediately before, simultaneous
with or immediately following the function of interest)

PERSONNEL INVOLVED: (Management, Technical Staff, Administrative Staff,
Safeguards Staff)

ANALYSIS OF MANAGEMENT AND ORGANIZATION
FUNCTIONS AND ROLES

(SAFETY ENHANCEMENT GUIDELINES)

TASK 3. - FUNCTION ANALYSIS

- o DATA COLLECTION
- o DATA MANAGEMENT
- o DATA ANALYSIS
- o DATA PRESENTATION

-
- o FORMAL BRIEFING TO THE NRC
 - o TECHNICAL REPORT TO THE NRC
 - o DATA BASE MANAGEMENT

ANALYSIS OF MANAGEMENT AND ORGANIZATION
FUNCTIONS AND ROLES

(SAFETY ENHANCEMENT GUIDELINES)

TASK 4. - ROLE ANALYSIS

- o ROLE SELECTION
 - o DATA COLLECTION
 - o DATA MANAGEMENT
 - o DATA ANALYSIS
 - o DATA PRESENTATION
-
- o DATA BASE MANAGEMENT

ANALYSIS OF MANAGEMENT AND ORGANIZATION
FUNCTIONS AND ROLES

(SAFETY ENHANCEMENT GUIDELINES)

TRANSITION ORGANIZATION

TASK 5. - FUNCTION/ROLE ENHANCEMENT MODELING

- o FUNCTION/ROLE SELECTION BY RESEARCH REVIEW GROUP
 - o COMPARATIVE ANALYSIS OF FUNCTION AND
ROLE DATA SETS
 - o ENHANCEMENT MODELING GUIDELINES
 - o ENHANCEMENT MODELING MEDIA SELECTION
 - o PRELIMINARY FUNCTION STRUCTURING
 - o PRELIMINARY ROLE STRUCTURING
-
- o FORMAL BRIEFING TO THE NRC
 - o TECHNICAL REPORT TO THE NRC

ANALYSIS OF MANAGEMENT AND ORGANIZATION
FUNCTIONS AND ROLES

(SAFETY ENHANCEMENT GUIDELINES)

PROJECT OUTCOMES:

DATA, METHODOLOGIES, ETC., TO SUPPORT
PLANT AND PUBLIC SAFETY THROUGH IMPROVED
ORGANIZATION AND MANAGEMENT:

- o FUNCTION ALLOCATION
- o ROLE ALLOCATION
- o PREROGATIVE AND RESPONSIBILITIES
- o POLICIES AND PROCEDURES
- o INTRA/INTER ORGANIZATION COMMUNICATION
NETWORKS

To = Dave Ward
From = Dick Pearson
Subject = Comments on Sept. 7 meeting

1. I'm not sure what our (my) job was here today. Was it to review the "aesthetics" of a plan or its utility? I could, for example, review an architectural drawing of a house and say "I like it" -- but the quality of construction would be judged by a specification of materials.

2. In the above context, are we to pass on scientific merit? If so, very little information (written or oral) was available or presented to make an informed judgment. For example, in the first two presentations on (a) Staffing/Qualifications and (b) Training, there was a paucity of technical detail (i.e. psychometrics) in such areas as experimental design, sampling, correlation techniques, statistical tests, etc. I was astounded by the lack of use of scientific words or terms such as "validity." In contrast, the presentation on licensing examinations exemplified the use of language relevant to judgment for scientific merit.

3. It is not clear that the areas of staffing/qualifications, training, and licensing

are to be coordinated or integrated, as they could be. Selection and training can be treated as complementary processes. Further -- the completion of training can be treated as a part of selection, as ^{done} with air traffic controllers. I would have liked to see someone address the correlation and prediction issues involved with selection and training (as predictors) and job performance as a criterion. For example =

~~Selection vs Training~~

Selection vs Training	r = ?
Selection vs Performance	r = ?
Training vs Performance	r = ?

4. In the area of management & organization I was impressed with Kirby's critique, especially pages 9, 20, and Appendix C. (C-2) - Evidence for a task analysis of utility management positions (e.g. training director) is weak & non-specific. It is even more unclear as to whether any skill analysis has been conducted. As an example, the suggestion is made that the training manager/director be a "qualified full-time professional." What does this

mean? I think the technical people with utilities do not know what skills a good training director should have. Also, I believe the entire human resources area is slighted, both within the utilities as well as within their safety review committees, ISEGI's, advisory boards, etc. The lack of sophistication in (a) training program operation and (b) human resources generally within utilities is a serious deficiency. I am beginning to think that each utility could profit from full-time availability of a doctoral-level, industrial/organizational psychologist with expertise in training.