ACRST-2018

# Official Transcript of Proceedings

# NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Reactor Safeguards
Ad Hoc Subcommittee on NRC Technical
Training Curricula

TR04 (ACRS)
RETURN ORIGINAL
TO BJWHITE,
ACRS T-2E26
415-7130
THANKS!

Docket Number: (not applicable)

Location: Rockville, Maryland

Date: Wednesday, December 7, 1994

Work Order No.: NRC-63 Pages 1-191

NEAL R. GROSS AND CO., INC.
Court Reporters and Transcribers
1323 Rhode Island Avenue, N.W.
Washington, D.C. 20005
(202) 234-4433

120008
9412120166 941207
PDR ACRS
T-2018 PDR

ORIGINAL

ACRS Office Copy - Retain
for the Life of the Committee

# D I S C L A I M E R

PUBLIC NOTICE
BY THE
UNITED STATES NUCLEAR REGULATORY COMMISSION'S
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

December 7, 1994

The contents of this transcript of the proceedings of the United States Nuclear Regulatory Commission's Advisory Committee on Reactor Safeguards on December 7, 1994, as reported herein, is a record of the discussions recorded at the meeting held on the above date.

This transcript has not been reviewed, corrected and edited and it may contain inaccuracies.

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

+ + + + +

MEETING

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

AD HOC SUBCOMMITTEE ON NRC TECHNICAL

TRAINING CURRICULA

(ACRS)

+ + + + +

WEDNESDAY

DECEMBER 7, 1994

+ + + + +

ROCKVILLE, MARYLAND

+ + + + +

The Subcommittee met in Conference Room 2B3, Nuclear Advisory Council, 11545 Rockville Pike, Rockville, Maryland, at 12:30 p.m., Robert L. Seale, Chairman, presiding.

SUBCOMMITTEE MEMBERS:

| | |
|---|---|
| ROBERT L. SEALE | Chairman |
| JAMES C. CARROLL | Member |
| IVAN CATTON | Member |
| THOMAS S. KRESS | Member |
| WILLIAM J. LINDBLAD | Member |

SUBCOMMITTEE MEMBERS (Continued):

DANA A. POWERS Member

WILLIAM J. SHACK Member

ACRS STAFF PRESENT:

Richard Savio, Deputy Executive Director

Doug Coe, Staff Engineer

William Kerr, ACRS Consultant

ALSO PRESENT:

Russell Anderson

Steven Arndt

Larry Bell

Edward Jordan

Stephen Koscielny

Kenneth Raglin

Lillian van Santen

Dagwood Ross

Jerry Wermiel

I N D E X


| AGENDA ITEM | PAGE |
|---|---|
| Opening Remarks by Chairman Seale | 4 |
| Briefing Introduction | 5 |
| Technical Training Program Description | 15 |
| Reactor Technology Training Overview | 62 |
| Specialized Technical Training Overview | 99 |
| Digital I&C Training Developmental Efforts | 120 |
| PRA Training Summary and Developmental Efforts | 142 |
| PRA Implementation Plan Public Workshop | 183 |
| Summary | 184 |
| Subcommittee Discussion | 185 |
| Adjournment | 191 |

P-R-O-C-E-E-D-I-N-G-S

(12:37 p.m.)

CHAIRMAN SEALE: The meeting will now come to order.

This is a meeting of the ACRS Ad Hoc Subcommittee on the NRC Technical Training Curricula.

I'm Robert Seale, Chairman of the Ad Hoc Subcommittee. The ACRS members in attendance are Jim Carroll, Ivan Catton, Tom Kress, Bill Lindblad, Carlyle is not with us, Dana Powers, Bill Shack is not with us yet, Charlie Wylie. Anybody else? And we have -- our consultant is Dr. William Kerr, a former member of this committee.

The purpose of this meeting is to review the curriculum, which is administered through the NRC Technical Training Center in Chattanooga, Tennessee, for classroom training of NRC personnel. This review will include the curriculum for the principles and applications of probabilistic risk assessment and the staff's progress toward developing that curriculum for digital instrumentation and control systems.

Mr. Doug Coe is the designated federal official for this meeting.

The rules for participation in today's meeting have been announced as part of the notice for this meeting

previously published in the Federal Register on November 16th of this year.

A transcript of the meeting is being kept and will be made available as stated in the Federal Register Notice. It is requested that each speaker first identify himself or herself and speak with sufficient clarity and volume so that he or she can be readily heard.

We have received no written statements or comments or requests for time to make oral statements from the members of the public.

Some of the members had the opportunity to meet with people from AEOD earlier, and unfortunately not all of us were able to take advantage of that opportunity. I think we look forward to this meeting because of the very strong interests in the development of training in these two particular areas that the committee has heard about over the last -- it's been over a year now.

I think we will proceed, and I'll ask Mr. Ed Jordan, Director of AEOD to begin.

Ed?

MR. JORDAN: Yes. Thank you, Dr. Seale, and members of the subcommittee.

We appreciate the opportunity to further discuss with the ACRS our technical training program response to changing NRC needs, and I think that's the key

of our discussion is we do see the needs changing and have done some anticipation of that and some surveying, and what we are going to be describing to you is our response to that understanding and the idea that it is ongoing.

So we are seeking from the ACRS comments on the evolving programs, and we want to provide you further insights on the future directions and the curricula and training methods. This is a follow up to the visits to the training center by Mr. Wylie and Mr. Carroll in October, and the briefing that AEOC gave to the ACRS on AEOD programs on October 6th.

While the NRC technical training program is becoming more academic, we don't plan to develop or provide course materials that are redundant. The materials that exist in the university systems are available under contract outside the nuclear industry. We do not and cannot use nuclear utility courses. We, of course, try to use whatever resources we can that are already in existence.

We do want to offer back to the university community and to the industry anything the NRC develops in the way of course materials or resources, and we have not fed very much of that back in the past.

For example, you'll hear, and some of you have seen, the nuclear engineering work station news that we use

now in classrooms, the software that was developed by or for the NRC for that effort, and the hardware specifications that we utilize are available for universities or industry. There is proprietary software associated that would have to be licensed, but certainly we would want to feed that back where it can be useful.

Another product is course material. An example I would give there is one I think we mentioned in the October 6th briefing, perspectives on nuclear safety. This is a NUREG CR6042 that was developed by Dr. Haskins and Dr. Camp of the University of New Mexico in Sandia for the NRC. In my view, it's an excellent treatise on the development and evolution of people with power plant safety strategies in the regulatory process, both from a historical and a technical basis.

And it is the basis in the NRC for a one-week course that we initially prescribed for relatively new employees, and because of its acceptance and the benefits integrating how the regulatory process developed, it's being offered much more widely to experienced NRC persons.

The technical training program that we have didn't develop or is being kept in a bottle. We have extensive interactions with related programs in the U.S. such as Department of Energy, the Navy, and even utilities, and also with other countries in terms of their regulatory

training programs. We have been assisting both Russia and the Ukraine in developing and setting up regulatory training programs.

We are proud of what has been accomplished. We're humble in the recognition that a great deal more needs to be done in a rapidly-changing environment.

MR. CARROLL: Ed?

MR. JORDAN: Yes, sir?

MR. CARROLL: Does DOE have anything comparable to your technical training center?

MR. JORDAN: No. They have looked at developing such a training program. The labs individually have elements of training that we have used. We have some under contract from them. But as far as an integrated training program, they do not now have such a facility and are seeking one.

Yes. We believe they're headed that way. We've had a number of interchanges with them in that direction.

MR. CARROLL: Okay.

MR. JORDAN: Today at the NRC hiring is, I would say, at a low point since I've been with the agency, other than short-term freezes with projections of continued reductions in overall staffing consistent with streamlining in the federal government. And we do have a representative

here from the Office of Personnel and also from NRR to respond to questions about those changing needs.

So we do anticipate that there will be a continued decrease in numbers of staff for several years projected. Hiring is going to be at relatively low levels, and so what we are in the mode of doing is providing refresher training for existing staff and retraining to satisfy the shifts in expertise needed with this existing staff, and of course to both improve efficiency and effectiveness of an existing staff.

Our training center is providing training now for agreement state materials regulatory personnel in conjunction with increased emphasis in the NRC on training for our NRC materials staff.

Clearly, we feel that coordination with the program offices is essential. It is their needs that we're trying to satisfy rather than create a product without an understanding of the need.

The technical training division itself plans to cover the overall program description, including recent needs survey findings, overview of the curriculum areas, and discussion of the developing programs for high priority areas. You've already identified those two of digital I&C and PRA training. Those jumped out of the needs survey we have just conducted. It is a work in progress that

continues to evolve.

We are quite anxious for your comments and questions, and we are not at all defensive regarding the need for further change and improvement.

The last quantum change that was made in our NRC training program was the adoption in about 1989 of a qualification program for other than regional inspection personnel, for headquarters personnel in program offices, and a revision at that time to the inspector qualification program. We believe that the changes that are underway and projected for the next five years are profound. They are necessary in order to help the NRC function in a streamlined federal agency way and be responsive to the criticisms and comments.

So without taking more of your time, I'd like to turn it over to Ken Raglin, who is Division Director for the technical training center activities.

DR. POWERS: If I could ask a question before you do --

MR. JORDAN: Sure, indeed.

DR. POWERS: Just a philosophical question. You're in the business of retraining, you think, rather than hiring to acquire expertise. I wonder what the down side is on pursuing that and how you -- what is your thought about compensating for that down side.

MR. JORDAN: Well, certainly -- and I'll give the example. We cannot train a PRA expert philosopher. That's not practical. So there are -- there is a level of expertise that we cannot train within the agency. We must, in fact, hire that experience. We need someone that has done three or four PRAs and needs to have the ability of teaching. That's something I don't believe we can train because you need that direct experience.

So there is a limited amount of hiring in areas that we will have to continue to do. But more broadly, let's say in the inspection staff, we are changing the inspection program to consider to a much greater extent the risk analysis concepts and focusing our attention on those systems and activities that have the greatest benefit. We can clearly provide that kind of training that increases their skills in that area without having to hire.

And I agree with you in terms of some down sides to not having a healthy attrition rate. The attrition is through those other older people in the agency that will be replaced by younger people. Some of us will just hang around here until they kick us out. But there is -- the agency does have a very low attrition rate, and say in average age it increases close to one every year. And so it's a different environment than we saw two or three years ago.

MR. LINDBLAD: As you say that, and I think I'm in the upper end of my career and life in terms of age and years and the like, and I find it very difficult to be retrained myself. I feel that --

MR. CARROLL: Even when you were younger, though, you --

(Laughter)

MR. LINDBLAD: But I think that my way is probably the best way whenever Jay tells me to change my way, or even if my wife tells me. It's hard for me to change.

Do you think that your program is skillful at redirecting people if --

MR. JORDAN: We clearly have made in-roads. I guess about four or five years ago Tom Murley and I somewhat simultaneously came to the view that the agency had an internal resistance to the use of PRA. And when we looked at our own training center, PRA was not a word that was uttered and so we then went through a process of causing the instructors at the training center and the staff to go through PRA training and to put elements of it within the training program.

So we've been kind of insidious in trying to put that in in a way that people learn some of the aspects of risk analysis and the concepts of how it affects

selection of systems for inspection, and so on.

There are some people that really are deterministic in nature, as an example, and simply will not change their view. I think the agency has the ability to sprinkle and respond in a broad enough fashion that those people's views will be overcome. And in the overall scheme of things, there is a much stronger PRA orientation of the staff today than there was a year ago, and it's on a slope, a positive slope.

MR. LINDBLAD: I appreciate that, and I appreciate that you've very carefully said each time that you're dealing with training, and you don't really talk about education or reeducating, because I think we all agree that education is for the young, not for the old.

(Laughter)

So, to me, training sounds very much like what I have to do every year with new form 1040s. You know, how to fill out the form. And I really believe that when we're talking -- and we'll talk about this more. But while I've got your attention at this point, on matters like probabilistic and PRAs, that we really need to deal with education rather than training. But we'll see how that develops in the discussion.

MR. JORDAN: Well, no, you're -- I totally agree with you, and there clearly is a transition that our

training center is going to -- that is, headed towards academic training. And I'm going to be careful if we cross the threshold that we're not trying to replace a university system in any fashion because we can't. And so it's in intersecting and connecting with what the university systems have to offer and providing that information and material to the staff that's outside of the university setting that we want to do.

But I have to say that the training center has made a remarkable transition in the past 10 years from being oriented towards, first of all, training operators for a control room environment to now training regulatory personnel to respond to problems in the field and in readings of material in their offices. That transition has been very, very profound, and many of our training personnel came from the industry training programs where they were training plant operators.

So we are -- we are somewhere on that slope, and we will always I think stop short of an educational facility. But we need to understand that we are providing, or are trying to provide in fact, something that's very close to education and changing people's values about safety.

CHAIRMAN SEALE: Well, I think we can work on this issue ad infinitum, and I'm sure that the members of

the committee won't be at a loss for additional thoughts and words on this.

MR. JORDAN: Excellent.

CHAIRMAN SEALE: I do -- I would caution you, though, that downsizing is not a word that is only restricted to business or to the NRC. The universities are in a downsizing mode in many ways today, too, and I think if you were talking about highly specialized activities, you may very well find yourself having to take care of yourself in terms of some of the -- even some of the academic training.

MR. JORDAN: And those are the insights that we're looking for.

CHAIRMAN SEALE: That's good.

Okay. Well, proceed, if there are no other questions.

MR. RAGLIN: Okay I am Kenneth Raglin, Director of the Technical Training Division.

I think that as the presentation proceeds and we get into some of the specifics, particularly in digital I&C and PRA, that some of these questions may be answered. Others may not. In any event, I'd like to spend just a few minutes discussing the NRC technical training program. What I'd like to do is frame the issue so that you understand what piece of the pie we're looking at when

we're discussing digital instrumentation control and when we're looking at PRA training.

The NRC technical training program is managed by the Technical Training Division within AEOD. Part of the mission is to coordinate with the NRC headquarters and regional offices in policy development and implementation of the formal qualification and training programs. Another part, clearly, is to provide the technical training to best meet the integrated needs of the agency.

We'll speak in more detail how we determine those needs and some of the decisions that are made to try to meet those needs. We develop new courses and make modifications to existing courses based on changing needs that are identified to us.

The Technical Training Division manages the TTC facility, which is located in Chattanooga, Tennessee, as well as its capital assets. The primary capital assets I'm speaking of here are the five full-scope reactor training simulators. It also includes a number of other things.

The TTD provides technical assistance as requested and as available to other organizational components of the NRC. This is done most generally with either NRR or with research, and it is done in cases where either the expertise of the TTC staff or the facilities of the TTC are advantageous to that particular product.

Determination of needed staff skills is not within the scope or the staffing capability of the TTD, and by that I mean that we react to the needs that have been identified by the line organization. We do not generate the needs, and typically we don't identify the needs.

The TTC facility itself consists of about 60,000 square feet in an office building in Chattanooga, Tennessee, a number of classrooms, the full-scope simulators, associated training aids, and the office space necessary for management of a remote facility.

CHAIRMAN SEALE: Do you have a question?

DR. POWERS: When you say you respond to the needs, does that mean that you sit by the telephone waiting for the line to call you up, or is there more --

MR. RAGLIN: No.

DR. POWERS: -- proactive effort?

MR. RAGLIN: It's much more than that. I will be describing what we've done in terms of needs identification, including the technical training needs survey, the continuous interactions of the training advisory group, the inputs that are received by us from program offices and regions on special needs.

It is very much a cooperative process. The only point I was making, it's not us who are setting the needs. It is the line organization; it has participated.

DR. POWERS: But --

MR. RAGLIN: Did I hit it?

DR. POWERS: But I guess I'm still -- is there -- in the course of teaching a lot of people, it seems to me you must acquire a lot of data --

MR. RAGLIN: Yes.

DR. POWERS: -- that says, "Gee, these people don't have good backgrounds in subject Y." You have that. Has anything ever happened to that data?

MR. RAGLIN: We get a lot of feedback from each course, both from students and from instructors from the course. Sometimes we get feedback from the supervisor of the students who attend courses. All of that is considered and a number of changes have been made. If it's an identified weakness that we feel we can fix, we make the change to the curriculum, and then that's the way the course is typically presented in follow-up activity.

If it's a weakness that can't be corrected within that course, in other words another course may be necessary, yes, we certainly talk to the people who are sending us the students. And that was exactly what was done at the onset of the reactor engineer intern program.

We noticed a number of recent college graduates coming to our courses who did not have the background that the courses were designed for. It was fairly obvious that

something needed to be done on the front end to better prepare these people to deal with the courses that we were presenting. So we talked to NRR; we built some special front-end training for those people.

So, yes, we do that. It depends on the situation whether it's perceived to be a problem big enough to warrant special courses, or whether it's a problem that can be corrected within the same course or through a different emphasis within the same course.

DR. POWERS: But it is, nevertheless, more -- a fairly ad hoc process?

MR. RAGLIN: We do regular reviews of the courses internally within the training center. The instructional staff does that. They're reviewed by the training center management. If problems or suggestions reach a certain threshold, then we proceed external to the training center and bring into the picture whoever the co-decisionmakers need to be.

MR. JORDAN: It's Ed Jordan.

Maybe to try to address that -- we kind of go out of our way to say that we don't create need from the training center ivory tower. We really solicit the needs of the program offices, and we do it very actively and aggressively. We did a very detailed needs survey that will be talked about some that included job and task

analysis for certain positions to establish what really is needed.

We get lessons out of, for instance, the regulatory impact survey, when the industry says the NRC inspectors have a void in a particular area, and so we changed our fundamentals of inspection program based on those kinds of needs. We have two advisory groups that we created that for the agency gather the necessary input to put back into the training center, both at a participant level and at a senior manager level.

So we're actively trying to do that, and that's really part of our interest in meeting with the ACRS is to test us. You know, where are we not meeting needs? Or what areas have we failed to see? So while we're -- once again, I don't want to be defensive, but I also want to convey these are the things that we presently do.

DR. POWERS: Okay. I'm prompted by the question, because I -- the question got prompted because I saw these advisory boards and things like that that you've done. I thought that was great, and I said but I do think that they're collecting a lot of data that may be more valuable in understanding what the needs are.

MR. JORDAN: Yes.

DR. POWERS: In the course of doing the work that you did.

MR. JORDAN: Exactly true.

CHAIRMAN SEALE: Okay.

MR. CARROLL: Are you currently reviewing the Tower-Perrin Report to see if that gives you any lessons?

MR. RAGLIN: We have it. Like everyone else in the agency, we're reading it and studying it. It will affect us somewhat indirectly, but --

MR. CARROLL: Well, it's --

MR. RAGLIN: -- there are clear implications.

MR. CARROLL: -- it's got a lot of the same issues that were in the regulatory impact survey.

MR. RAGLIN: Sure.

MR. CARROLL: But it doesn't attribute any of these to lack of training, does it?

MR. JORDAN: Well --

MR. RAGLIN: I don't think it singles them out that way. It describes the symptom.

MR. CARROLL: Yeah. I think that's a good characterization. But it's something that if, in fact, some of the problems they point out are true, it's something training could play a role in correcting or head-pointing; I don't know which.

(Laughter)

DR. CATTON: Where is the problem of prerequisites dealt with?

MR. RAGLIN: In our syllabus of courses, there is a page for each course. They're arranged in terms of the difficult curriculum areas. Each page list has a field that lists prerequisites where there are prerequisites. There are not firm prerequisites for too many of the courses. The courses are designed for qualification programs, and so it's fairly well understood that people who are attending these sets of courses are inspectors of a certain discipline who are proceeding along a qualification path.

Where we feel that there are minimum prerequisites that someone must meet they're not going to get a great deal of value out of the course, or we feel that they would drag the course down in terms of its overall effectiveness, we've included some prerequisites there. It's not a hard-and-fast requirement.

Okay. The TTD program elements can be basically broken down into reactor technology, specialized technical training, and what I would call infrastructure support for reactor technology training. This corresponds to the three branches within the Technical Training Division pretty well. There is the Reactor Technology Training Branch, which has 10 reactor technology instructors, each of whom is typically qualified in two reactor technology areas.

The Specialized Technical Training Branch has three senior health physicists and five program managers. These people serve both as instructors and program managers for a variety of commercial contracts and interagency agreements.

The Technical Training Support Branch does carry out the infrastructure support. It has three simulator engineers, two reactor technology instructors, two office automation assistants, a senior project manager, and it also has the responsibilities for contracted simulator support. This includes contracted hardware technicians to maintain the full-scope simulators and contracted software engineering work as well.

This slide shows some of the methods of providing technical training. A variety of methods are used to provide training for the NRC staff. When there are sufficient numbers of NRC staff who need a particular type of training, it is generally more cost effective and productive to create a customized course for the NRC staff. This can be done using in-house FTE resources or through the use of contractor dollars.

The custom courses are typically more effective because -- more effective than the off-the-shelf courses because they can emphasize areas that are more important to regulators as opposed to areas that are perhaps more

important to operators or other -- members of other institutions.

Almost all of the reactor technology training is conducted using the in-house resources at the technical training center. On the other hand, most of the specialized technical training is done through contracts which are managed by the Technical Training Division. Typically, about 30 different job codes are established, maintained, and managed to provide the variety of specialized technical training that is available to the NRC staff.

We also take advantage of courses that have been established within other agencies. Of particular importance to us is the DOE Central Training Academy in Albuquerque, New Mexico, and that is, in fact, where we get most of the training that is provided for the NRC safeguards curriculum.

Frequently, needs arise for specialized courses, but the target audience is relatively small. This limits the cost effectiveness of creating a customized course. What is typically done in these cases is to send the NRC staff to open enrollment courses on a slot basis, individual training opportunities. This is frequently referred to as 368 training or the 368 process, because the students must fill out an NRC form 368 and have it approved

before going to the training.

But this is a wonderful way of allowing NRC staff to receive university training and to receive training that other external organizations have established and provide for the general public.

DR. KERR: On whose initiative does this usually occur?

MR. RAGLIN: It can come both ways, either from the employee through an individual development plan, or in the context of a formal training program where the method chosen to satisfy that training need is to have identified certain courses which are available through the 368 process, and then all of the NRC staff who need them go through that. So it can come from both the program or from the individual.

Maybe all things considered, more of the 368 requests come from the individual.

Lillian, could you confirm that?

MS. VAN SANTEN: That is true.

MR. RAGLIN: Okay.

MS. VAN SANTEN: That is true. They come also from individuals.

MR. RAGLIN: Okay.

DR. KERR: Is this typically done out of hours or during a regular work day or --

MR. FAGLIN: It's typically considered work, and the students go during regular hours to attend the courses.

The NRC technical training program is driven by needs that have been identified by the line organization. The needs that have been identified can be loosely thought of in terms of those that are associated with formal qualification programs, those that are associated with special training programs, and what I'll just call other recommended training.

The highest priority agency needs are those that are defined in the formal qualification programs, and by that I mean specific courses are included in the qualification programs and the students must complete these courses before they can be considered qualified to do certain jobs.

Of particular note here is the NRC Inspection Manual Chapter 1245, which deals with inspector qualifications. This is kind of an umbrella document for all of the inspectors, and when I say inspector here I'm speaking of someone whose job title has inspector in it. That manual Chapter 1245 has something like 17 different inspector categories that are covered in it, and the training requirements are listed. I will show a little bit more about that momentarily.

In the last couple of years, there has been a second related manual Chapter 1246 that was created for materials license reviewer qualification. This is for regional and NSS license reviewers. It is similar in structure to the existing 1245 for inspectors.

There are other formal qualification programs that you can see up there. One for operator license examiners, one for headquarters operations officers with AEOD, and one for reactor technology instructors at the technical training center.

DR. KERR: Are the operator license examiners required to have an operating license?

MR. RAGLIN: No, they're not. They do have a formal qualification program, pretty much similar to that of inspectors, but they're not required to be licensed by NRC in order to be an examiner. There's a lot of development work that is part of their qualification program to ensure that they can give the licensing exams, though.

DR. KERR: In the licensing of pilots, or requalification of pilots, are the people who do that usually licensed pilots?

MR. RAGLIN: I'm sorry?

DR. KERR: In the licensing of pilots for aircraft, are the people who do the examining usually

licensed pilots?

MR. JORDAN: At least for --

MR. RAGLIN: Yes, they are.

Okay. It's important to note that the NRC technical training program, and I'm speaking both of the curriculum and the courses within each curriculum area, were developed to support these formal qualification programs, and it really all started with inspector qualifications.

Assumptions were made concerning the incoming student knowledge and experience in terms of relative familiarity with the terms that were being discussed, having perhaps been at sites, having seen equipment, having seen equipment in operation, and so forth.

The point I'm making is that these courses -- and that's most of the courses that you'll find in the syllabus -- were designed to support qualification programs that were not specifically designed to support employee development. They've been used for employee development because there's nothing else that's better and is available.

But if you go back to the roots, it was to support qualification, and some of the assumptions that we make on incoming students relate back to that.

The next tier of priorities would be what I'll

call the special training programs.

MR. LINDBLAD: Before you get into that, I'd like to go back to Dr. Kerr's question about operator licensing examiners and whether they are themselves licensed operators. And certainly, we were only talking here about the regulatory agency, and that each plant, each licensee, has the responsibility to develop their own operators, and their training programs I think invariably -- I don't see Mr. Carroll right now to confirm this -- but I think their training programs invariably have steps to be taken by candidates for license which are reviewed by licensed operators in the plant before they are put up for examination by the regulator itself.

So there is some home-grown demonstrations of airmanship by a competent reviewer in that case, too. Isn't that correct?

MR. RAGLIN: Yes, that certainly is.

MR. LINDBLAD: You're talking about the second stage of review of a candidate, one done by the licensee himself and then subsequently by the regulator.

MR. RAGLIN: Exactly. No licensee would send up for an exam someone who hadn't gone through the licensee internal process, and they've already done the same things that the NRC examiner is going to do because they want that person to pass.

MR. LINDBLAD: But they would use licensed operators to --

MR. RAGLIN: Yes, they -- typically, it's a combination of instructors, utility instructors who most often are licensed operators, former licensed operators, and so forth. They have to have a license to have some of those jobs.

MR. LINDBLAD: Yeah.

MR. JORDAN: And I'd like to clarify for the NRC portion as well. Many of our personnel that are in the license examining area have formally been licensed, as many of our training personnel at the training center have formally been licensed, but they no longer have an active license and certainly would not have a license on the particular facility at which they're examining.

So their qualifications -- the reason for having this formal qualification process is to identify the minimum courses and, in fact, an examination of those persons to assure they are adequately qualified. I'm very happy and confident with the level of their qualification for the purpose intended. So it -- don't mean to leave behind any residue that we're dissatisfied with that qualification.

DR. KERR: I didn't think that the NRC was dissatisfied with the situation. It just struck me as

being a difference in approach because I do believe the FAA does require that their examining people have operative licenses, and this doesn't mean that in the case of commercial aircraft that the commercial company -- they also have rather rigorous examining procedures, which they use periodically.

But it's just -- it's a different philosophy, and I'm not sure which is better. It seems to me there is an argument to be made that day-to-day experience in the licensability does keep one up to date and experience and give a certain amount of judgment which one does not retain if one is out of the business. But since I've never been a licensed reactor operator, I can't speak from personal experience.

MR. LINDBLAD: I do recall that up to about 20 years ago, having a license was much more common in organizations. But about 15 or 20 years ago, the NRC said they no longer wanted to support programs to keep people licensed who weren't actively using their license in the operation of power plants. So certainly, they could identify that examiners should have and that was a need that was to be satisfied, but they chose not to require that examiners be licensed.

MR. RAGLIN: From time to time, the need for special programs appears. The special programs are

typically for a relatively small group within the NRC, and they typically become formalized, although not quite to the extent of the formal qualification programs. One good example of this is the reactor engineer intern program which was designed by NRR a few years ago. That program has peaked, I think, in '91 and '92 and is now down to fairly minimal numbers.

Special programs, particularly that one with its big peaks, can have a significant perturbation on the overall technical training program, and I'll be able to show you some graphs to show you the effects that we have seen from that.

Another example of a special program is one that is currently under development -- NRR -- for a position called a senior reactor analyst. As currently planned, this program will include significant PRA training for the selected individuals. It is still under development.

As part of the NRC's overall human resources strategic plan, use is being made of the NRC senior fellowship program, which allows selected NRC employees to return to college to attain advanced degrees in identified critical skill areas.

Then, there is this other tier which I'll call other recommended training.

MR. LINDBLAD: How many people are participating in a senior fellowship program currently?

Lillian, do you know the answer to that?

MS. VAN SANTEN: Currently, I believe 4.

MR. LINDBLAD: Thank you.

MR. RAGLIN: This lowest tier can be classified as other recommended training. It includes training that's defined in generic training plans or office letters, meaning that the general office policy is that staff in certain positions should have certain training. These needs are softer than the needs that are identified up here in the formal qualification programs. It's not absolutely mandatory that staff in those positions attend that training, and so it's not always done.

I'd like to --

MR. LINDBLAD: When you say mandatory, you're talking about those things where qualifications are required?

MR. RAGLIN: Well, for formal qualifications, in order to be an inspector --

MR. LINDBLAD: Right. Right.

MR. RAGLIN: -- the individual must complete these --

MR. LINDBLAD: But you spoke of some of the other programs as being development programs --

MR. RAGLIN: Well --

MR. LINDBLAD: -- an individual would be interested in.

MR. RAGLIN: Yes. All of these up here, in order to become qualified for that job position, you must have attended certain training. The one here, the reactor engineer intern program, the program requirements are clearly identified, and NRR absolutely ensures that each of those interns attends every one of those courses. In that sense, it's mandatory for those people.

MR. LINDBLAD: I see.

MR. RAGLIN: For generic training plans here, for NRR project managers for example, there's a generic training plan. It is not absolutely mandatory that those project managers attend everything that's in that training plan, so I think if you looked you would find that some have and some haven't.

Okay. I'd like to show an example of a typical qualification program here. I just happened to pick out BWR operations inspector. It is typical of all of the others that are described in manual Chapter 1245. This would be the program that a resident inspector at a BWR site would go through for examples, and it includes an extensive amount of regional training in the areas that are shown up here, CFRs, updated safety analysis report,

regulatory guidance of different types, the NRC Inspection Manual, industry codes and standards, various ones depending on the inspection discipline.

That's a considerable amount of work, and there is a document called a qualification journal that is really an appendix to this manual Chapter 1245 which is a quarter of an inch to a half-inch worth of paper describing the individual things that must be done. It's quite a bit of work.

Then, there is a section on required formal training courses. In the case of this BWR resident inspector, it would start with a power plant engineering course or equivalent experience. We will briefly describe these courses a little bit later in the presentation, but it's a front-end course prior to our full-course series. They are all required to go to this full-course series, which is an integrated series of four courses in succession, a total of seven weeks to the student.

They are all required to attend the Fundamentals of Inspection course, as well as the Inspecting for Performance course. And again, we'll cover those in a little bit more detail a little bit later.

DR. KERR: Okay. Excuse me. If you take the required regional training and the required formal training courses, what's the total amount of time spent by an

individual to complete those two?

MR. RAGLIN: Okay. From starting through completion of the oral qualification board, it's about a year.

MR. LINDBLAD: And during that period, he has not been part of an inspection team, or he has been part of an inspection team?

MR. RAGLIN: During that period, the person is not yet qualified as an inspector. That means he or she cannot do independent inspections, which means he or she will not be signing the inspection report. They will be participating in inspections. In fact, part of this required regional training specifically includes inspection accompaniments. It specifically includes going with qualified inspectors at entrance meetings and exit meetings, and so forth.

Yes, they're used. They're not used as independent inspectors until they're qualified.

MR. LINDBLAD: And once an independent inspector, can he be assigned a part of the inspection to perform and then to make recommendations on that? Or is he an apprentice that --

MR. RAGLIN: It's more like an apprentice role. I think that's a good way to look at it. They can do things, they can report results, they can try to defend

their results to maybe other members of the group or a team if it is. The leader of the inspection activity, the resident inspector or the team leader, or whatever, is not going to accept that without verifying it. So that the person can be used to uncover things.

MR. LINDBLAD: Is he identified to the licensee as being an inspector in training or an unqualified inspector?

MR. JORDAN: No.

MR. LINDBLAD: And so if a licensee says that inspectors come who are not qualified, he may be right.

MR. JORDAN: He'd be accompanied, yes. It's sort of like learning to fly. You can't learn to fly unless you sit in the seat and hold the stick.

MR. LINDBLAD: You always tell the passengers if there's somebody up front who --

MR. JORDAN: You have no passengers while you're in training, it's true. In this case, one has to go to the field, observe others, select the medical to observe one, do one, teach one. There is a process an apprentice goes through, but we don't make them wear an armband saying that --

MR. LINDBLAD: A scarlet "A."

MR. JORDAN: Yeah.

(Laughter)

It's awkward. The leader of the team has to maintain an understanding and a control and prevent the individual from getting himself or the team itself in trouble.

MR. LINDBLAD: But we shouldn't take too much umbrage if a licensee does point out that occasionally the inspectors --

MR. JORDAN: No.

MR. LINDBLAD: -- are unqualified.

MR. JORDAN: I was an inspector for many years, and I did some pretty dumb things and people pointed them out to me.

MR. LINDBLAD: Even before you were qualified.

(Laughter)

MR. JORDAN: At that time, we didn't have a qualification.

MR. LINDBLAD: Thank you.

MR. RAGLIN: It's probably also worth mentioning that on some of the inspections there are people that are part of the inspection team that do not have the term inspector in their name. They may be there as the electrical expert to help evaluate some electrical problem or some situation.

The people I'm talking about here would be people who will become the resident inspector at a BWR

site, and they have to undergo this year-long program in order to be properly prepared. It is also worth mentioning that this formal training that I'm showing right here is considered to be about 25 percent of the total effort to prepare that person to become an inspector. So there is a good bit of activity that goes on out here in the regions.

CHAIRMAN SEALE: During the time when this person is going through this qualification process, you say he has this training effort, how much time is that actually? How many hours a week are they involved in what would go as training under this definition?

MR. RAGLIN: Well, for the formal training, this is three weeks. The full series is seven weeks. Each of these is one week. So that's 12 weeks of formal training, where they're --

CHAIRMAN SEALE: In residence or --

MR. RAGLIN: They're typically at the training center, let's say.

When they're not doing that, in between times here, they're working on these other things. They're working on that qualification journal. It's pretty much of a full-time job of qualifying for a new employee.

Now, if it's an employee who has been an inspector at one site and maybe is going to be an inspector at a different reactor type, only really the differences

need to be done in that case, not a full-time qualification job. But it's a load.

DR. KERR: Typically, what fraction of the people after their training pass that oral qualification on the first try?

MR. RAGLIN: We don't have a lot of data on that.

DR. KERR: I didn't mean exact results. I just wondered if it's typically 100 percent or --

MR. RAGLIN: No. I'm sure it's not 100 percent.

DR. KERR: -- 80 percent or --

MR. RAGLIN: But I would guess that it's a high percentage because there is a great deal of preparation that the individual goes through prior to the board.

And the board, by the way, isn't checking the technical training parts so much. We give exams for our courses. We report the results of the courses to the supervisors. They verify that the person has met all of these training requirements. By and large, the questions that are on the oral qualification board have more to do with implementation of the inspection program.

DR. KERR: Yeah. But presumably, everything that comes before that is aimed at making the person a qualified inspector.

MR. RAGLIN: Yes.

DR. KERR: So I --

MR. JORDAN: Dr. Kerr, we canvassed the room. Nobody here really has an answer. For AEOD, we have a qualification program for our operations center officers, and I would say that it's of the order of 70 or 80 percent qualified based on the board, and that the remaining person -- and this is a one-person-at-a-time type qualification -- the remaining person has to go back and dig into a particular area to satisfy the board.

So I would guess that in the regions it would be that kind of a thing, where upon being questioned about the enforcement program the panel might find that there are some loose ends that the person is not really intimate with about the enforcement program, and may have to go refresh before satisfying. So we try to set a pretty high threshold and cause people to work hard and be prepared before going to a qualification board. It's not automatic.

MR. RAGLIN: After the oral qualification board, the inspector is then qualified, and there is another set of training requirements which says within two years of whatever that date is that the person was qualified on, the individual must attend this PRA Basics for Inspection Applications course, and this Effective Communications for NRC Inspectors course.

This PRA course is the single PRA course that is required training for NRC staff. The Effective Communications course is a course that was added to the formal training requirements following the NRC's regulatory impact surveys two years ago.

There is also a refresher --

MR. CARROLL: Why wouldn't both of those be part of the initial training?

MR. RAGLIN: That was a call that could have probably gone either way. The decision was made to put it two years after because this process takes so long -- a year -- that the regions are anxious to get these people -- to get work out of these people for several months before they have to send them back for training. And the decision was made that by doing all of this it would be good enough to get a feel for the job, and that these things could come a little bit later.

MR. CARROLL: So for two years, you've got a guy out there that's an ineffective communicator.

MR. RAGLIN: Well, I wouldn't say it that way.

(Laughter)

MR. JORDAN: Maybe to put it -- you asked a good question. It was structured this way because the priority was on training the staff that were out doing inspections at the time, as opposed to those that were

being qualified as new inspectors. And so it was -- that was a matter of retraining existing staff.

I think now with a very low level of new people being trained, it would be appropriate to stick it on as one of the qualification activities. So it's a good question.

MR. RAGLIN: And certainly, somebody can do it right away, and there wouldn't be any prohibition with that.

There are also refresher training requirements for each of the inspector disciplines. The requirements for the BWR person here are a simulator refresher course which focuses on emergency operating procedures and uses a simulator for the particular reactor design.

All of the inspectors have a requirement for a Fundamentals of Inspection refresher course, which is a short course that refreshes some of the things that were covered in the Fundamentals of Inspection Course, and it also provides senior management philosophy refresher for inspection activities.

MR. LINDBLAD: What is the frequency of those refreshers?

MR. RAGLIN: Every three years is the requirement.

DR. KERR: Do you have requal. exams?

MR. RAGLIN: This does not have an exam. The simulator refresher course formerly had a written examination. When the focus was changed to emergency operating procedures, the examination went away because it was too difficult to have a meaningful exam. So as it stands right now, none of that refresher training has an exam.

DR. KERR: But our reactor operators do have to have exams --

MR. RAGLIN: Yes, they do.

DR. KERR: -- requal.

MR. RAGLIN: Yes, they do.

DR. KERR: And it must be equally difficult to examine them on simulator performance.

MR. RAGLIN: It's a little different with the operators. Let --

DR. KERR: That's okay. I was just curious as to --

MR. JORDAN: These are not the license examiners. These really are the inspectors --

MR. RAGLIN: That's right.

MR. JORDAN: -- who get a simulator course, and now periodically get a refresher on the simulator.

DR. KERR: Well, what does a refresher mean? I presume it means that they learn something or don't learn

something, and --

MR. RAGLIN: In this context, the refresher course is intended to refresh the familiarity with the control rooms, to refresh the use of instrumentation to interpret events, normal events, abnormal events, and so forth.

Before we shifted to essentially all EOPs, because it takes most of the week to do that, it did include discussion of recent events and exchange of information -- inspectors from one region talking about events that happened there to share information.

DR. KERR: I'm not trying to penalize anybody. I'm just curious as to how you determine whether your refresher course is accomplishing what it is you want to accomplish. And unless you have some feedback from the students, I'm not certain how you know.

MR. RAGLIN: Okay. We do collect feedback from students from all of the courses in the form of a course evaluation form. We also collect feedback from the training advisory group each time we meet. And each time we've met for the last four or five meetings we have specifically asked them, "Is the EOP simulator course meeting your needs for refresher training?" and each time they have come back and said, "Yes. We want you to keep doing exactly what you're doing with that."

DR. KERR: Maybe I can -- it sounds like sort of a qualitative --

MR. JORDAN: Let me -- this is Jordan again. Let me try to help that one, because in the simulator refresher for the EOPs, you have a group of people who are not licensed, haven't worked a simulator for perhaps two or three years, and who watch operations in control rooms frequently.

They're now on a different control panel than they see in the site that they normally inspect, and they are not going to be agile as operators in terms of where the switches are, where the controls are. They're walking through responses to transient events and using the EOPs for that simulator to respond. So it's a walk-through and an enactment and an appreciation for how the EOPs work and assist the operators, therefore, to help them inspect.

We are at a loss as to how to extract meaningful evaluation of the students under that kind of an environment. We get feedback from them that, yes, this is helpful to them in their inspection role and from their supervisors, but for the instructor to measure the fact that they went to the right control and they followed the procedures precisely during a week of a dozen or so different scenarios is very, very difficult.

We are interested in your recommendation as to

how we might do that.

DR. KERR: Well, see, without knowing what your objective is, it's a little hard for me to know. If it's just a matter of letting them see what a simulator looks like, sort of a cultural exchange, it seems to me you could accomplish that with a well organized videotape.

MR. JORDAN: No. Let --

DR. KERR: You really are trying to determine whether they have some level of competence. Then, it seems to me it would be wise to try to determine what level of competence you want to achieve and try to devise some measure of that. I mean, this is obviously something to which I have not given a great deal of thought and which you probably have.

So it just strikes me unless you have some way of examining people in the course of this refresher, you don't know what you're accomplishing, other than that they have a warm, fuzzy feeling, and warm, fuzzy feelings are valuable, and I'm not against them.

CHAIRMAN SEALE: Bill, this is a bone, if I may make a comment, this is a bone that the people in the utility training business have chewed on, too, quite a bit. There are 11, as I recall now, specific qualification or identified training program sets in the NPO-approved utility training program. Some of them are licensed

operators; others have to do with maintenance tasks, health physics, chemistry, and all of those other things.

There is the complete set of operator, senior operator, plant supervisor, and so on, programs which include the NRC licensing of the individual at the end of the road and occasional requalification.

One of the sets, though, that was identified was for engineering -- let's see, engineering supervision, technical supervision training. And very early on that activity included a simulator component, and the purpose of that simulator component, or the question on what that simulator component was supposed to accomplish, very quickly developed into exactly the same kind of questions that you're asking here. What do you really want them to know about, and so on?

What they really try to do there is to demonstrate systems interaction, using the simulator but with the flexibility of being able to do different systems interactions using different scenarios from time to time, and in a sense -- and again, it's a kind of a warm, fuzzy feeling, but what comes out of that is a strongly reinforced feeling for the importance of understanding the environment in which each of these individuals work in terms of what happens whenever you start interacting with and treading on the toes of your neighbor in the system or

the technology that makes up the overall plant operation.

There is no licensed requirement for that component, and I guess in recent years as simulator time has become more and more dear, some of that training has been cut back by the utilities or the numbers of people who undergo that training has been reduced.

But there is that similar element in the utility training program.

MR. LINDBLAD: Professor Seale, if that is similar to what Steve is describing here, then probably simulator refresher course is the wrong descriptor, and instead it is the emergency operating procedure course using simulator as a demonstration tool.

MR. JORDAN: That is precise. You've fingered it.

MR. LINDBLAD: Okay.

MR. RAGLIN: And what we do in that course --

MR. LINDBLAD: And so, do you have an examination on emergency operating procedures?

MR. RAGLIN: No, we don't. Although we can take that under advisement, because I can see it -- the course is not all done in the simulator. It is a mixture of classroom and simulator. Part of the time is spent in a classroom explaining the EOPs, entry conditions, and so forth, and then demonstrations are done in -- using the

simulator. So it's more than the simulator, it's more than the EOPs, it's more than the classroom; it's the combination of all of these things that makes it a reasonable course.

MR. JORDAN: Yeah. That's a helpful comment because the simulator is only a tool, and the EOPs are the understanding we're trying to convey.

CHAIRMAN SEALE: We're going to have to move along here, gentlemen, or we'll get in trouble.

MR. RAGLIN: This one shows the Federal Workforce Restructuring Act of '93. The point I want to make here is that as part of the national performance review, the Federal Workforce Restructuring Act loosens some of the restrictions on employee training to help develop a multi-skilled workforce in the federal government.

What it does is allow training to be used to advance an employee's professional goals. The training does not have to pertain to the employee's current occupation or profession, but it does have to be in the interest of the organization to spend the money to send the employee to training.

MR. LINDBLAD: And is this during working hours or outside of working hours?

MR. RAGLIN: This would be during working

hours, typically.

This is not a radical change for the way NRC has operated; there is just increased flexibility. And in the specific case here, it allows probably even better use of that 368 training for individual training opportunities, and it -- there have been commitments made by the Chairman and with the labor-management partnership committees that this will be used more effectively. And it's just another way that allows for sending staff to improve knowledge and skills in necessary areas.

MR. LINDBLAD: So will the time allowed for training expand, or will this compete with the professional job-related training that you conduct?

MR. RAGLIN: My guess would be that this also will be in competition with everything else. We're seeing it for all other phases of training, whether we're talking technical training or other federally-mandated training, or whatever. It's all in competition for the people's time.

MR. JORDAN: The analogy I would make would be if we have a health physicist who is interested in becoming a reactor inspector rather than continue in the health physics line, that this will be a facilitator for him changing to a reactor engineering type approach, and that the agency would now support it, where if he was employed as a health physicist previously we would say, "Well, we'll

provide you with more health physics training. We'll even help you get certified as a health physicist. But you're not a reactor inspector, and we don't plan to make you one."

Now, we would consider it. It would be a prioritization of our training --

MR. LINDBLAD: But his supervisor would likely ask for additional FTE to support his time lost during training?

MR. JORDAN: Oh, he could ask.

(Laughter)

CHAIRMAN SEALE: Well, but more than that, have you identified a need for and addressed the question of how you prioritize these different demands, or calls I guess we'd say, on the time of an individual? Do the necessaries take precedence over the druthers, and how?

MR. JORDAN: Well, certainly, for me and my officers, the necessaries take priority over the druthers. Previously, I was not bound to consider the druthers; now I am. And so the -- and the chairman has made that commitment in the EEO briefing, that the agency would in fact do this. And in the partnership meetings with the union, it has been a matter of great discussion. So there is a dimension available to the staff that was not necessarily available before and a commitment by the agency

to do it.

We're simply recognizing here that there is a Pandora's Box here, and it will affect this training. We don't really know how much or how far.

MR. RAGLIN: There's a series of graphs which I'll cover very, very quickly. These chart courses over the range FY87 through '94. Reactor technology effort is represented by this graph here and specialized technical training by the other one.

You can see in terms of courses that there were highs in FY91 and '92, primarily related to the interns that were coming through the program, and there's a later graph that shows it even better.

This one shows course weeks. For example, one course, a power plant engineering course that was on a previous slide is a three-week course, so that would constitute three course weeks each time we gave it. It's just another indicator. And again, it shows this peak in '91 and '92, and again it shows the reactor technology course weeks having dropped below specialized technical training course weeks.

MR. JORDAN: And it was a recognition of that knee in the curve that caused us to say we have to reevaluate, have to reexamine our training needs, based on the changing rate of training various groups.

MR. RAGLIN: This one shows instructional hours. An eight-hour course for one person is eight instructional hours. It's a better indicator than students, which is the next graph, because the student count just reflects anybody that went to anything, whether it was a one-day course or a five-week course.

This reflects the time spent by the individuals receiving the training. And again, we've got reactor technology, the top one, and specialized technical training at the bottom. This change that you see here from '90 to '91, and '91 to '92, that's the effect of the special program I mentioned before with reactor engineer interns. Several people were hired in the same general timeframe, and they just flooded the course schedule, and that resulted in a relatively gross number of instructional hours during those two periods.

But again, specialized technical training course hours have come up and now represent more than what we're doing in reactor technology.

MR. LINDBLAD: Let me see what I -- this is the total sum of all employee hours that have been done for the agency. Is this right?

MR. RAGLIN: Yes. For the --

MR. LINDBLAD: So if I add 30,000 and 40,000, I get 70,000, and if I divide that by the agency's

employment, what -- 3,500?

MR. RAGLIN: 3,100 maybe, yes.

MR. LINDBLAD: That says -- what does it say, 20 hours per employee per year is in training on the average?

MR. JORDAN: That's in technical training. The Office of Personnel offers considerable other training, job related, the computer training courses, management training, so for the Technical Training Division that is the portion. There is other training that is on top of that in addition.

MR. LINDBLAD: So we ought to divide this, instead, by the professionals in the organization?

MR. RAGLIN: Another way to look at it --

MR. JORDAN: This is the technical training for the --

MR. LINDBLAD: Yes.

MR. JORDAN: -- professionals.

MR. RAGLIN: About a year or so ago, I just ran through some numbers to try to get an answer like I think you're seeking, and when I counted the number of hours that were being spent and divided it all out, it was something on the order of the agency was spending about 50 FTE on the technical training. It's, you know, a good healthy number.

MR. LINDBLAD: But on the average, an employee

spends one week in training a year, in professional training.

MR. RAGLIN: Maybe on average, but recognize that new employees are spending much more than that, and seasoned employees may not be spending that at all. So it's kind of a gross way of averaging.

MR. LINDBLAD: But that's how we have --

(Laughter)

CHAIRMAN SEALE: It's sort of implicit in the --

(Laughter)

MR. RAGLIN: The other graph shows students. And again, reactor technology is shown here, and specialized is shown here. This can sometimes be a misleading indicator in that a student is counted -- a person is counted as a student if they attend any of the courses that are covered in the syllabus. If they attend two of them, then they're counted twice. And new employees, employees in qualification programs, and so forth, are typically attending many of these courses, so there is a lot of double, triple, quadruple, etcetera, counting in those numbers.

CHAIRMAN SEALE: Just to get an idea of what the future holds in the reactor technology area, just to kind of baseline that, do you anticipate that your outline

requirement for that kind of training is going to hold at about the level it is at this year, or will it drop even further?

MR. RAGLIN: That's a good question that we don't have a great answer for right now. But we have made a number of adjustments in the reactor technology program. We have intentionally reassigned some FTE within the training center staff to work on more pressing things in the specialized area. We have taken into account the reduced registration levels and the fact that some courses have to be canceled due to insufficient registration.

What we have done in effect I think is to cut the reactor technology training program down to about the minimum that can sustain it and support the formal qualification programs that I showed you before. So I think we're about at our long-term capacity in terms of being able to provide the number of courses, and so forth, that we're likely to see for the next few years, absent some other change.

MR. JORDAN: And in fairness, I have to also say that the IG did a recent audit of the training program and found that the initial training, the qualification training, was administered very well and that the refresher training and the additional technical training less so, and so there is a residual of refresher training and additional

training that is a backlog. So since it has now risen on priority, it will show up.

MR. RAGLIN: Needs identification and feedback is very important to us. We have used a number of methods in the past to try to determine what we should put on the schedule, how many of them, what they should be, frequency, and so forth. We relied on these historical trends for a numb of years.

Two or three years ago we knew conclusively that if we scheduled three full series in Westinghouse technology that that would meet the agency needs and that the courses would be relatively full. Changes in the NRC, as with changes in the federal workforce as a whole, makes this historical data of much less value these days, and we have to look elsewhere for our answers.

That's really -- these trends are really what prompted the technical training needs survey, which began in September of 1993. A memo was sent to office directors and regional administrators asking for input on courses that existed, courses that were similar to ones that existed but were not offered, and courses that were needed, whether or not they existed.

And we got a great deal of information from that technical training needs survey. What the needs at that time showed -- now, remember, that was near the end of

1993, the needs survey results told us that the need for what we were already doing was almost constant; don't change anything. And in addition to that, there is these 44 other new course possibilities that we would like to have considered.

So we had a training advisory group meeting and had those 44 proposals prioritized and whittled down and thought of in terms of the overall implications, where one of the implications is the -- what I'll call the cumulative effect of training and the various training courses that are in competition for the time of the people, as well as their regular job function.

When it was all done, there was a certain disposition of these 44 proposals that's documented in the training advisory group minutes, as well as our annual report. Several of them are proceedings. Some of them were put on the back burner, and some of them were actually tabled.

The training advisory group is a group of regional and headquarters managers, typically at the division director level, that advises the training center on new initiatives, provides feedback on how things are going, what we need to change, where we need to change emphasis, and so forth. It served us very well there.

We're also looking for strategic planning from

a different group of agency managers that constitute the Training Advisory Council. These are typically people at the deputy office director level. Dr. Ross is the chairman of the Training Advisory Council.

We also receive user needs from individual offices or regions. One example of that would be a pretty well defined curriculum that was necessary in fuel cycle technology. NMSS provided the user need and we, in conjunction with NMSS, are working to develop that curriculum. Other examples of user needs are some of the PRA course initiatives that will be covered a little bit later.

We also get a lot of good information from counterpart meetings and conference calls, reactor/health physics counterpart meetings, nuclear materials/health physics counterpart meetings, operator license examiner counterpart meetings, and security.

MR. LINDBLAD: What's a counterpart?

MR. RAGLIN: It means those people working in that area, all of the operator license examiners get together to discuss common problems, and so forth, or all of the security people get together. It's a sharing of information. Typically, guidance is provided by the program office for that particular program. Typically, that's where needs for --

MR. LINDBLAD: But it's common that they're all regulators, is that true?

MR. RAGLIN: Oh, yes. Yes. Yes. I'm sorry.

MR. LINDBLAD: And do you meet with industry, do you get invited to industry seminars to find out what industry is training their people to do?

MR. RAGLIN: Yes. Yes, we do. We regularly attend the Society for Computer Simulation conferences, and we regularly attend the ANS biannual symposium on training of nuclear facility personnel. We get some useful information through that.

We also have work groups that are convened from time to time, convened by the training advisory group. One example was the fundamentals of inspection work group, which completely revised the course following the NRC's regulatory impact survey. Another was the manual Chapter 1245 review work group, which reviewed the inspector training requirements about three years ago, three or four years ago. And the most recent is the digital instrumentation and control work group, which is active right now.

And, of course, we get course feedback from every course, as well as soliciting post-course feedback some number of months after the student has attended the course for certain courses.

Okay. With that, I'd like to turn it over to Dr. Arndt for the overview of reactor technology training.

MR. JORDAN: Steve, I hope, will be kind to you and let you move right along.

DR. ARNDT: Oh, absolutely.

Since some of this has been covered previously, I will move along quickly.

My purpose here in this section is to give you a little more details on the reactor technology program and let you know what we're doing to change and incorporate new things.

The reactor technology program covers all four major light water reactor designs, GE, Westinghouse CE, B&W. We concentrate more of our effort on the CE -- or, rather, on the Westinghouse and GE simply because there is more license interest for those plants, and we have more inspectors devoted to those plants.

The core curriculum supports the initial qualification program, as Ken mentioned earlier. A major part of that is the full series course, which consists of a three-week systems course, a two-week advanced course, a one-week general simulation course, and a one-week simulation course specifically devoted to EOPs.

These courses are offered throughout the year. As Ken alluded to earlier but did not mention specifically,

one of the reasons we schedule them is so that people can get through their qualification program. If you're not scheduled, then regardless of enrollment, at least every year or every -- or every six months, we have an unacceptable delay in qualifying.

The curriculum also consists of courses that are generic. That is to say they're not specific to a particular reactor vendor. For example, the reactor safety course that Mr. Jordan mentioned earlier in the presentation which is a general history and philosophy course which covers all the areas and important topics like severe accidents and PRA.

These are offered for various qualification programs or special program. Another one is something like more general things -- like, we offer a course in news media for the news media -- general background reactor technology. We also have initial training and refresher training. Refresher training is -- be discussed in detail consists of the EOP simulator refresher course.

We also have a management overview course. Those managers who do not wish to go through a full series. We talked a little bit more about the reactor technology full series. The first course, as I mentioned earlier, is a three week course. It's 35 hours of instruction per week plus required reading for homework, which usually consists

of -- oh, anywhere from two to four hours per night self study in the evenings -- homework, if you will.

It covers general system design, general operation, instrumentation control and a detailed section on PRA insights. The advanced course, which is a two week course, similar level of effort, 35 hours of instruction per week plus significant homework, includes system interactions, analysis of plant response, technical issues. What I mean by technical issues are any particular issues that are -- that have plant type -- in history.

For example, we'll cover the Browns Ferry Fire and ATWS scenarios and various other kinds of things. Additionally, PRA insights and large portions of course are devoted to analysis of how inspectors or other regulators should interact with the tech specs -- interpretation of the tech specs.

Then the first simulator course is general familiarization and utilization, understanding procedures, affects of equipment malfunction, inappropriate operator actions, general using simulator as a tool to understand how the plant is run.

And the second week of simulation is a week long EOP course which talks about the structure, interfacing, entry condition symptoms -- all the various things that are important for emergency operation for the

plant.

DR. KERR: Do you find this much concentration of exposure to be an effective method of transferring information?

DR. ARNDT: It is -- well, first of all, let me mention to you. Between the courses, there is a break. So, we have a three week course, then we send them home to digest some of this. Then we bring them back a month to a month and a half later for the two week course. Then we send them home and we bring them back later for back to back simulator courses. So it's not seven weeks straight.

DR. KERR: Okay, let me rephrase my question to three weeks straight.

DR. ARNDT: Okay, okay. It is not as effective in an educational point of view as a three hour a week lecture with homework that a traditional educational course would be, because there's not sufficient time to do that.

However, given our limitations -- that is to say, we can only get them for a certain period of time, and we usually have to do -- like to do the training at a remote site so their other job functions do not impinge upon their training. We think it's the best compromise between competing effects.

DR. KERR: A lot of the trainees are ex-Navy, and they're used to that kind of training also, aren't

they?

DR. ARNDT: True, although we did find when we started doing more intensive training of this sort for interns -- that is to say, people right out of college, they did have some difficulties adjusting to the style.

MR. RAGLIN: This is Ken Raglin. I think we've found universally that the students are very motivated to pass the exam. If they're qualifying inspectors, they want to become qualified. If they're going through some other special program like the intern program, they want to be successful, so they're more motivated to spend this outside time than you might imagine.

DR. KERR: It wasn't a question. I mean, I was just curious as to what your experience -- I have done some teaching in which one had students supposedly attending class were six or seven hours a day, and well -- you heard the story about the professor who dreamed he was giving a lecture, and we woke up and found out he really was. (laughter) The students can -- I mean, human beings, it seems to me, have sort of a limited absorption capability, and I just wondered what your experience was.

MR. RAGLIN: It's very tough, it's very intense.

DR. ARNDT: We do have some problems with that. One of the things -- there are several ways we compensate

for that. First of all, we don't use the same instructor seven hours a day for the entire course. We usually have two or three different instructors which have different styles and have different kind of interface.

We also use visual aides, audio/visual walk throughs, graphics -- active graphic simulation in the classroom which uses a different kind of feedback. We try and break it up and give them different -- but it is a concern.

MR. LINDBLAD: Do I understand that your student profile is basically new to the agency, and perhaps still under probation?

DR. ARNDT: More so now than it used to be. I wouldn't say -- less than 50%.

MR. JORDAN: Less so now than while we had a large number of interns.

DR. ARNDT: Yes.

MR. JORDAN: So now it's changing back to --

DR. ARNDT: Yes, it's changing back.

MR. JORDAN: -- very experienced NRC people, but perhaps in a different technology.

DR. ARNDT: Yes.

MR. JORDAN: Let me make one comment --

CHAIRMAN SEALE: Old dogs being taught new tricks.

MR. JORDAN: Yes. One comment about the training environment. For a number of years, the training activity was carried out here in Bethesda, or there in Bethesda in a classroom environment. And the students were there for four, six or eight hours, whatever. And they went home in the evening and also got calls about their particular job.

We did have a step change improvement in efficiency of training moving to the training center and having people captive in Chattanooga, where we could put a pretty good work load on them for after hours reading, and where there was an incentive to pass the course and a -- you know, an atmosphere of -- okay, this is intense for three weeks, and then you can go home.

I believe very strongly that that was a great benefit in not having the day to day work assignment to work with or to prioritize their time. That they're not thinking about their job as project manager or an inspector while they're cramming at the center. So if we keep the course duration short enough that we don't burn them out at the center, my view is it's more effective.

I would be interested in a way for us to optimize this further. If any of you have experience, it might help us.

DR. ARNDT: It is a very difficult trade off

between the various considerations

DR. POWERS: Aren't there now coming available substantiated theories on the way people learn? And doesn't this run counter to those theories? The transfer of information I'm thinking from short term -- the long term memory?

DR. ARNDT: Yeah, I'm familiar with those studies.

CHAIRMAN SEALE: They're not new.

DR. ARNDT: Yeah, there's been discussions in that area for a long time. There's new theories in that area, but it does run counter to the pure educational philosophy in not taking into account the programmatic concerns.

What Mr. Jordan was mentioning is that the programmatic concerns -- although in an ideal world we would love to be able to do it the most effective educational process as possible, there are so many other organizational things like people calling back -- calling you to go and do some other job, it also increases educational efficiency.

DR. POWERS: My note here said that the old way of doing it was like trying to educate foot'all players during the season. They're simply not paying attention. There's nothing else on their minds. I don't doubt that,

but if you're running counter to something very human, then you have to think of some way to come up and save for that as well.

DR. ARNDT: Yes.

DR. POWERS: And when I say substantiated theories, I think unlike -- we've all heard speculations about the way thoughts change now. They have CAT and MRI and scanning techniques --

DR. ARNDT: Oh, yes.

DR. POWERS: -- where you can actually chemically detect changes in the brain.

DR. ARNDT: They have a whole branch of psychology now they're looking for.

MR. RAGLIN: We feel that one of the ways that this is compensated for is through the use of that integrated series of courses where we introduce certain concepts in the first course, and they're reenforced in the advanced course. For example, systems and system interactions. And they're further reenforced on the simulators. So, a lot of material is hit and then hit again and then hit again, and may be hit again to try to drive it home.

MR. JORDAN: But, let me make it clear. We do what we do because of a development that we've gone through, but we're trying to be and are open minded in what

your advice would be. Maybe the advice would be for us to get a suitable consultant that would help us examine the way we teach and the process we go through with the limitations that one has to get it optimized.

Because you know, we are not educators. That is in fact a reality. And some people have more or less experience on the staff in that role, but we really are engineers and inspectors and regulators that are trying to convey what we've learned to a group of people who have at least less experience in those activities.

MR. LINDBLAD: But, I'm thinking of this new work force training act restructured of 1993. If that becomes very popular, and you're required to send health/physics people to reactor technology courses just because they want to go, it seems to me that one of your contingency offerings ought to be to try to get Maryland Community College system or something to develop similar courses here in collaboration with you, so that someone -- an employee, can pursue interests like this without incurring large per diem costs off site. And do it on his own time.

MR. JORDAN: That's a good recommendation.

MR. LINDBLAD: But I think in other parts of the country where there are specialized technology issues like in our community where the computer technology people

do, they work with community colleges or the local universities and colleges to have technical programs which are available to people. But it would be a shame to have to send people off site on full time basis to attend your courses just because they'd like to do it rather than what is in your supervisor and manager viewpoint as needed to be done.

MR. JORDAN: Yes.

DR. ARNDT: Yes, we're trying to develop the curriculum -- continually develop the curriculum the most efficient and effective method. And we generally strive for most effective and efficient --

MR. LINDBLAD: I wasn't talking curriculum so much as venues.

DR. ARNDT: Okay. Let me talk a little bit --

DR. CATTON: As long as you're mentioning venues, what about a correspondence school type course?

DR. ARNDT: Most of our courses are highly interactive and do not lend themselves to that very well. However, some of our courses which are less interactive both with the instructor and the other students --

DR. CATTON: But computers can -- PC's can go a long way to provide the interaction.

DR. ARNDT: Yes, they can.

DR. CATTON: What is -- maybe I'm missing

something. I could see where the simulator is highly interactive, but a reactor technology course -- what has to be interactive about it?

DR. ARNDT: Well, the sheer imparting of knowledge on a particular system or something like that is fairly non-interactive. However, the discussion of how that knowledge is applied in the regulatory process -- for example, the tech spec discussion in the advanced course requires a significant amount of interplay between the various students and the instructor.

DR. CATTON: So it's not very rigorous?

DR. ARNDT: It is very rigorous.

DR. CATTON: Then you should be able to write it down.

MR. LINDBLAD: Structured rigorous is what you had in mind?

DR. CATTON: Well, I guess I'm just missing something.

DR. KERR: Professor Catton is assuming that people can read. There are a few people who can read.

DR. CATTON: Oh, okay, I'm sorry.

MR. JORDAN: No, let me make a point though. What Steve was indicating is that there is a learning that occurs among other regulators who are adding their experience into the course. So the instructor becomes a

discussion leader, and provides some fundamental and basic information. And there is an interactive learning between the members of the class that is very beneficial because of the fairly wide experience gradient among the people that are participating, especially as we go into a retraining of existing personnel to some other skill.

DR. CATTON: I hear the words, but I don't really.

DR. ROSS: All right, then, let me follow up a little bit on that. You're almost in the area of a latter day development, university training of the television/studio type training where some of the students are in the class and some are --

DR. CATTON: I don't like that either, but go ahead.

DR. ROSS: Well, this -- because I've taught these kind of courses, and they're -- and this application -- it's sort of a rich man's correspondence school environment where you have a TV monitor. The lack of interaction either in the reading on your own or being at the other end -- receive your TV style lecture, in this application would be decidedly inferior. Because as we've pointed out, the group interaction -- the group interacting with themselves during this Q & A format is highly desirable.

MR. LINDBLAD: But I'm afraid that -- as I listen to that, I get the impression that part of your instructional ability comes from the students. And that you're looking for the students to teach other students, which makes me a little nervous.

DR. ROSS: I think share experiences would be a better description.

MR. LINDBLAD: Right or wrong experiences.

DR. ROSS: But these are not neophytes.

MR. LINDBLAD: Good or bad.

DR. ROSS: These are people who have observed operating plants before. They've observed turbine driven pumps trip out over speed before. Certainly it's good for them to exchange these type of experiences.

MR. RAGLIN: I think I would classify it as we don't depend on it, but we take advantage of it when it's there. If there's a seasoned inspector with direct experience about what is being discussed, we will take advantage of it.

MR. LINDBLAD: If you can agree that his point of view is the correct point of view. And I guess I'm concerned about probability and statistics in which I know I have a warped view of statistics, because I'm old. And Dr. Lewis told me that many times. (laughter)

DR. ARNDT: Well, I'm not old and he's told me

I've got a warped view of statistics.

MR. RAGLIN: Part of this interaction is also just the sheer number of questions by the students. One thing that may not have come across is that typically for the courses, we have a wide variety of people as the students. It could include people who have as much experience as that of a senior reactor operator.

It could include people who have no experience and are fresh out of college, or people who may have experience in some particular discipline of engineering, but really have had no prior nuclear training. So there are a tremendous number of widely differing questions that is part of the dynamic interactions that the instructor has with the class in each one of these classes.

DR. POWERS: Isn't that a flaw?

MR. RAGLIN: Yes. It's something that makes it very difficult for us, but it's a fact of life for us. It's a significant problem.

MR. CARROLL: I don't know how many times in the teaching I've done, I've had the experience of somebody asking a question and afterwards learning that everybody wanted to ask it, but if Joe hadn't asked that question, we never really would have understood what you were talking about. So I think the interaction --

MR. LINDBLAD: Oh, yeah, yeah.

MR. CARROLL: -- of the group is very important to good training.

DR. CATTON: I think it depends on what it is. And I still -- just listening, am not sure -- when you say a reactor technology curriculum, what you want the person to know. Because the answer I got to correspondence school was you want him to gain experiences.

Then that means you just want to have bull sessions now and then to pass experiences on. There's a magazine they -- a throw away magazine called Industrial Engineering, and in the back of it, they have a section where people write in experiences. To me, I have found that reading that has been very educational. They talk about how they fixed this, how they fixed that, what you do in the different circumstances.

I'm not sure you learn that in a classroom environment unless you very carefully select the students each time you put this course together. Where do you have something for one of these courses where you say this is what we want the person to know when he gets out and this is the best way to impart that information, and are we doing it? I'm not hearing anything about that.

MR. RAGLIN: Behind all of this, there is a network at the training center of lesson plans -- instructor lesson plans which define what we expect the

instructors to cover, what reference material we expect them to use, and so forth. There are also --

DR. CATTON: That comes after. First, where -- there should be some kind of a statement to what this person should be able to do once he finishes your course.

MR. RAGLIN: We have those statements --

DR. CATTON: Then you put together your lesson plan to be sure that whatever you do is going to give this information to them, and that you've got the proper amount of time, you have the proper balance of the experience discussions, or whatever you think you need to do it.

MR. RAGLIN: We have that in the context of what we expect the people to know when they leave us about that particular reactor technology. There are leaning objectives for each of the modules.

We have not extended it to the point how we expect them to use this information when they're in their particular job, because there are a number of different job functions that are coming to the same courses. But we do in fact have fairly detailed learning objectives for each of the modules.

DR. CATTON: I think I'd find it very helpful if you pick one of these courses and showed the path from concept to implementation. Because I kind of lose it in a lot of the words. Sometimes the discussion I'm hearing

sounds much like a friend of ours who teaches first grade. They're using the same kinds of descriptives that you're using, and I find that a little unsettling, actually. Anyway, this might be a singular view.

DR. ARNDT: To mention one thing that I heard before this discussion got going, we are continually reevaluating venue and technology presentation, and we are indeed part of the early pilot program for getting video conferencing and video teaching available for those courses that we determine are best suited for that kind of course.

DR. CATTON: I'm not sure I like video conferencing either, but that's just been -- they actually tried it at UCLA at one time and it was a failure. It turns out the students who were in the classroom where they guy is lecturing sort of pay attention, but in the other room, they're all asleep or some diddling around in the back of the room. It doesn't work out too well.

MR. LINDBLAD: It needs lots of homework.

DR. CATTON: Yeah.

MR. LINDBLAD: If you have enough homework, you don't need the class

MR. JORDAN: At the risk of sounding defensive, which I said I wouldn't --

DR. CATTON: No, I'm just throwing these out and I'm actually making statements that are beyond what I

believe myself just to hear your answers. (laughter)

MR. JORDAN: Thank you. The ideal that we have would be to do a job and task analysis for the particular activity. Let's say you're a licensing project manager. We do a job and task analysis for that particular position that would then from it develop the learning objectives that would be necessary in the course. Build then a course around those.

We have done it for a limited number of courses in -- and that would be, I would say, the most rigorous thing that happens. Other courses have evolved over years by using the feedback from the instructor -- I'm sorry, feedback from the students that participated, and feedback from the supervisors who get these people back. And then feedback from industry that says -- through the regulatory impact surveys that -- inspectors come to our site without a good understanding of enforcement, or whatever the activity is.

So, this thing has evolved over a number of years. We're kind of now at a threshold of saying okay, how can we do things more effectively? We have not adopted computerized training except for pretty much cookbook canned things. For instance, the requalification for personnel to have site access is on a computerized learning scheme.

And so, you can go to the computer and you can requalify to get unescorted access at a reactor facility. But in terms of teaching emergency operating procedure implementation at a plant, I can't imagine doing it on a computer in that fashion.

So, there is a whole range of courses that -- we're searching also for which is the best combination to use. We have under consideration now a video training link that do -- for the revision to the training center, will have a studio as one of the potential classrooms that we would be able to transmit courses back to some location here in Bethesda -- in Rockville, excuse me. I keep being in Bethesda.

So we're looking at those, and we're really looking for advice on what kind of a mix should we be driving for in order to be able to do the most effective job. Another for instance limitation we've learned in addition to the pretty wide gradient among the students in a given class, is that now we have the situation where the regions for instance, need a frequency of providing a particular course that -- in order to improve their efficiency for inspection that causes us to be inefficient in teaching because we may have a class of only 12 people that is developed from the four regions that's inefficient for us to teach.

But it's very efficient for the regions, because they don't lose too many people at one time, and have a crippling of their inspection program. So, our list of limitations is remarkably long. Yes, sir?

DR. CATTON: A classroom of 12? That sounds good to me.

CHAIRMAN SEALE: And I think it would be worthwhile though for one or two of the technical courses, where you have done an assessment of learning objectives and then done a detailed lesson plan and all that sort of thing -- would be worthwhile if you could at some point in the near future, we could -- some of us could take a look at that.

MR. JORDAN: We'd like that.

MR. JORDAN: It would tend to mark -- it would give us a --

MR. JORDAN: Give you a benchmark.

CHAIRMAN SEALE: At one end of the spectrum.

MR. JORDAN: Yes.

CHAIRMAN SEALE: And perhaps it would also be worthwhile to look at one of these courses --

MR. JORDAN: We'll give you both ends.

CHAIRMAN SEALE: Yes, where you've actually built the courses as a result of the cumulative feedback from students and supervisors of students and so on. We

can look and see what the differences are.

MR. JORDAN: We appreciate that.

CHAIRMAN SEALE: One other comment I'd make --

DR. CATTON: I can tell they've never been before a courses and curriculum committee.

CHAIRMAN SEALE: Yeah, actually there's a -- well, at least in some part, they're tougher. But one of the things that gets to be interesting in this is that -- you know, whether you know it consciously or not, one of the reasons you can teach people 35 hours a week of contact and not have them transported out in coma at the end of ten or 15, is because you have the diversity of people that -- with diverse experience in the class, some of whom are clear role models for the other people in the class.

And that's what holds their attention span. The interesting question is whether or not you actually seek to have those mixes when you decide -- when you pick the people or respond to the applications of people to be in some of these classes. You really do need the diversity.

MR. JORDAN: Yes. The only course that I know we've done that actively is the course that I talked about earlier on safety. We seek a graybeard or two to come in and have lived through the TMI experience, or that have revolved in review of the Browns Ferry Fire to add

credibility to the instructors. And for instance, Haskins has taught some of those for us, so there is a real intent there that -- maybe that's another suggestion that would be beneficial that we add in a mix of experience.

DR. KERR: How big are your classes?

MR. JORDAN: Up to 24.

DR. KERR: Ideally, this core model however should be the instructor.

DR. ARNDT: And one of the things we consciously do is have two or three instructors per class to give different kinds of role models.

CHAIRMAN SEALE: The instructor can't be a second class citizen, that's for sure.

MR. LINDBLAD: You know, all the focus and the discussion today has been on what is being broadcast, what's being transmitted. And we really haven't talked about what is being received or absorbed. And it would be interesting to hear how rigorous your examinations are and whether your tests are comprehensive or not.

And Jay and I know that in the industry, test giving is a big business these days with random questions regularly rotated so that no one has last week's quiz. And I suppose the same type of test giving is happening is your shop as well?

MR. RAGLIN: Yeah, I think pretty much the

case. We do have a computerized exam bank system which has exam banks for the different areas. And we do have automatic generation or manual generation of exams. So we can ensure that on a particular course exam, we could give an exam that hasn't been given before. What we can't prevent is students getting previously given exams and studying those exams.

DR. CATTON: Nothing wrong with that if they're good.

MR. LINDBLAD: Are you exams mostly objective or are they subjective ones as well?

MR. RAGLIN: Mostly subjective. Essay answers, they're -- depending on the course, some of the front end courses have some multiple choice exam questions or mostly multiple choice. But for the exams that are part of the full course series, they're mostly essay type.

DR. KERR: You know, one way of avoiding this chore of hitting the right new exams is to use the same exam over and over but change the answers. (laughter)

MR. JORDAN: I think they already accused us of doing that.

DR. POWERS: I think that's what the utilities claim the license inspectors do.

DR. ARNDT: Let me finish the reactor technology program by talking a little bit about some of

the things we are currently changing or improving in the curriculum. The first two bullets there are the GE curriculum modifications and Westinghouse curriculum modifications.

As I believe we mentioned earlier, we are in the process of starting to use our boiling water reactor four simulator, which is replacing our boiling water reactor six simulator. The integration and changing of materials to support this integration is a major project. We're also taking this opportunity to go back and look at all our curriculum while we modify it and update it, improve it, change the teaching style where we feel appropriate.

We're doing a similar function for the Westinghouse curriculum modifications to the Trojan plant. Additionally, we are undergoing a major change in the way we teach tech specs to enhance the course and the examination methods to make it a more performance based instruction.

The enhancements include implementation of case studies, classroom developing the open book examinations for tech spec case studies, and trying to make the curriculum more based on natural job that the inspectors will have in interpreting the technical specifications.

Also, we are integrating the nuclear

engineering work station simulator, acronym NEWS, into the curriculum as Mr. Carroll saw while he was down there. The nuclear engineering work station simulator is a work station based simulation program designed for classroom use. We have specifically designed the interface -- machine interface for classroom application.

It consists of various kinds of displays, some of which are designed to teach particular specific concepts such as interactions with components with each other and things like that. In which case, P & ID's or component logic diagrams or whatever are used. Some cases, it's used to teach systems integration and broad plant performance, in which case the plant mimics and things like that are used.

It can be used either in real time or in a play back mode. We've also developed several less high fidelity mini models to simulate particular responses of particular systems, and we're using that very extensively for complicated subsystems such as the over power delta T calculators and things like that.

Beginning in September of '93, we've started integrating this into the curriculum classroom, and we find it very useful for teaching difficult concepts, particularly for the less experienced individuals such as system integration and walking through various component

activation sequences and things like that.

The other major point I wanted to mention is the PRA additions. One of the PRA working group recommendations was that the PRA training should be included as part of systems training. And that systems training should be included as part of the PRA training.

The PRA work group went on to recommend that insights be taught as part of the curriculum training. As Mr. Jordan mentioned earlier, prior to the work group -- as a matter of fact, as far back as about eight years ago, we had a PRA training program that taught things, and we also had as part of the reactor technology program, some PRA work.

In the last year, we have considerably increased the amount of PRA we teach as part of the reactor systems technology courses. As an example, in the systems course, the first three week course, we have a lesson plan on PRA that familiarizes them or refamiliarizes the terms and basic methodologies.

Then, as part of each of the systems discussion, we talk about the insights, the risks significant to that particular component. For the advanced course, we select and choose the various kinds of issues that we have based on risk significance.

In a similar way to the way that the -- well,

the licensing group chooses which scenarios they're going to teach, test on based on the risk significance of those courses.

DR. KERR: What do you mean by the risk significance of a component or a system?

DR. ARNDT: Well, as part of the curriculum for each system -- say for example the reactor technology system, we will discuss based on an IPE or a PRA what the relative importance of that functionality is using one of the risk importance measures.

DR. KERR: What is a risk importance measure then?

DR. ARNDT: Well, risk reduction factor, for example. Or core damage frequency -- the percentage of --

DR. KERR: Okay, so you're most likely to use contribution to core damage frequency rather than risk to an individual or a population?

DR. ARNDT: Yes, more likely. But we use other indicators as well. The point being, that we want them to understand the system in terms of risk and -- tools in terms of the system, and not divorce them. That they should be an integrated type curriculum. We also go through various events briefings, generic letters, NUREGS, and things like that such as the precursors to potential sphere accidents, NUREG, and documents and research like

that.

DR. CATTON: Where in this structure do these people learn about equipment reliability and the relationship to maintenance?

DR. ARNDT: There is not --

DR. CATTON: You sort of jump from technology to fancy words like PRA. Where is all the glue that goes in between?

DR. ARNDT: Okay. Things like importance of maintenance and things -- and what is necessary to look at for reliability --

DR. CATTON: But first, it's the reliability and its relationship to maintenance because it's maintenance and things like that that you're going to be inspecting.

DR. ARNDT: Right. Those kinds of practical level issues are included in the PRA insights course that all the inspectors are required to take as part of their --

DR. CATTON: Yeah, we have at UCLA a fellow named Apostalakis which probably helped you guys in many things. And one of the things that he did, because he just couldn't get students to work in the area, was he initiated an undergraduate course that is really reliability. Because reliability is the basis for a lot of what you do in PRA, and I don't see it. Maybe you've got it and I just

don't see it, but --

MR. JORDAN: We certainly are working very hard in that area. One of the things that we're doing, and I think we mentioned it in the October briefing, is the agency is looking at obtaining reliability data for those important pieces of equipment. We have at the system level based on failures, the overall reliability cross industry of auxiliary feed pumps, etc.

DR. CATTON: I'm talking about something a little more fundamental than that. Just a basic course in reliability and maintenance.

MR. JORDAN: What's in that course?

DR. CATTON: We don't have one.

MR. LINDBLAD: No, we're asking is it a numerical reliability or is it be sure to grease the pump?

DR. CATTON: It's how many times will a pump fail if you don't grease it.

MR. LINDBLAD: Okay, so it's the numerical reliability issue?

DR. CATTON: I think so, because PRA means numbers.

MR. LINDBLAD: Right.

DR. CATTON: And one of the things we see here all the time is that the numbers that they put into the PRA sometimes are randomly selected. And you need, I think, to

establish in the thinking of the person who's going to do that sort of thing, an understanding of what these numbers are all about and how to feed them into the PRA.

MR. JORDAN: Yeah, we're speaking of the same song sheet.

DR. CATTON: We are?

MR. JORDAN: Yes, sir. It is a fundamental that we're able to derive from what's happening at plants -- what kind of reliability we're achieving with their maintenance programs. The maintenance rule does not in fact require reporting of that data presently. The staff is -- has initiated rule making in order to obtain that on plant specific basis -- at the train level, so that we can assess it -- we are --

DR. CATTON: But you need to --

MR. JORDAN: -- meeting with our inspectors on the need for their focus on maintenance for the purpose of improving reliability. And we do know the effects of poor maintenance on -- we picked the auxiliary feed water system -- then we can in gross detail explain what constitutes the failures. You know, the steam driven aux. feed system which is more or less reliable than the motor driven aux. feed system.

The over speed failures are the most frequent. The over speed failures are driven by the woodward

governor, and the woodward governor problems are based on both design and how well it's maintained -- steam admission valves, and so on. We've got that in great detail.

What we don't have yet is, for a specific plant, what level of reliability are they achieving on individual components, nor do they collect it in a fashion that makes it available for reliability. But we do convey it to the staff what elements of maintenance --

DR. CATTON: We're talking -- but I'll just reiterate one more time, our particular in house PRA type came to the conclusion that engineering schools across the country don't do a good job in this particular topic. They don't have a course for mechanical engineers usually in reliability. So you get statisticians who don't understand the machinery to do it for you.

So he instituted such a course, and it seems to me that that's missing. And when I asked about it, you start telling me all about reliability of plants and so forth. I'm talking about something more fundamental. Understanding of what reliability means, not numbers derived from plant data. I mean, that's certainly how you get the number, but what does it mean and how do you get it or what do you do with it? And what can impact it?

Like change the temperature that your feed water pump is operating at, this can have an impact on it.

Changes in the temperature of the water that's going through it relative to saturation. These things can all impact.

MR. JORDAN: Okay, I thought we were in synch when I was describing to you how the aux. feed water system --

DR. CATTON: Well, but then I lost it, because -- but maybe we are and I just don't understand.

MR. JORDAN: Okay.

DR. KERR: What you will conclude Ed, if you've listened to this group, is that PRA includes everything -- it probably does. And that you can't learn it all in three weeks. And you finally probably decide that before you let somebody into this course, he or she has to take a marriage vow to love, honor, and cherish PRA for the rest of our natural life.

MR. JORDAN: Let me -- a conversion before the deathbed, I hope. The march staff, and Steve is one of those people who was converted before, and is carrying forward with the training center that will -- we have a -- and the committee has been briefed by the PRA working group work shop last week, an industry invited public work shop for discussion of how the agency can better apply risk assessment technique where the limitations are.

We are clearly trying, and I'm still fishing

for where we should go further. I would be interested in George's course in reliability. Maybe there is something there that we should be applying in our program. We certainly have worked with him in the past, and I have a strong appreciation for his activities.

DR. CATTON: Well his view is that the basic elements that have to go into the PRA are just not -- and the engineers as trained in this country today, just don't get that particular piece of knowledge that's needed.

MR. LINDBLAD: Steve, what does the curriculum tell the students about implementation of the safety goals?

DR. ARNDT: There is a discussion in the overall area -- the insight, the basic, that discusses the basic principles behind the safety goals. But it does not give an extensive discussion of it. Just to try and close out this issue of reliability, I agree with you that we do not hit that as strongly as we might should.

The kinds of things that are in the insights chapter -- I went back to my chair and got some of the examples -- would include a short discussion -- this is the general effort, reactor safety system, and I will read in part -- it basically discusses that the reactor protection system is major contributed to the ATWS cut set sequence.

It discusses briefly how the things fail most predominantly. It discusses very briefly the primary

failure mechanism for this particular PRA was a mechanical failure. It discusses briefly what that particular number is within context with the others, and then it references that the failure probability -- this particular one was derived from the numbers in NUREG 0460 so the student can go reference where that particular thing came from.

And then it just happens to -- and it mentions the relative risk reduction factor for this particular system. So it's not extensive. It does speak to the major areas.

DR. ROSS: Ivan, one more point. Another portion of AEOD are risk and reliability efforts. Point number one is, they have on a consulting arrangement, the more or less regular services -- Professor Mosely at the University of Maryland, about ten miles from here, who's also fairly well published in the reliability area. Along that line, we are in the process of writing a large number of reports, each of which deals with the reliability of a given component or perhaps a single train function.

We're well along way to publishing reports on the RCIS, high pressure core injection, high pressure core spray, air operated valve, solenoid operated valves, operated release valves, code safety valves, just to list a few. And in each case, we're examining anywhere from five to 20 years operating history of these. How did they fail?

When did they fail? Where did they fail? And then, what statistical or reliability inferences can be gathered from this information.

I think what you're saying is if you could see a sample of these reports, you probably will say yeah, that's what I had in mind, now how do you teach it?

DR. CATTON: That's right.

DR. ROSS: So, I'd like -- I think we can do the first part. We can give you a representative sample and then await your reaction and say yeah, that's what I had in mind, how are you going to teach it? So why don't we make that offer, and -- it will probably be a month or two before we can give you a few samples, but we'll be glad to do it.

DR. CATTON: Okay.

DR. ARNDT: Okay, Mr. Anderson will now go.

CHAIRMAN SEALE: Before we do that, the timing situation, I think, is a physiological problem for some of us. (laughter) Plus the fact that I need to walk around and kick something or my knee stiffens up on me. And so, I'm going to say let's get back here at ten minutes after. And I will also point out that we're two presentations behind on our schedule, and I must say that I don't think it's the fault of the people from AEOD, but it's a very interesting topic, and so maybe we will defy Kerr's law

here.

(Whereupon, the proceedings went off the record from 2:55 p.m. until 3:10 p.m.)

CHAIRMAN SEALE: I promised we'd start at ten after and by golly, the witches are here.

MR. ANDERSON: My name is Russ Anderson, I'm the chief of the specialized technical training branch at the technical training center. I basically have been told that I have no time for this presentation. So, we'll make it quick. I'll be showing some several example courses in each of these curriculum areas. If you have questions about particular courses, please ask me, but I'm not going to dwell in depth on any of the courses.

The TTC syllabus currently lists some 91 courses in the specialized technical training area. This area has grown considerably since the mid '80's, expanding in response to anything the agency needs. The courses are divided into six curriculum areas, PRA, engineering support, radiation protection, fuel cycle, safeguards, and regulatory skills.

Larry Bell will be talking about PRA here in a few minutes, and Steve Kosceilny will be talking specifically about digital I & C. What I'd like to do is discuss in the following slides an overview of the remaining areas of the specialized technical training

curriculum.

This slide shows an instructional hour trend by breaking down into each of the curriculum areas. A couple of the areas have only specific points, namely the PRA curriculum because it's new to us in 1994. And the fuel cycle curriculum because it's also a new area for us in '94. Both of those areas will tend to increase in instructional hours over the next couple of years as we add new courses to the program and as the PRA implementation plan is developed.

If you look at the graph here, you'll see for example, in the -- particularly in the reactor health/physics area, we've had considerable growth in radiation protection in general since 1987. That's primarily due to the fact that we made some significant improvements to both the reactor and the materials training programs back in that time frame.

We've brought on line several new courses since 1989. And in 1989, also saw the implementation of site access and site access refresher training requirements for headquarter personnel. The training has peaked in the 1992 time frame primarily due to a lot of part 20 training that we've done since that time.

In '92, '93 and '94 we've done a lot of training, not only for NRC personnel but other government

agencies having to do with changes in the new part -- part 20. We've probably peaked in the radiation protection area, but it's likely going to stay fairly high over the next three years as agreements state personnel start attending more TTD courses.

Overall, the engineering support curriculum has been relatively stable for around '87 through '94. We're seeing a decrease now as people are catching up with training requirements, and as the agency's hiring practices have fallen off.

We peaked back in the '92 time frame as we brought on line some new courses in motor operated valves and emergency diesel generators. We're catching up on attendance of personnel of those type -- that type of training now, and training is starting to trend off. It's probably going to increase slightly in the future, particularly as we get into new areas such as digital I & C.

Safeguards training is a relatively small part of the overall training curriculum. It remained relatively steady, and will likely do so in the future. We peaked back in the '89 time frame due to some very specialized courses that were presented for safeguards inspectors during that time.

The regulatory skills training shown by the

circles -- open circles here, peaked back in the '88 and '89 time frame when we added some new courses on performance based inspection. And about that time, NRR implemented new training requirements for operator licensees and examiners.

That training is trending downward right now, but I expect that in reaction to such things as the Tower Perrin report, that we'll probably see a slight upward trend in the future in the area of regulatory training. The engineering support training curriculum has its origins back in the reactor construction program. Many of the courses were originally developed to train construction resident inspectors.

Others were developed to train regional based specialized inspectors. Now the curriculum provides mostly supplemental training to support a variety of inspector disciplines. You see some of the inspector disciplines up here. The operations inspectors, as Ken mentioned earlier, are either resident inspector types or regional based inspectors who specialize in operations.

Engineering support inspectors include specialists inspectors in areas such as I & C electrical, welding, non-destructive testing, and so forth. The reactor construction resident inspectors are also addressed in this area, although at present time, I think we may only

have one or two people still around with the title of construction resident.

A lot of NRR inspection personnel attend courses in this area, as well as people from NMSS involved in inspection of transportation packaging. Some of the courses that we offer in this area are courses such as the power plant engineering course that Ken mentioned earlier, that's a three week course that emphasizes the practical aspects of nuclear power plant operation.

Topics range from reactor physics to thermal hydraulics to motors, generators, electrical distribution, process instrumentation, nuclear instrumentation, and radiation protection. We brought the motorized valve actuator course on line several years ago, and that's proved to be a very popular course.

A lot of training has been done in that area in support of the generic letter 8910 initiatives. The welding course is a practical oriented course pointed towards welding technology as applicable to fabrication and construction at nuclear power facilities.

Steve is going to be talking about digital I & C later, but as far as new initiatives in this area, we've got a new course that we're bringing on line in the March time frame that's going to be a course that will provide an overview of welding and non-destructive examination

technologies for NRC technical managers.

DR. SHACK: Do NDE inspectors end up at the EPRI NDE center for things like performance demonstration? Is this basically theoretical sort of stuff or sort of a background?

MR. ANDERSON: Well, it depends on the background of the students. We might send people to EPRI courses on an individual basis. We've worked with EPRI in the past. For example, when the BWR intergranular stress corrosion problem first surfaced, we went to EPRI for some training of people in that area.

DR. SHACK: But presumably, you don't maintain the same kind of library of cracks that they do for performance demonstration sort of things?

MR. ANDERSON: No, no. Our people are basically -- we're training our people to look over the shoulders of the licensees and the people hired by the licensees doing the inspections, and be able to ask the pertinent questions about why something -- what is this showing me? You know, why did you do it this way, that sort of thing.

Also as part of the need survey, we're investigating --

DR. KERR: What does an inspector do with that information?

MR. ANDERSON: They'll feed that back -- information back into their inspection reports. Our region one office, for example, has a mobile NDE van where they can actually go out in the field and do such -- radiography and some of the basic NDE tests as a back up to tests that have been performed by licensees.

DR. KERR: So in effect, the resident inspector is supposed to be able to judge whether they're doing a good job?

MR. ANDERSON: No, residents don't typically attend this training. This is specialized -- this is generally training for specialists. Some residents will attend the training with the idea of being able to know who to go to for -- to get an expert answer when they need to.

DR. KERR: Okay.

MR. LINDBLAD: Well, doesn't leave the certification as examiners?

MR. ANDERSON: No, no, no.

MR. LINDBLAD: But your mobile van must use certified inspectors?

MR. ANDERSON: Yes, they do. They use certified contractors to support their work.

MR. LINDBLAD: So this is just part of the infrastructure of report writing and overview of activities?

MR. ANDERSON: Right.

MR. JORDAN: But it isn't a judgement of the utility program. Let's say it's a -- a utility is doing an inservice inspection and it requires doing an examinations radiography on whatever -- a particular wells. The personnel -- the NRC personnel who are overlooking that have to have sufficient knowledge to understand that the utility examiners are using the right codes and standards, are qualified, have experience, and in fact are capable of finding flaws where they exist.

So there is a judgement that's made, and in some cases there's a finding of inadequacy on the part of a utility program.

DR. KERR: So this requires a fairly high level of sophistication --

MR. JORDAN: Yes.

DR. KERR: -- on the part of the inspector?

MR. JORDAN: Yes, it does. And so, the object here is to give them enough hands on experience to complement their own personal experience and background, to allow them to make judgements about an activity the utility is doing.

DR. KERR: So on some occasions, they may tell the utilities, start over, you're not doing it right?

MR. JORDAN: Yes, sir. And I have to say it

was the NRC that caused the bank of flaws to be developed to start with, and I was involved in that process when the BWR pipe crack episode occurred where the examiners -- the inservice examiners that the utilities were employing -- contract personnel -- and they were using drill holes and solid pipes to try to find cracks.

That was pretty silly. And so, the process has gone a long way. Yeah, that's what the code required. The code was inadequate at the time. And so it is being able to make those determinations and feed back through the code process and faster where appropriate. I mean, each one of these steam generator flaw mechanisms that we've had, is a learning process for everybody involved.

Though from thinning to various cracking and fatigue problems, one has to get in step and apply an inspection program that will find flaws where they exist. And so it's having NRC people that are capable of making those judgements. Hey, this isn't working, or that it is working once it's been developed.

So it is a very on going program, and it does require retraining to the current techniques.

DR. SHACK: But do you do that training or do you really depend on --

MR. JORDAN: No, we --

DR. SHACK: -- the NDE center to do that?

MR. JORDAN: We get contractors to provide the hardware and hands on side of it, and a contractor to provide the actual training. We don't develop internally that skill. I mean, for instance, Westinghouse has a very sophisticated program for doing steam generator inservice testing. And we urge industry to use the best available technology when a new failure mode occurs. And then we train our people in it.

MR. ANDERSON: I think that one thing to point out is that Ken mentioned earlier that -- particularly in the specialized technical training area, we contract most of our training. Particularly in courses where a very specialized knowledge is needed in order to present the training.

I might add that in this engineering support area, we are currently working with NRR to provide some training and support of the service water functional inspections that are coming down along the line in EPRI. They likely will be included as part of that training.

As I mentioned a couple of minutes ago, we started a very aggressive program to upgrade training in the radiation protection area back in the 1988/'89 time frame. Since then, we've hired three health/physicists to support this training. Two of those personnel have doctorates, the other has a master's degree. Two are fully

certified by the American Board of Health Physics, and the other should complete his certification in 1995. We currently have a curriculum of 28 --

MR. LINDBLAD: Did they have power plant experience as well?

MR. ANDERSON: Some of them did, yes. Basically, I have a senior health physicist in the materials area that came out of the Air Force medical program, and the other two health physicists both have reactor experience.

MR. LINDBLAD: Reactor or power plant experience?

MR. ANDERSON: Power plant. The curriculum of 28 courses has evolved to meeting NRC inspector needs. Basically, the inspectors who we train right now in this area include reactor and materials, health/physics radiation specialist inspectors. Some fuel facility specialist inspectors, and as I mentioned a few minutes ago, agreement state inspectors.

We expect considerable enrollment in this area as we start training more agreement state inspectors. Some of the key courses in the radiation protection area include the applied health physics course which is a five week course given by Oak Ridge Institute of Science and Education that we use as an introductory level course for

people without much of a health/physics background.

It's also used extensively by agreement states to -- as a first course for training their personnel. The actual training that we do in house for health/physics starts with a health/physics technology course. This is a two week course taught by my staff that provides a working understanding of health/physics fundamentals applicable to NRC inspectors.

And it's really intended -- like I said, to be the first course attended by a health/physics inspector. And after the inspectors attend the health/physics technology course, they go on into other specialist courses depending on what particular inspector discipline they're involved in.

These include courses such as environmental monitoring, diagnostic and therapeutic nuclear medicine, teletherapy and brachytherapy, safety aspects in industrial [illegible] phy, radwaste management, and a course that we call t[illegible]lth/physics topical review course. This is a course we utilize as refresher training course for health/physicists.

We change the topics in that course on a rotating basis about every 18 to 24 months in order to provide the HP's with current information. For example, a couple of years ago we did a round of training that had to

do with instrument use and calibration.

We're currently getting ready to do a new round of training that's going to address new areas in teletherapy and brachytherapy, particularly high dose remote after loaders and gamma knives and that sort of thing.

DR. CATTON: What is teletherapy?

MR. ANDERSON: Teletherapy is the use of a source -- external source such as cobalt 60 to treat cancer. Brachytherapy is basically similar in purpose, but it -- brachytherapy generally involves the insertion of sources inside the body for treatment of various types of cancer.

In response to the need survey, we're developing a couple of new courses in this area. One is going to be an introductory health/physics course that's going to be a five day course intended to provide a basic understanding of health/physics and radiation protection principles for general NRC staff.

We're also developing a health/physics technical manager's course that's intended to familiarize NRC managers and supervisors with important radiation protection issues and hazards encountered in various areas within the nuclear industry. We'll be discussing both power and non-power reactors, industry radiography, medical

issues, fuel cycle issues, gamma irradiators, and so forth.

MR. LINDBLAD: And how long a course will that be? It seems -- what I don't see is a power plant source term course. And where does the health --

MR. ANDERSON: Part of that is picked up in the radwaste course. The sources of radwaste from a power plant perspective are picked up in that course.

MR. LINDBLAD: But that deals with maintenance problems and power plants and reactor water chemistry and --

MR. ANDERSON: It basically deals with the sources of processing and storage of waste that originate in a power plant.

MR. LINDBLAD: And steam generator inspections?

MR. ANDERSON: Steam generator inspections are really dealt with back in the engineering support curriculum in terms of any current testing courses and that sort --

MR. LINDBLAD: The exposures -- the source term --

MR. ANDERSON: Source term exposures and that sort of thing are discussed. We discuss some of that type -- those types of things as general issues in this HP technology course.

MR. LINDBLAD: Thank you.

MR. ANDERSON: An area that is new, at least as a curriculum title, is the fuel cycle training area. This area is rapidly growing as response to action plans to revise regulations such as 10 CFR part 70 and 10 CFR part 40. Also, we've been actively involved in this area as a result of the 1986 accident at the Sequoyah fuel facility, the potential criticality incident at GE Wilmington in 1991, and the transfer of oversight responsibilities for the gaseous diffusion plants from DOE to NRC.

In October of 1993, NMSS sent us a memo that is the fuel cycle safety and safeguards division of NMSS, requesting us to start work on a new curriculum that would consist of nine courses. We are currently actively involved in developing seven of those nine courses. The other two are being developed by NMSS.

This is a new curriculum and targeted for fuel facility inspectors, license reviewers, headquarter staff, and other personnel that have regulatory oversight over the fuel cycle facilities. NMSS has a lead on revising the inspection manual 1245 to incorporate the new training requirements.

This next slide depicts the nine courses of the fuel cycle curriculum as they will be grouped and they're revised -- inspection manual chapter 1245. Of the nine courses, four are being established as required initial

training. Three others are being established required within two years of certification. And the remaining two courses are supplemental or specialized courses.

Scheduled presentation dates for the seven courses which have been established at this time are indicated on the viewgraph.

MR. LINDBLAD: I remember when a similar thing was observed in the reactor technology -- reactor inspectors, required within two years of certification, and the answer was well, we already had an established inspection group, and so we needed to get them qualified and would come back later and do these other things. Do we have an established fuel cycle inspection program?

MR. ANDERSON: There are people out there doing fuel cycle inspections. Most of those people have not been through this rigorous of a training program. I think there's also trade off of --

MR. LINDBLAD: But I don't think mechanics of sampling and measurement would be basic to the initial training.

MR. ANDERSON: I think it came down to a program office trade off of what courses did they think were specifically needed to get the inspector to a point where they could let him loose independently to do some useful work within a given time frame, and then catch up on

some of the other courses later. It was a value judgement by the -- you know, the people who designed the curriculum as to what -- you know, which part of this thing came first.

MR. LINDBLAD: But will they be permitted to do inspections before they take the course on sampling and measurement?

MR. ANDERSON: Yes. They would take these required courses, then they'd go through an oral certification process similar to what Mr. Raglin pointed out earlier. Then after they completed that process, they'd be required to catch up on these courses.

MR. LINDBLAD: Somehow, that seems more important to me than general health/physics, but you asked for my comment, and that is what it is, I guess. (laughter)

MR. ANDERSON: As Mr. Raglin said, we respond to needs. The program office has set the standards, and we provide the training the way they would like us. As I mentioned, the safeguards training is a very stable area. Because of the low number of people working in this particular area, we rely heavily on courses contracted through other government agencies or presented off the shelf by other government agencies such as DOE Central Training Academy, the Army and so forth.

Typical students include physical security

curie inspectors from the regions and NMSS, and the material control and accountability inspectors which are currently headquartered as part of the NMSS program. Courses range from physics security system courses that discuss basic aspects of physical security including definite defining threats, analyzing targets, detection of intruders both internally and externally, and entry control and responses from security forces.

We offer some weapons familiarization courses that introduce NRC people to the type of weapons used by licensee security forces as well. And we also offer some refresher training courses in this area. The neutron assay of nuclear materials course is a course representative of the type of training attended by MC & A inspectors.

For the most part, the assay type courses are presented through Los Alamos National Laboratory. We're currently working on an agreement that will get us support from the CIA for security training, and allow us to use some other their facilities for training of our personnel.

MR. CARROLL: That almost scares me when you say that, but okay.

MR. ANDERSON: Well, I learned to have a new respect for one of my staff members after he attended that weapons familiarization training, because when he came back from the training, he immediately posted one of those

targets that you see in the FBI type training -- you know, the bad guy target? And this thing had a 12 gauge shotgun solid shot right between the eyes. So, he claimed that he was the one that had done it, so --

DR. POWERS: I wasn't the one he was shooting at? (laughter) Nevertheless, it should have an effect on his evaluation.

MR. ANDERSON: The regulatory skills training area is sort of a catch phrase for a lot of what you might think as sort of softer training. It's not real technical training, but it is training that's very essential to how an inspector performs his job. Every inspector of the 17 inspector disciplines that Ken mentioned earlier attend some -- at least one or more courses in this area.

These courses help prepare inspectors for the non-technical aspects of their jobs. That is, they supplement the OJT and the self study activities the inspectors do as they complete their qualification journals. We try to emphasize inspection and examination techniques providing philosophy and techniques that enable inspectors to perform their inspection activities more effectively and more thoroughly.

The fundamentals of inspection course is probably core to this area. It's attended -- it's required training for every NRC inspector. Basically, we try to

provide an understanding of the inspection program. We discuss the regulatory environment, professionalism, ethics, the inspection program and environment quality principles, inspection planning and performance, preparation of inspection reports, allegation management, and the enforcement program in that course.

Inspectors are required every three years to attend a one day refresher course where part of the time will be spent discussing topics from the original course. The other part of the topic will be discussed by senior level NRR and NMSS managers discussing their expectations and current issues.

MR. CARROLL: That sounds like one that's ideal for video conferencing instead of hauling people to Chattanooga.

MR. ANDERSON: Well, we don't haul people to Chattanooga that -- generally speaking, that -- and a lot of these courses are presented at the location in the regional office or headquarters. Courses that require specific facilities such as NDE or welding have to be held someplace, but fundamentals of inspection type courses and a lot of these courses can be held at the regional location.

DR. CATTON: What are fundamentals of inspection?

MR. ANDERSON: How to behave as an inspector, how to communicate in a non-adversarial manner with the licensee.

MR. CARROLL: You know, the guy that used to come in and sit down in your office and put his feet on your desk?

DR. CATTON: They don't let them do that anymore?

MR. CARROLL: No. It's NRR charm school.

MR. JORDAN: I'm from the government and I'm here to help you. (laughter)

DR. CATTON: Then you get nervous. Okay, I understand.

MR. ANDERSON: Other courses in this area include the examination techniques course which is the basic course attended by all the operator licensee examiners. Here they discuss how to prepare and administer the examinations associated with the RO and SRO process. We provide a course in licensing practices and procedures for the people to write the materials type licenses.

We also offer a root cause incident investigation workshop. Although not required training, this has probably turned out to be one of the most popular course that we've ever offered. We offer a performance based inspecting course that we call Inspecting for

Performance.

DR. CATTON: I'd like to see that.

MR. LINDBLAD: Yeah, what is that?

MR. ANDERSON: It's a relatively short course, it's about a two and a half day course. But basically, it works on the concept of performance oriented inspection. That is, observation of inspection activities rather than review of paperwork.

MR. LINDBLAD: But it doesn't use the word excellence as distinguished from regulatory standards, does it?

MR. ANDERSON: No.

MR. LINDBLAD: Okay.

MR. ANDERSON: It's a safety -- you might want to put inspecting for safety performance.

MR. LINDBLAD: How about process inspection. Is that what it's like?

DR. CATTON: What is process inspection?

MR. LINDBLAD: Inspecting processes that work rather than results.

MR. ANDERSON: I'd say that, yes. The last course on the list here is incident investigation team training course. This is a specialized course for NRC staff members that form the incident investigation teams. Students for this course are selected from a list of

potential candidates that are maintained by AEOD.

This course provides an overview of the incident inspection program, investigation perspectives and guidelines, and covers a lot of the same type of topics that are covered in this Root cause incident investigation workshop. This is a very, very intensive course.

It culminates with each of the teams in the course making a presentation before a mock commission composed of personnel such as Mr. Jordan. We've even had commissioner participate in that briefing session as a culmination of this course. That concludes my remarks. I'd like to now introduce Steve Koscielny who will discuss digital I & C.

MR. KOSCIELNY: Good afternoon. My name is Steven Koscielny, I'm with the technical training center. I'm going to be discussing the NRC's efforts with respect to the digital instrumentation and control area. Background -- the initial need for technical training with regard to digital instrumentation was brought to the point in August of '93 at the training advisory council.

In November '93, we looked at the training need survey, and in February of '94 a working group was established. In the April '94 training advisory council meeting, three courses were identified as being needed for NRC technical personnel to understand the digital world.

Those three courses were digital control systems, a digital instrumentation design and operation, and a software quality assurance. The digital instrumentation working group which I'm going to discuss here momentarily, is going to take those three courses and try and figure out what the best way to analyze the NRC's needs.

The recommendations that the working group is going to come up with are going to require line management approval, because we're going to try and take some of that training time that those resident inspectors, regional based inspectors, and NRR technical reviewers are using for other purposes, and focus it in the digital area.

The working group is composed of a charter, and that is to determine the needs in digital instrumentation control and related areas. We're going to define the target audience for this type of training, identify some courses that are to be developed and course objectives, and review course materials as they are developed and then finally recommend changes to the curriculum.

Now one point I forgot to mention is why we need to look at digital instrumentation control. Licensees were -- or plants were licensed with an analogue system. As times have progressed, analogue systems are becoming more and more difficult to obtain parts for, and the

technology is now better to use digital instrumentation to control safety related parameters.

So that's why we're now looking at the digital world. The membership of the digital instrumentation and control working group is a mixture of resident -- pardon me, regional based inspectors, NRR personnel, myself and the technical training center, as well as Steve Arndt and Russ Anderson.

We've got a complete group of individuals from the regional based inspectors right to the section chief level. So you've got a good background of individuals to assess the needs of the commission.

The quantification of the training needs. We looked at who's going to need this training most, and who's going to need it soonest. We concluded that the most needing -- the group that needs this training most is the regional based inspectors. They are an asset that can be utilized throughout the entire region. They're going to look at whatever modifications are in progress by various licensees, and they can focus their efforts on those particular licensees.

The next group we feel is going to be the headquarters based inspectors. They're going to do technical reviews of packages submitted for technical specification changes, modification packages. The third

group is the resident inspectors. We feel that the resident inspectors are lower on the totem pole because their particular activities are based on one particular site.

If that site, however, is going to do a lot of digital modification work, we can include them in the regional based inspector pool.

MR. LINDBLAD: Isn't it likely that the resident inspectors as a group perhaps had a greater exposure to digital electronics in college than the other groups as well?

MR. KOSCIELNY: It's possible. Depending on what gentleman you get -- or person you get, I should say, as the resident inspector at the time. If you get a gentleman or a lady that has got a power engineering background double E type, they're not going to have that digital expertise. And you're seeing that throughout the regions, that we're seeing -- you can have a gentleman that has many years of power expertise and no digital instrumentation and control, or a recent graduate who is specialized in digital activities.

So our group of students can again vary considerably. And that's one of the issues that we've taken into account in our selection of courses. We look at a relatively small target group roughly four regional base

inspectors per region and roughly four NRR individuals. So we're looking at a group of about 20 individuals. We're looking at the best way to handle this type of --

MEMBER CARROLL: What does that mean now for an individual class?

MR. KOSCIELNY: A total population of about 20 students from the Commission's 3,100.

MEMBER CARROLL: Well, what was this four and four?

MR. KOSCIELNY: Okay. I'm sorry. We're looking at roughly four individuals per region and roughly four individuals from NRR, so a total of about 20 individuals that will lead this type of training.

MEMBER CARROLL: Okay.

MR. KOSCIELNY: Okay? We looked at what would be the best way to handle this training based on the diversity of the population. Again, I could have a gentleman that's been doing digital instrumentation work for the last 10 years, someone who is straight out of college and only got a EE degree in power engineering. We thought about the best way to present the information so they all have the same digital level of information when they're done with this type of training. And we came to the conclusion that to develop a single source NRC-developed course would not be cost-effective.

We looked at the commercially available courses in the industry that we could utilize, and we've come up with a choice of courses. We call those the off-the-shelf commercial courses: digital instrumentation control fundamentals, digital electronics for industrial instrumentation, a basic course on programmable logic controllers, and principles of software engineering.

So we're going to look at these four courses as a core curriculum. If the individual has plenty of digital expertise, we won't need to send him to as many courses. We're going to try to get all of the four regions and NRR to the same basic level by accomplishing a number of these courses.

Yes?

MEMBER LINDBLAD: Same basic level, that reminds me of a discussion we had an hour or so ago. When we're developing a curriculum, what is our objective for the students to achieve at the end of it? Have you got a slide that shows this out?

MR. KOSCIELNY: I've got a slide that's going to discuss what the end result of the end product should be.

MEMBER LINDBLAD: Good. Okay.

MR. KOSCIELNY: So we're going to take them and try to get them to all about the same level so they all

understand the digital instrumentations and how it can be utilized. We're now going to flavor that with a presentation of about a one-week course on the regulatory perspectives force.

(Slide.)

MR. KOSCIELNY: We've now got them to the point where they're all looking at the material in the same manner. Now we're going to put the political -- or put the regulatory aspects of it.

(Laughter.)

(Slide.)

MR. KOSCIELNY: We want to now look at how we regulate this item.

MEMBER CARROLL: And who would teach that course?

MR. KOSCIELNY: That would be taught by NRC individuals. We're going to use NRC expertise. It will be a combination of NRR, AEOD, and potentially Research that will do the instructions.

Okay. Some basic sources of the off-the-shelf courses, the commercially available courses, are: the Instrument Society of America; GPS Technologies; Rockwell Automation, Allen Bradley; Data Technical Instruction; System Technology; and Instrumentation Data Communication, Incorporated. And we use some courses from the University

of Wisconsin.

(Slide.)

MR. KOSCIELNY: Okay. Now looking at the regulatory perspectives course, train the roughly 20 individuals.

MEMBER CATTON: Where do they learn about the impact of local environment on a digital system? I didn't see anything like that in your list up there.

MR. KOSCIELNY: It's not. It's not in there. It would have to be --

MEMBER CATTON: Because that's an important aspect, I would think.

MEMBER CARROLL: Certainly is on the backfits.

MR. KOSCIELNY: It is. If you put it in a high humidity area, you're looking at what --

MEMBER CATTON: Or where the temperature can get a little out of hand on occasion.

MR. KOSCIELNY: And it changes --

MEMBER CATTON: Dust and dirt.

MR. KOSCIELNY: Dust, dirt.

MEMBER CATTON: I would think that would be important for inspectors, more important than some of those basic courses. This is why before I tried to emphasize the point that you've really got to write down what you want him to know before you start laying out your courses.

MR. KOSCIELNY: We'll take that under advisement. This is still in the embryonic stages, and we appreciate any constructive advice you can give us.

MEMBER CARROLL: We've had continuing difficulty convincing NRR and Research that they ought to get serious about the environmental issues other than EMI.

MEMBER CATTON: So maybe if you'd start in your class teaching them these things, it will eventually filter through the rest of the agency.

MR. KOSCIELNY: A good point.

MEMBER CATTON: We have or wherever we can.

MR. WERMIEL: I'll just make a comment. I was never not convinced. My name is Jerry Wermiel, Chief of the Instrumentation Controls Branch, NRR.

I was never not convinced that other factors affecting qualification of digital systems were important, other than EMI, RFI. I always thought the issue was a question of emphasis and how to get the point forward in the best way. Maybe I missed that point.

I would make the point that it's my understanding that a number of these basic courses that Steve has put up here do concern themselves with issues of temperature and environmental qualification concerns on not only digital systems, but analog systems as well. So it is covered in the basic courses to some degree, depending on

which course of emphasis we're talking about.

MEMBER CATTON: Who teaches it?

MR. WERMIEL: And it's certainly going to be covered in the regulatory perspectives course that Steve has been talking about because it is an area that will be part of the inspectors' focus, as pointed out in not only the inspection procedure that we are developing, but it's certainly called out and with your help emphasized a little bit more forcefully, I would say, in the generic letter that's out for public comment right now on retrofits.

MEMBER CATTON: Let's go on.

MR. KOSCIELNY: All right. The regulatory perspectives course. This is where we're going to teach you what we as an NRC agency want to get as an end result from an inspection. It's going to be a cooperative effort with NRR because NRC policy is established. It's going to provide needed NRC aspects of the digital issues, industry weaknesses, and lessons learned. So if we find that a certain licensee had a number of problems, we can provide that information to other inspections so that they can see the pitfalls in previous installations.

It's being designed to allow conduct of effective inspections with prudent use of limited resources. And it's going to be a nuts and bolts approach to the inspection.

We're going to actually try and utilize a seminar-type format with a modification package as a workshop.

(Slide.)

DR. KERR: Is that NRC policy being established now?

MR. KOSCIELNY: It is still in the embryonic stages. It has not been established. And it will be established prior to actually conducting the course.

DR. KERR: Who is establishing it?

MR. KOSCIELNY: NRR. It's an NRR project right now.

Okay. Here are the course topics. The first thing we're going to hit is the introduction and reference materials. Since this is still in the development stages, NUREGs are being developed, NRC documents, and EPRI instructions on digital modifications. As Jerry mentioned, the generic letter is out to endorse the EPRI methodology to utilize a 50.59-type review for modifications installed as digital replacements for analog systems.

We're going to look at regulatory policy, current generic letter that's out --

MEMBER CARROLL: You mean NEI, not EPRI?

MR. KOSCIELNY: It's an EPRI document.

MR. WERMIEL: The document is an EPRI document,

but it was sponsored, of course, jointly by EPRI and NEI. That is a fair characterization, Mr. Carroll.

MR. KOSCIELNY: The regulatory policy, the generic letters, temporary instructions that are being developed for digital instrumentation inspection, regulatory guides, standard review plans, any new branch technical positions, and inspection manual chapters that would be applicable to the digital instrumentation inspection.

An inspection planning workshop. The proposal now is to use a modification package to conduct the mock inspection in a seminar/workshop format.

DR. KERR: That means you're going to use Diablo Canyon's proposal to go to Eagle 21 or something like that?

MR. KOSCIELNY: Something like that.

MEMBER CARROLL: Is that what you mean that modifications?

MR. KOSCIELNY: Yes, sir, something that's actually been in the field and --

MEMBER CARROLL: Case study?

MR. KOSCIELNY: A case study. A case study is our format. The wrap-up would be the inspection report preparation, a development of final inspection report, and open items list similar to other inspection-related

courses, and then recent plan problems and lessons learned, basic. You always learn something when you go in and inspect and when you look for something for the first time, you want to feed that information from the general and the "done this inspection in the past."

(Slide.)

MEMBER LINDBLAD: Will there be a PRA perspective on digital?

MR. KOSCIELNY: We haven't looked at that, but that's a good point. That's an issue we should include in the course. As we talked earlier, the resident inspection, the training for the resident inspectors, Region I has already done a short seminar to acquaint the residents with the technical issues associated with digital instrumentation controls a part of one of their recent counterpart meetings. It went over very well. It was well-received.

We propose a technical component to go over some digital modification plans, a regulatory perspectives component to cover the highlights in the digital issues that are affecting regulatory perspectives right now, and the subject is going to be addressed in the form of future meetings of the working group. That's one of the open items on our list of things to do, how to train the residents.

(Slide.)

MR. KOSCIELNY: Related training activities that are going on as a result of digital instrumentation are some tutorials conducted by Lawrence Livermore National Laboratory. As a result of the advance reactor work, Lawrence Livermore was able to have some training available to the NRC. And two sessions have been conducted so far. One was in July and one was in August. And those two tutorials covered an overview of software safety, software reliability, software verification and validation, software testing, real-time systems, real-time performance, formal methodologies, and software audits.

The next Lawrence Livermore training session will be in January '95. And the following subjects are due to be covered: data communications, programmable logic controllers, diversity and defense in-depth, software hazards analysis.

The in-house briefing of --

CHAIRMAN SEALE: Yes?

MEMBER CARROLL: Who sits in on these? Who are the trainees?

MR. KOSCIELNY: The trainees have been NRR regional based inspectors and some representatives from the technical training center.

MR. WERMIEL: Yes. Research has also been

involved. Even some staff from our IRM office have come to listen to these tutorials.

MR. KOSCIELNY: They've been well-received. There's roughly been 20 per session, and they've been very in detail of some very interesting aspects of the problems associated with digital software. The one that sticks mostly in my mind is the X-ray machine that was developed by the French and licensed in the United States by the Food and Drug Administration that as a result of software errors overexposed four people.

MEMBER CARROLL: You mean Canada, not French?

MR. KOSCIELNY: It was a French-Canadian joint effort.

MEMBER SHACK; If you're speaking there of 25, that was a Canadian.

MR. KOSCIELNY: Canadian? I'm sorry. Okay.

The in-house briefings, what we're referring to here in the resident inspector counterpart meetings, OJT would be utilizing these individuals that are in the training pipeline to work with seasoned inspectors conducting digital instrumentation inspections.

And then there are two NRR fellows that are sponsored for their graduate work in Master's programs: one at Virginia Tech, who is being sponsored by the Office of Research; and one gentleman at the Carnegie-Mellon

University in Pittsburgh, which is sponsored by the Office of NRR.

That's a wrap.

MEMBER CARROLL: Is that Jim Story? Is that what we're talking about?

MEMBER STACK: Jim's at SEI right now.

MEMBER CARROLL: And who is the --

MR. KOSCIELNY: The gentleman from radon research, his name is Terry Jackson.

MEMBER CARROLL: Okay. Don't know him.

MR. KOSCIELNY: That's a quick overview of the digital instrumentation and control efforts in the training area.

MEMBER LINDBLAD: Are the tutorials published?

MR. KOSCIELNY: The tutorials are not published, but the handouts, material is available. And we can make that available if you'd like.

MR. WERMIEL: They were presentations. They weren't lessons. There weren't exams given to the students.

MR. KOSCIELNY: That's correct. There were no examinations.

MR. WERMIEL: For the Committee's information, they were familiarization tutorials, so to speak. I believe, Doug, did you -- yes. I think Doug Coe attended

at least one of them.

It was more or less a matter of familiarizing people whom we believe in the future will be associated with this area with some of the issues and concerns and things that we have been facing over the years with digital technology.

MEMBER CARROLL: I guess the one comment I would have is we have known of this as an emerging issue for a long, long time, I guess going back to some of the combustion plants that made use of digital technology in their core protection calculators and then the backfits that have come along and so forth.

What's wrong with the process of getting courses developed -- what does it tell you is wrong with the process? -- in getting courses developed that we're now just at the stage of deciding what we want to teach people when, in fact, there's a lot of major backfits that have gone on and a lot more are going on. Are we going to have people trained about the time everybody is finished their backfits?

MR. WERMIEL: Can I try to address that, Mr. Carroll? I'll give you my perspective. Over the years up until, say, the early '90s, it appears to me, at least, that retrofitting of digital technology in general was fairly limited. And those retrofits that were going on in

general were receiving staff review and evaluation and a safety evaluation report.

As the industry now believes retrofitting, the pace at least, will pick up and they intend to implement much more of it, they believe under 10 CFR 50.59 without prior staff approval, other people who were not previously in the loop will not be involved, we believe, in performing reviews and evaluations.

For example, the first person that usually becomes aware of a modification in 10 CFR 50.59 is a resident inspector or a region-based inspector, not an NRR headquarters person. So we felt it was now much more important that those people, that the people in the region and the residents, become aware of what's going on and essentially be our eyes and ears for any safety concern or any issue that may be involved as retrofitting, we believe, picks up.

So that's why I think there's more of an emphasis now than there may have been, oh, say, 10 years ago, even though, as you point out, modifications have been made for quite a few years.

MEMBER CARROLL: Well, now, let's take an example. When Zion backfitted Eagle 21, how were the field aspects dealt with? Did you send your people out?

MR. WERMIEL: Yes, exactly.

MEMBER CARROLL: You didn't say to the resident --

MR. WERMIEL: No, no. The implementation issues were all dealt with by headquarters staff, by the Instrumentation Controls Branch out of NRR.

MEMBER LINDBLAD: But does headquarters staff actually have experience in developing the software for complex control systems?

MR. WERMIEL: Some of them do. Paul Loeser, as a matter of fact, who is sitting on this working group developing this training, has developed software systems. I believe it was for the military, for the military and FAA, and for FAA.

MEMBER LINDBLAD: Was that project management or was that execution?

MR. WERMIEL: No. I believe it was both. I know he did execution early on. And I know in his latter stages there he was managing larger programs.

MR. JORDAN: One comment. The word "backfit" was used. Mr. Carroll used it. I don't believe these are backfits in terms of NRC requiring --

MR. WERMIEL: Well, then use the word "retrofit."

MEMBER CARROLL: Yes. I misspoke. I know what backfit is, too.

MR. WERMIEL: I know what Mr. Carroll meant.

MR. JORDAN: And as far as why we didn't do it sooner, I regret that we didn't do it sooner. That really is sincere because equipment is being changed and has been at an increasing rate. And so suddenly at some point it trips us and says "Okay. We have to have stronger capability in the regions."

And I think we're looking for advice on other emerging areas that we need to jump in on more quickly. And the needs survey internally is one way of us doing it. Meeting with you is another.

So if there is a technological area that you see the staff lagging on, the training programs lagging on, we're very interested in it.

MEMBER CARROLL: I think one I mentioned down in Chattanooga, Ed, was you're going to have a big change in regulatory emphasis and inspection needs when a maintenance rule becomes effective in 1996.

MR. JORDAN: Yes, agreed. And we should be providing training for that purpose. Totally agreed.

MEMBER LINDBLAD: In fact, I see in the presentation that there's a great emphasis on field representative training and that the training is focused on the regions. And with apologies to the NRR representatives here, I do have a feeling that headquarters are many more

years out of college and formal training than the field is.

I do remember at the beginning of this industry and the beginning of this regulation that in order to do reactor designs, the agency had to hire a lot of doers, people with actual practical experience in developing projects.

And I don't know if there's still the opportunity today to bring in people who have actually accomplished work. You spoke of one, and I'm pleased to hear that. But I think there's been kind of a stability in the headquarters in personnel in the face of a changing industry.

I was educated as an electrical engineer, but that doesn't qualify me to do anything today in -- I don't even take the back off my TV anymore.

MR. WERMIEL. I would make two points concerning my staff. Number one, those that are some time out of college have gone to take a lot of the courses that Steve is talking about, the off-the-shelf courses, so to speak, to get up to speed in areas that they do not have the formal education in.

But, secondly, I would also point out that while I have had a relatively stable staffing level in accordance with my staffing plan, I have exceeded my staffing plan by acquiring over the last two to three years

four interns out of the intern program, all of whom have formal education in computer science or computer technology. And there is a fifth one, who will also be coming out of the intern program this summer that also plans to join my staff.

So I have a fairly large mix on my staff right now. And it's been very helpful in permitting us to do what we need to do in this area.

MEMBER CARROLL: How come you've never told Hal Lewis that you had all these computer science dudes?

MR. WERMIEL: I swear we did. I'm just not sure he ever heard us. I don't know what to say.

MEMBER CARROLL: I'm not surprised at that.

(Laughter.)

MR. JORDAN: But you point out a problem. Yes. As it is less likely for us to hire new people because of the shrinking agency staff and we get there by attrition, then we're going to have to be training and providing more to the staff we have and being very selective about hiring when we do have an opportunity to get true quality expertise, hands-on experience.

MR. KOSCIELNY: Thank you.

I'd like to introduce Larry Bell, who will now talk about probablistic risk assessment training.

CHAIRMAN SEALE: And I'd like to thank you.

You've almost gotten us back on schedule.

(Laughter.)

MR. BELL: Well, I can't talk as fast as Steve does. So I'll slow us right back up.

MEMBER LINDBLAD: What do you mean throw us "back on schedule"? We're an hour off?

CHAIRMAN SEALE: I'm sorry. An hour off.

MEMBER LINDBLAD: We only gained 15 minutes.

CHAIRMAN SEALE: Only gained 15? Okay. That's true.

MEMBER LINDBLAD: That's how we got in this hole in the first place, in keeping a schedule like that.

(Slide.)

MR. BELL: The final report is a PRA working group recommended the systems approach to training applications to the field of PRA. The systems approach to training consists of six distinct elements. First is the analysis phase, then the design phase, development, implementation, evaluation, and feedback.

In the analysis phase, we use tools such as job and task analysis to determine the task that the employee has to accomplish and, like terminal objectives, enable the employee to accomplish those tasks. Also in the analysis phase enabling objectives are developed that enable the employee to master terminal objectives.

In the design phase we look at each of the tasks or terminal objectives and determine the best training method to allow the employee to master those tasks. It could be on-the-job training. It could be in the computer room or a laboratory or it could be classroom training.

In the development phase, the instructor writes his lesson plans, training material for the courses developed. And also examination questions are written in this section of the systems approach to training.

The course is finally taught in the implementation phase. Evaluation consists of evaluating an instructor's performance and also the students' performance to assure that the material was presented and the student received the material.

And then the last phase is a feedback phase, where the students, the instructors, and supervisors provide feedback on the course. And that feedback may be used for course improvement.

PRA working group also had some additional training recommendations. They recommended more system design and operational knowledge -- and that knowledge is provided by the reactor technology series courses at the TTC -- also recommended rotational assignments to branches within the NRC that carry out PRA activities. And that

would give the employee hands-on experience.

And, finally, they recommended training on the Appendix C of the NUREG-1489, or the PRA working group report. And Research completed that training in September of this year.

(Slide.)

MR. BELL: PRA working group also defined three categories of users. Those users are labeled on the slide up here, but those aren't universally accepted terms yet.

The first user is the staff who use PRA results and require information on how PRAs are performed and how the results obtained. We label that basic user. Advanced user is the staff who works with PRA models or manages contractor efforts. And they require more extensive knowledge. And the final category is the expert practitioner, the staff who perform quality assurance and expert advisory functions as well as develop new methods. And they require very extensive.

MEMBER LINDBLAD: Do I understand that the decision-maker would be called a basic user?

MR. BELL: Would you define decision-maker a little more, please?

MEMBER LINDBLAD: The Commissioners of the NRC. Who will use the PRA results if not the Commissioners?

MR. BELL: Who will use PRA results if not

Commissioners? Resident inspectors, regional based inspectors, licensed project managers.

MEMBER LINDBLAD: But not the Commissioners?

MR. BELL: I assume that Commissioners, but we don't train the Commissioners, sir.

MEMBER LINDBLAD: So which category do they fit in these three categories?

MR. JORDAN: I don't think we would like to answer that.

(Laughter.)

MEMBER LINDBLAD: I think you want to change your terms.

MR. BELL: Yes, sir. I said that has not been universally accepted.

MR. JORDAN: This is really aimed at the staff. And so I would say journeymen guru. I mean, you can make up different terminology. But this is really for the staff, what level of expertise that we're expecting. And we try to gear courses to reach those three levels. You can make five levels or two levels.

MEMBER LINDBLAD: Why don't you call people customer or mechanic? What's in a name?

CHAIRMAN SEALE: Or a philosopher.

MEMBER LINDBLAD: Yes. I like philosopher. That's better than guru. Thank you.

(Slide.)

MR. BELL: We looked at the typical knowledge and skills that the basic user should have. The basic user should have a detailed system's knowledge, should be familiar with PRA methodology. And the user would use that information to, he would use PRA information to, determine the dominant accident sequences at his particular plant, what are the systems that contribute most to risk, what operator failures were assumed in the PRA or what operator recovery actions were taken credit for.

The basic user may be involved in the development or implementation of risk-based inspection plans. And the last bullet we have on this slide is identification of issues that warrant further study.

(Slide.)

MR. BELL: If he's doing an inspection or he sees a plant and has a lot of outage time on the diesel, he doesn't know the statistical significance of that. So he calls the PRA experts and identifies that problem to them.

Advanced user would also require a detailed systems knowledge and an understanding of the PRA methodologies at all three levels: Level 1, Level 2, and Level 3.

He should have a working knowledge of PRA models to know how to model the event trees and fault trees

to obtain estimations of initial core damage frequency or estimations of event frequencies. And he should also know how to modify the databases that are provided in PRA programs.

Another duty that the advanced user may have would be the management of PRA contractor activities.

(Slide.)

MR. BELL: The expert practitioner in addition to a detailed systems knowledge must also probably have performed several PRAs. He needs extensive experience in systems reliability. And some of the duties that this individual would have would be quality assurance on PRA activities and perhaps develop new PRA models.

There is a considerable doubt whether or not PRA training program as it exists now or as we plan on modifying the program can by itself develop these skills. Skills will probably have to come from outside the agency.

DR. KERR: Do you use statistics and probability synonymously?

MR. BELL: Do I?

DR. KERR: Yes because I see statistical skills, but I don't see understandings of probability. It seems to me --

MR. BELL: Probability institutes skills.

(Slide.)

MR. BELL: PRA program has been examined in --

CHAIRMAN SEALE: Could I ask a question?

MR. BELL: Yes, sir.

CHAIRMAN SEALE: Back when we still had stars in our eyes about what all you were going to be able to do with PRAs and so on, one of the slogans that was developed was the idea of a living PRA. And I've tried to figure out what all of that means on occasion.

MEMBER LINDBLAD: These may not be the best people to ask.

CHAIRMAN SEALE: Well --

MEMBER CATTON: You should visit North East Utilities.

CHAIRMAN SEALE: Well, let me finish. And there are a couple of things that I come up with. One is that it seems to me that the PRA ought to be a very real part of the basis for developing emergency planning, training materials, the scenarios for consideration and your simulators and all of that sort of thing.

And the other is that the PRA ought to be something that the people in the plant use to plan their activities, not only routine activities, but when they have a problem, like when somebody shorted out all of the high-voltage DC and knocked out all of the computers and they were sitting there at 85 percent power, "Where do I go

from here without having to declare a site emergency?" And the PRA was actually used in that case.

Are you satisfied that you have gone through those kinds of considerations in deciding what it is that your basic user ought to know? Because it seems to me, especially in the last category, the person in the NRC that's got to be able to work with the utility on that problem is the basic user.

MR. BELL: We have not performed a job and task analysis on anyone that we would consider a basic user at this time. That hopefully will occur in the future. So I can't define all of the tasks that the basic user would be required to accomplish at this time.

CHAIRMAN SEALE: I think it's important that you do that fairly soon because that's probably going to help you decide what the allocation of resources is going to have to be in order to meet those needs.

MR. JORDAN: Well, Dr. Seale, maybe I could intervene at this point.

MR. BELL: Yes.

MR. JORDAN: When that event happening such as it happens, we do bring in our PRA expert to assist us in making that determination. So I get the call as an executive team member for the instant response.

CHAIRMAN SEALE: Yes.

MR. JORDAN: And I want the PRA expert on the line. And we have several on call available and then in conjunction with Bill Russell and the regional director, we then respond to that utility action.

I thought you were going somewhere else on the living PRA thing.

MEMBER CATTON: Maybe I could push it a little further, then.

(Laughter.)

MEMBER CATTON: Living PRA is being used more and more, as I understand that. And I would bet in the future you're going to find even heavier use.

And I understand that at North East Utilities, they do a lot of decision-making based on that day to day evaluation of the PRA. And they're feeding plugged data into it. Well, if you start feeding plugged data into it, you'd better have inspectors there who understand these kinds of things and the meaningfulness of the data.

And the recent incident in what, Sweden, where they plugged up the strainers, for several months after, almost every move they made was based on their living PRA.

So I don't think your incident response center would be enough. You need people on site who understand these things as well.

MEMBER LINDBLAD: Yes. It seems to me that the

easiest approach to get to your definition of who the basic user is is to look at the industry and see who you want in the industry to be the basic user. And to me it's probably the maintenance manager and the outage coordinator in a power plant.

MR. BELL: But you would also want the operator.

MEMBER LINDBLAD: Let me finish. Let me finnish. All right. The operator who signs off on taking the system out of service.

Recently Bill Russell has made some trips around sites and thinks there's too much voluntary entry into LCOs. And the ledger that I've seen on it is rather silent on whether the plant was using its PRA or not, but it seems to me it should have acknowledged whether those plants that took systems out of service during operations were using the results of their PRA to do it.

And it's going to be hard for an agency to be critical of living PRAs if you don't expect the maintenance manager to look at it and decide we're going to take out a channel today.

MR. JORDAN: But both the industry and the NRC are in a transition with the use of PRAs. Some utilities who did their IPEs and IPEEEs have them on a very tall shelf, and there's already dust on them. Some utilities

have, in fact, a real living PRA and they run daily numbers. And so that's the gradient.

So we do have to provide, let's say, priority among our NRC personnel for those who are working directly with a plant that has a true living PRA. Then they get priority for training. Those who are working with the plant that have it on the very high shelf, it's going to be beneficial for the inspector, but he's not going to have an interface problem any time soon.

What we were trying to do in setting up these three levels was at least have within the agency three levels to train to, then to pick and choose who gets trained at what level, and then be able to call up the right person with the right level of expertise.

We have a fairly reasonable within the agency of who our experts are today. That's not going to change much as a result of training, which was, I think, a true point. And so we have to go to those people when we have, in fact, a problem that we have to resolve that needs more help.

But we're going to be training up people for the two operating levels over the next several years. And I think we have to now pick our priorities as to who gets the training first.

And certainly my first interest is: Have we

stratified reasonably well with the kind of knowledge that's necessary? And then have we put a priority on training the right people based on the stratification and then work iteration from there.

MEMBER LINDBLAD: I think, though, that you've basically assumed that the PRA is plant-specific and that the issues that will arise in a discussion of PRA are specific to a plant. Is that correct?

MR. JORDAN: In my discussion, yes. But, of course, the training that the people get is going to be generic training, not plant-specific.

MEMBER LINDBLAD: Right.

MR. JORDAN: So methodology is --

MEMBER LINDBLAD: It seems to me that the basic users are going to also be those people in headquarters staff jobs that have either identified that generically speaking their concerns are either important or not important to reactor safety.

MR. JORDAN: Certainly there are people in the headquarters who have to make those determinations, but we do see a --

MEMBER LINDBLAD: Will they make them with a review of PRAs?

MR. JORDAN: Well, for instance, the CRGR in its review of new regulations or new generic letters or

bulletins that are going to affect utilities is looking for a risk-based perception of the impact and the benefits. And the staff that brings a new product to us has PRA expertise that they convey and examine, just as the ACRS does.

DR. KERR: If there's a conflict between a regulation and the results of a PRA, which one would befall?

MR. JORDAN: That's a Pennsylvania-type thing. We try to use PRA to assist us in making decisions. And regulations are, in fact, requirements that already exist or there's a compliance problem with the regulations.

If we ultimately need to change a regulation because what we've been doing is stupid based on risk analysis, then we should do so. And now we're making recommendations on what we do with regulations based on risk in addition to the deterministic approach that we were using many years ago.

DR. KERR: Okay. Suppose you were a plant operator and you were faced with a decision which you were convinced that following the regulation would make things less safe. What would you do?

MR. JORDAN: Well, that's an accident situation. We have a regulation that enables that, 50.54X, that if the operator is in an emergency action and he needs

to take an action that is outside the regulations to save the plant, then it is legally appropriate for the management of the utility to direct that action. So there is a regulatory nexus loophole built.

DR. KERR: It sounds like if one requires a certain amount of concentration and --

MR. JORDAN: We certainly want it to, yes. It's not something daily operation encounters.

DR. KERR: So it's inconceivable that that might occur where somebody would have to make a quick decision?

MR. JORDAN: Outside of an emergency, yes.

DR. KERR: You've heard some of the comments that have been made in the past on emergency rule. It's different than the aviation one, in which unless some guy's absolutely stupid, he can't be called to account for declaring an emergency. I gather in the NRC regulations, he can be second-guessed.

MR. JORDAN: Yes. I think you and I have had this discussion some years ago.

DR. KERR: There's a good bit of reluctance, I would think, to declare. Has one ever been declared, by the way?

MEMBER CARROLL: Yes.

DR. KERR: How many? Two?

MEMBER CARROLL: Several.

MEMBER LINDBLAD: I think one or two a year.

DR KERR: Okay. So it does work?

MR. JORDAN: It does.

MEMBER LINDBLAD: I don't know how many might have been declared if it had been different.

MR. JORDAN: Well, the object is that you don't need a loophole or a misuse as the basis for somebody doing something that's convenient, as opposed to something that's safety necessary. And so there is a high threshold.

In accident space, there are very few actions that an operator has to take in seconds or minutes to save the plant. In most cases the automatic action is, in fact, the preferred action. And the operator is there to back up the automatic action and that a deliberate shift outside of the EOPs, let's say, is one that ought to be done very cautiously.

MEMBER CARROLL: Given the BWR strainer blockage issue, I'm not sure I totally agree with your statement. Maybe it's better not done if you're running all the ECCS pumps at full bore.

MEMBER LINDBLAD: When you speak of the advanced users having detailed systems knowledge, is that of all reactors or will they specialize in BWI 6 or water loop PWRs or something like that?

MR. BELL: I would assume that they would acquire systems knowledge for the particular reactor that they're working with. So if they're working with a combustion engineering System 80 type plant, they would need combustion engineering system knowledge. If they're working with a --

MEMBER LINDBLAD: So an advanced user would be a system-specific advanced user?

MR. BELL: He certainly could be. We don't assign people duties in the other branches. So I don't know the background of all of the people who would be advanced users.

MR. RAGLIN: This could have a broader application than just particular reactor designs, too. I mean, it could be a PRA application somewhere in NSS. And the detailed system knowledge could be completely different systems than the reactor systems than we've talked about in our index to the program.

MEMBER LINDBLAD: When one says "detailed systems knowledge," how detailed do you mean?

MR. JORDAN: I think what we're seeing here is that the person has, in fact, at least one technology of detailed system knowledge, but with the PRA and that kind of background, one can apply to another steam supplier or rather --

MEMBER LINDBLAD: I think I'm talking at two slides back at 37, where you said "typical knowledge and skills of advanced users." I really believe that you're looking for the person who has the capability to absorb systems knowledge specific to the project he's working on --

MR. JORDAN: Yes, exactly.

MEMBER LINDBLAD: -- and that he doesn't have to come to the PRA already at full speed on the detailed system arrangements.

MR. BELL: That's true, but the employee should come to the PRA with the understanding on how the systems interact or potentially inter-react.

MEMBER LINDBLAD: Well, he can only do that by looking at your drawings and working on the system itself.

MR. BELL: Yes, sir, but he has some fundamental knowledge, like what would be the affect on a generic planning by loss of filling water or surface water. That should be a starting point for that knowledge.

MEMBER LINDBLAD: All right. And so that's the level of detail you're looking for?

MR. BELL: Yes, sir. Maybe the components that are cooling water at Plant X are different than the components at Plant Y, but he should realize that component cooling water is an important system. It affects both

safety-related and non-safety-related equipment.

MEMBER LINDBLAD: And so it's the same detailed systems knowledge that the basic user needs?

MR. BELL: Yes, sir.

MEMBER LINDBLAD: Thank you.

(Slide.)

MR. BELL: We examined the PRA for detail and with our ultimate goal to determine what forces would satisfy the planning requirements of the three groups.

We have three basic types of courses that we're currently presenting: orientation courses, basic user-level courses, and advanced user-level courses.

(Slide.)

MR. BELL: Orientation courses may be attended by either the basic user or the advanced user or in some cases the expert practitioner may attend those courses.

The PRA overview course, that's a one-day course that discusses what a PRA is, designed for new staff or new managers that are going in the NRC.

PRA fundamentals course provides the student with training in PRA fundamentals. He learns what a Level 1, Level 2, Level 3 analysis is, also learns things like the purpose of fault trees, event trees.

MEMBER CARROLL: How long is that course?

MR. BELL: I beg your pardon?

MEMBER CARROLL: What's the length of that course?

MR. BELL: That course is currently three days long.

DR. KERR: This is the PRA overview course, P100? I'm looking at this syllabus. It says one day, but --

MR. BELL: The fundamentals of PRA is the next page here. And that's the three-day course.

DR. KERR: Oh, okay. The overview is one day?

MR. BELL: Yes, sir.

The overview of performance assessment techniques for high-level waste. And that course is a one-day course. And the students in that course learn the regulatory basis in analytical techniques and the objectives of performing performance assessments on high-level waste repositories.

There's also a week-long course on probability and statistics for PRA, where we take the student through all of the probability distributions that are used in PRA applications. And I believe the last two days of that course, the student gets exposed to Baysian reliability techniques.

MEMBER CARROLL: Why did you mention that?

(Laughter.)

MR. BELL: I don't really have to answer that, do I?

DR. KERR: I noticed in the prerequisites, it is suggested that he or she must be familiar with calculus and be able to perform proficiently in probability and statistics at the undergraduate level.

MR. BELL: Yes, sir.

DR. KERR: What does that mean? Undergraduate level art, for example, or --

MR. BELL: We would assume that most of our students are from an engineering background. And we would suspect that they would have taken a statistics course at either the math department or the engineering department at their university.

DR. KERR: Strange things happen.

MR. BELL: I know. That's why we've got the probability and statistics courses.

DR. KERR: I would guess that might not be the case, even today, but it might be. Calculus, yes. Probability and statistics, maybe.

MR. BELL: Well, if you notice, the next slide in the syllabus addresses the applied statistics course.

DR. KERR: Yes.

MR. BELL: Dr. Lury presents that course to anyone in the NRC. And it hopefully will address that

weakness that you just mentioned.

MEMBER CARROLL: Who is he?

MR. BELL: Dr. Lury works in Admin.; right?

MEMBER LINDBLAD: He's one of the two authors of that book that we got.

MS. van SANTEN: He's in IRM, I believe.

MR. BELL: IRM?

MEMBER CARROLL: Okay. That's the book. You went through it and --

MEMBER LINDBLAD: Baysian was just in the index, but that's all.

MR. BELL: It mentioned what area he lived and died in.

MEMBER CATTON: Where do you teach your inspections and so forth about the source of data for PRA?

MR. BELL: That's the next slide.

MEMBER CATTON: Okay.

(Slide.)

MR. BELL: We have two basic user-level courses called, the first one, PRA basics for inspection applications. And in that course, we teach the inspector an overview of PRA activities. He learns about event trees, fault trees, dominant accident sequences, systems treated to risk. And he would learn about databases in that course. He also learns about the strengths and

weaknesses of PRAs.

DR. KERR: Is this P103?

MR. BELL: I didn't bring those numbers.

MR. JORDAN: P105.

DR. KERR: One-o-five? Okay.

MR. BELL: PRA basics for licensing project managers is a modification of the PRA basics for inspection application, with the emphasis on the duties and responsibilities of licensing project managers.

MEMBER CATTON: How long are these courses?

MR. BELL: Those courses, each course is three days long. The inspection applications course -- I might mention this -- is part of the regions. The PRA instructors travel to the regions once a year to teach that course.

MEMBER LINDBLAD: And the PRAs, do they include human actions as well?

MR. BELL: Human actions are discussed in that course.

MEMBER LINDBLAD: And shutdown conditions?

MR. BELL: Shutdown risk?

MEMBER LINDBLAD: Yes.

MR. BELL: I think shutdown risk is only briefly discussed right now.

MEMBER CATTON: Do you do all of that in three

days?

MR. BELL: Yes, sir.

MEMBER CATTON: This must be one hell of a course.

MEMBER LINDBLAD: Well, they say it was intense.

DR. KERR: Maybe you ought to take it.

MEMBER CATTON: Maybe I will.

DR. KERR: Incidentally, in none of these courses according to the syllabus are exams given.

MR. BELL: That's correct.

MEMBER CATTON: I will take it.

(Laughter.)

DR. KERR: Again, is this because you feel they aren't necessary, you haven't had a chance to develop them, or --

MR. BELL: We are in the process of evaluating which courses we need examinations for. And once we make that determination, we'll, of course, have to develop the examinations.

MEMBER CARROLL: Just as a general observation, people really get a lot more out of the course if they have an examination at the end hanging over their heads.

DR. KERR: But you also get some idea of how well you're --

MEMBER CATTON: Oh, absolutely. If for no other reason than just to motivate the students, an examination is good. What you're saying, Bill, is also very important.

MEMBER LINDBLAD: That's supposed to be a 43 percent improvement in retention if you tell people there's going to be a quiz.

MEMBER CATTON: That's all you have to do is tell them?

(Laughter.)

MR. JORDAN: Yes.

DR. KERR: Did you just make that up?

MEMBER LINDBLAD: I read it. It's in the book. Look it up.

MR. JORDAN: We have not for these PRA courses at this point put an exam on the qualifications. Most of the qualifications for the courses do have an exam at the end. A large number of the training center courses do for other purposes. I agree with you personally, but it is a benefit. There is a driving force. And so we will take that under advisement.

DR. KERR: Do you have formal course evaluations in connection with these for students, write out suggestions, comments, and so on?

MR. JORDAN: Every course, yes.

MEMBER CARROLL: Going back to low power and shutdown risk, I think we all ignored this for a long time. It would seem to me you would want to rethink whether you'd want to put more emphasis on it in your PRA course.

I guess if you look at the grand dolphin surrey and low power PRAs, well, you get convinced that that's a pretty important period of operation.

MR. JORDAN: The agency had put a great deal of emphasis on it subsequent to the Vogle event. I'm not sure what we think into the courses here, but I certainly agree that we've ignored it for too long and I came here treating a problem for it.

We will examine what we've done and what we need to do in that area of the course.

(Slide.)

MR. BELL: The courses that can be classified as advanced-level user courses include the integrated reliability and risk analysis system basics course. That's a software course where the student learns how to manipulate data, not a --

MEMBER LINDBLAD: I've heard that line.

MR. BELL: Then we have a human reliability assessment course.

MEMBER CATTON: Is he going to be taught how to bring organizational factors into play?

MR. BELL: I beg your pardon?

MEMBER CATTON: Organizational factors and their impact on human reliability.

MR. JORDAN: As soon as the agency learns this.

MEMBER CARROLL: I thought they did all they needed to know. They don't want to do any research on the subject.

MR. JORDAN: No. We are doing research on it.

MEMBER CATTON: I know what you're doing.

MR. BELL: And the last course that we have listed on this slide is the seismic margin methods. This course provides an introduction to seismic margin methods with an emphasis on the submittals, on reviewing the submittals, on seismic vulnerabilities for existing and advanced reactors.

MEMBER CATTON: Do you have a list of prerequisites for these courses you're taking?

MR. BELL: The prerequisites are listed in the syllabus, sir.

MEMBER CATTON: I'll look at them, not now.

MR. BELL: All right, sir.

(Slide.)

MR. BELL: The '94 training statistics on PRA courses took all the attendance sheets for the courses, eliminated duplicated names, international students,

students from government agencies. That left me with 162 individuals. And here's the breakdown of those individuals.

We had 10 resident inspectors, 19 region-based inspectors, 11 project managers, 9 managers or supervisors, 11 reliability and risk analysts, 49 staff engineers, and others, other members of the NRC staff, 53. That other section would include people who worked in emergency preparedness, geologists. We had a couple of attorneys taking the course.

MEMBER CARROLL: What?

MR. BELL: We had a couple of attorneys taking the course, technical assistants, and so on.

(Slide.)

MR. BELL: There are several mechanisms that we use to make curriculum changes. As discussed before, we have the job and task analysis that's used to find the terminal enabling learning objectives so that an employee can master certain tasks.

We have feedback from the students. As Mr. Jordan said, each student fills out a student comment sheet following each course. Also from students' supervisors and from students' managers, we may receive feedback.

MEMBER CATTON: Is part of the feedback a rating of the instructor?

MR. BELL: Yes, sir, a part of the feedback a rating of the instructor or instructors and an overall rating for the course.

MEMBER CARROLL: Does that work, Ivan? Do you get rated at UCLA?

MEMBER CATTON: Yes, I do.

MEMBER CARROLL: How do you come out?

MEMBER CATTON: It depends.

(Laughter.)

MEMBER LINDBLAD: It depends on the grades he gave.

MEMBER CATTON: You tell them what grades you're going to give them at the end, and you get rated higher. You've got to be careful about being innovative or you get killed.

MR. BELL: Another example of feedback is we receive input from NRR's PSA Branch that says we should discuss the concepts of risk management in our PRA courses.

Currently we, like someone said earlier, only talk about how the numbers are developed and not what to do with the numbers once you get them. NRR suggested that we should add the concepts of risk management. And we're going to make appropriate modifications to the PRA fundamentals, the PRA basics for inspection applications, and also the PRA basics for licensing project managers to

make those --

DR. KERR: What did do they mean by risk management in the context of this?

MR. BELL: Well, risk management in the context that we'll be talking about in the course would be including methods that may be used for use of risk in initiating events, increase reliability of mitigating systems, or increased reliability for the containment of fission products.

MEMBER CARROLL: A big place where that concept comes in is in shutdown.

MR. BELL: Yes, sir.

MR. ARNDT: It also goes to a lot of the comments Dr. Seale was making about the maintenance rule and reliability and things like that.

CHAIRMAN SEALE: Living PRA.

MR. ARNDT: Living PRA.

DR. KERR: Yes.

MR. BELL: Special needs often arise that require the addition of a course or perhaps training, changes in training. Those special needs may be identified by an employee or the employee's supervisor. And the course development that usually results from special needs may be a one-shot type situation, where you need training in this for this many people, similar to digital

instrumentation.

Also the office-level PRA implementation plans will change training. You're all familiar with those changing requirements and the licensee having to implement training because of a change in requirements. The office-level implementation plans will parallel that path and cause changes in the curriculum.

I wanted to point out that PRA curriculum is not the only thing that's changing. As mentioned earlier by Dr. Arndt, we have PRA insights that were added to the reactor technology program, also the advanced technology course in the reactor series teaches PRA insights, and also system integration. When we get students to the simulator, we show the students how the systems interact to increase their knowledge.

And, finally, when we teach EOP courses, the student sees ATWS scenarios or other scenarios that involve losses of multiple safety systems. So the PRA is going through our whole curriculum.

(Slide.)

MR. BELL: As I said, job and task analysis is one means that's used to change the curriculum. There was a pilot program initiated by the PRA working group. That pilot program performed a job and task analysis for the Generic Safety Issues Prioritization and Resolution Section

of Research and also from the Events Assessment Section of the Probablistic Safety Assessment Branch in NRR.

The first job and task analysis was completed in March. And the second job and task analysis was completed in July; currently have plans to do a job and task analysis for the Division of Waste Management in NMSS.

(Slide.)

MR. BELL: As a result of those two JTAs, we developed four courses. We will be developing four courses: an accident progression analysis course that will teach Level 2 concepts, an accident consequences analysis course that will teach Level 3 concepts.

In addition, we'll have two courses that will improve the employees' PRA modeling capabilities. One we call system modeling techniques, and the second one is risk assessment in event evaluation, where the individual will be able to modify event trees to calculate changes in risk.

Yes, sir?

MEMBER LINDBLAD: In the last several months, in the course of Committee meetings, we've frequently raised questions with the presenters about the issue of uncertainty, not only uncertainty in PRAs, but even uncertainty in some of the what they call deterministic engineering that is done.

Have you given any thought to developing

training for engineers to evaluate uncertainty in their assumptions and uncertainty in their decision-making process? Has the word "uncertainty" ever come up through curriculum development?

MR. BELL: MEMBER LINDBLAD: Yes, sir, the word "uncertainty" has come up. It came up both in the job and task analysis --

MEMBER LINDBLAD: And is it something that is done by a statistical process or is it something that is evaluated?

MR. BELL: It will be something that is evaluated with a statistical process. The IRRAS program I think can evaluate some of those uncertainties.

MEMBER KRESS: What is IRRAS?

MR. BELL: I beg your pardon?

MEMBER KRESS: What is IRRAS?

MR. BELL: Integrated risk and reliability.

MEMBER LINDBLAD: It's a computer program, runs on PCs.

MEMBER CATTON: Here they have accident progression analysis, accident consequences analysis. In these particular cases if you don't bring to bear uncertainties associated with phenomenological modeling, your certainty doesn't mean very much.

MR. BELL: Yes.

MEMBER CATTON: Now, I know they have a program somewhere. And there was actually a meeting almost a year ago for the output. Nothing has come from it yet. I think that's an important area.

Where are you going to teach your inspectors or whatever how to deal with that? One of your biggest uncertainties comes from the second bullet. What do you do about it?

MR. BELL: Well, our inspectors probably won't receive training in accident consequences analysis. That would be an advanced user unless our job and task analysis shows that they need that training.

MEMBER CATTON: but if you're reviewing a PRA, somebody is taking a look at system modeling that was used in that PRA or if you're at a plant, North East Utilities, where they use PRA for almost day to day business decisions, somebody has to come to a conclusion about the system modeling and uncertainties associated with it. Who does that? And where do they get the training to do that?

MR. JORDAN: The object is that the understanding of uncertainties and the ability to analyze for and quantify uncertainties is an integral part. And, Steve, can you address that from the PRA working group?

MEMBER CATTON: The reason I mention it is that there was a -- I forget what you call it, but kind of a

school book exercise done of this book. And it was a very simple system. It was a feed water system. And they had a bunch of people come to calculate unreliability. There were factors of 30 to 40 variation.

So then they went back. And what they did is they said "Let's tighten up on the conditions that you use." And that reduced it somewhat, but I think, even at the end, it was still something like a factor of 10.

MR. JORDAN: Right. For instance --

DR. KERR: That's pretty good, a PRA within a factor of 10.

MEMBER CATTON: Yes, but they could --

DR. KERR: That's true.

MEMBER CATTON: -- They should be happy with that, even though it's just a feed water system.

MEMBER LINDBLAD: You've developed another whole issue, and that's eliciting expert testimony.

MEMBER CATTON: These are supposed to be calculations. I mean, this is system modeling.

MEMBER POWERS: But you still are going to be a strong expert in --

MR. JORDAN: When you model the system, do you use the input data for the reliability or do you use the plant data? And so plant data largely doesn't exist. The IPEs were done largely with handbook data. And so as a

part of any kind of a living PRA, one has to now use the actual plant performance reliability information for getting the rates that --

MEMBER CATTON: The reason I mention this is that I think anybody looking at somebody else's work with a PRA needs to have a high degree of skepticism.

MR. JORDAN: Yes.

DR. KERR: You're not going to accomplish this in a three-week course.

MEMBER CATTON: That depends on where you're going to be.

DR. KERR: I won't do it in a three-week course or even a three-month course.

MR. JORDAN: No. I get Dr. Catton's point. The point is that --

MEMBER CATTON: Read the paper.

MR. JORDAN: Yes. The point is that whatever we do in this area in providing training to our people, we have to include very explicitly how one looks at the uncertainties and that one must quantify or understand the process that was used and be skeptical of it. The IPEs are an example. You have similar plant designs that when they complete the work come out with a couple of orders of magnitude difference.

When we do the accident sequence precursor

analysis and we come up with 20 or so events that we want to evaluate for the year, when we do our evaluation and send it to the utilities, we're arguing over a decade and a half or two decades of difference in every case. And we end up resolving them, but it is based on those uncertainties.

So I'm totally with you. I think we have to address it more specifically.

MEMBER CATTON: I don't know how you're going to do it.

MR. JORDAN: It has to be cranked in.

MEMBER CATTON: Somehow.

MR. JORDAN: Yes.

MEMBER CATTON: Well, you might want to use this work as a lesson.

MR. JORDAN: Okay.

MEMBER CARROLL: Did you circulate that paper?

MEMBER CATTON: Yes, I did. I've done it twice. Would the Committee like me to do it again?

They also did a similar study with the human factors and found I think there it was even bigger variations.

MEMBER CARROLL: Why don't we circulate it to the Committee one more time and make sure that AEOD gets a copy also?

MEMBER CATTON: Okay. Will you put something in the bullet to remind me?

MR. COE: Yes.

MEMBER CATTON: And when we get it, we'll get one to Bill Kerr, too.

CHAIRMAN SEALE: Let's move alone.

(Slide.)

MR. BELL: In addition to the courses that are being developed as a result of the job and task analysis activity, we're also developing two courses as a result of feedback among the users.

One is an advanced IRRAS course that will discuss some of the more sophisticated capabilities of the software package. And the second course is PRA insights into an IPE. That PRA insights into an IPE is also taught in the regions with a plant-specific IPE. And it teaches the inspector how to find things in the IPE such as the dominant accident sequences in the systems that are important to risk.

We just recently completed a course based on results of a special needs. That course was a seminar on Poisson and binomial updating. That was an advanced user-level course.

MEMBER LINDBLAD: What does it do to the advanced user if the basic user doesn't know what to do

with the result of the advanced user?

MR. BELL: Hopefully at the end of the training program, if we've taught it would lead the basic user to at least recognize that there is a potential problem and he gets in touch with the advanced user, we've accomplished something.

But, again, you've got me at a disadvantage because we haven't completed the job and task analysis in the basic user groups yet.

(Slide.)

MR. BELL: Expert practitioner. Our future training activities will include some training for the expert-level people. As we said earlier, we don't think we can accomplish that with our PRA training program. We talked about earlier also how that skill may have to be recruited into the agency.

The only alternative to that might be university-level courses that might be cost-effective from the NRC's standpoint, but there also are some drawbacks. That employee would be away from his job function many, many semesters or quarters in order to get the PRA knowledge that the employee needs.

MEMBER CATTON: Even if it were University of Maryland.

MR. BELL: Well, the University of Maryland, if

I go over there and take --

MEMBER CARROLL: Full-time student.

MR. BELL: -- three or four courses a quarter or a semester, that's a lot of time.

MR. JORDAN: We could provide an opportunity for the academic credentials, but it's still a matter of someone doing PRAs with sufficient rigor that they become expert. I mean, placing only helps.

MEMBER LINDBLAD: Is the recruitment recommendation still future or has that been made?

MR. JORDAN: From the agency's standpoint, it's a critical skill. And that is one of the few areas that we will be hiring outside as needs come up.

MEMBER LINDBLAD: Well, if Hal were here, he would tell you that the last time he went to an ANS meeting, there was no recruiting poster for such a person. And it's not listed as one of the desired skills in the last recruiting poster that Hal told us about, which would have been last spring.

MEMBER CARROLL: Nor do I ever find it when I look at the NRC's ad for people in "Nuclear News."

MR. JORDAN: Well, I don't know about the ads. I don't look at them. But in terms of --

MEMBER LINDBLAD: Your recruits look at them, though.

MR. JORDAN: Right. The matter is well-taken. In terms of the Office of Personnel and the EDO's identification of what are critical skills, this is one of them. And so if --

MEMBER LINDBLAD: If one walked in the door, they would recognize them?

MR. JORDAN: Well, I'd have to say that my hiring of one of your fellows was based on that person being a critical skill --

MEMBER LINDBLAD: Yes, yes.

MR. JORDAN: -- and getting the exception to hire that person.

MEMBER LINDBLAD: Yes.

MR. JORDAN: So it works.

MR. BELL: Another possibility for developing expert practitioner skills is on-the-job training at one of the national labs that's doing a lot of PRA work for us.

MEMBER LINDBLAD: Why not at one of the licensees or at one of the vendors?

MR. BELL: I would think that there would be potential conflict of interest problems. Mr. Jordan could probably address that better.

MR. JORDAN: Yes. That's been a problem for us in the past. We can do it in a lab, but with the utility, it has been a conflict with the NRC person there doing --

MEMBER LINDBLAD: When you say "lab," do you mean a university-operated lab or a contractor-operated lab?

MR. JORDAN: Contractor-operated lab.

MEMBER LINDBLAD: Well, what's the difference between Westinghouse at Savannah and West nghouse at Pittsburgh?

MEMBER CATTON: Big, big difference. Some of us were able to do a little consulting at Savannah River. We can't for Westinghouse.

MR. JORDAN: It becomes then a legal distinction of whether there's a conflict of interest.

MEMBER LINDBLAD: Does it matter who's paying the company? If the NRC is paying the person to work in Westinghouse, that's still a conflict?

MR. JORDAN: Yes.

MEMBER LINDBLAD: November 8th.

MEMBER CATTON: It takes a while for it to filter.

MR. BELL: Other future PRA training activities will involve the office-level PRA implementation plans. We will review those plans for the office. Those plans will be reviewed by the Technical Training Division to determine training requirements that are written into those plans. And if required, we'll do additional job and task analysis.

Speaking of job and task analysis, once we complete the Division of Waste Management job and task analysis, we're going to sit back and look at the process, let management review that to ensure that the process is giving us what we need to change the training program.

Future job and task analysis will incorporate any changes that are recommended. And then we'll perform job and task analysis as requested by NRC offices.

MEMBER LINDBLAD: Ed, why can't you call the guy a resident inspector?

MR. JORDAN. We could call him that, but it still wouldn't get us out of the legal bind.

MEMBER LINDBLAD: Yes.

MR. JORDAN: Is it a good time to summarize?

(Slide.)

MR. ARNDT: Give me 30 seconds. I just wanted to mention -- this is Steve Arndt again -- last week, as some of you probably know, the agency had the PRA implementation public workshop Friday all day. And the people in the agency who are in charge of putting together the PRA implementation plan met with the public and discussed what the implications of enhanced use of risk-based regulation means and how we're going to go and what we're going to do.

Just to make a couple of brief comments, in all

the formal presentation, both from the agency and from the public, the large deal was made out of the importance of training and getting things done and understanding what was going to be needed for staff capabilities to make the program work and a lot of good feedback, both internally and externally on PRA training. What the issues were discussed by NRR was the whole subject of living PRA and how that was to be used and what that meant, how the maintenance rule was going to apply to that. And we got a lot of good feedback on that issue. So that and other public forums in the PRA area are being fed back into the training program as well as the overall agency PRA implementation program.

With that, I think I'll turn it back to Jordan for some summary.

(Slide.)

MR. JORDAN: Okay. A quick summary is thank you;. You came for advice and consultation. I think we got quite a bit. We'll examine the transcript and pull out those matters that were recommended to us.

I jotted down a few of them. And there was a suggestion for course development for maintenance programs for the maintenance fuel; in the PRA areas, recommendations for teaching the reliability side of PRA, deal with the uncertainties, including shutdown risk explicitly; the

recommendation for considering examinations for PRA courses as well as these qualifications which we're presently considering now; comments on methods and lecture duration, I think what I would call educational theory.

That's one of the areas we're very weak, I think, on. And I would be interested in the consultation you might recommend. Give us an opportunity to absolutely examine our method of getting information, see if there is a greater efficiency that could be obtained -- not to see. I know there is, but to identify specific areas we can deal with.

Let's see. There was a discussion about the ideal conversion of needs position. You were interested in looking at a couple of the exams in terms of doing it in an ideal way and where we'd done it by --

CHAIRMAN SEALE: Feedback.

MR. JORDAN: Feedback; right. There are a couple of case studies. How could we have that interaction? Would it be best to invite some of you to the training center to do that or for us to put together at package that we can meet with you on here?

CHAIRMAN SEALE: Why don't we discuss it and come up with what looks like the best strategy for handling that. We can work through Doug and make some kind of other --

MR. JORDAN: Good. There were others that I didn't capture well along the way, but I did get a lot out of it and received thoughtful comment.

MEMBER CARROLL: And there was one that we changed the subject on that I was going to raise. I started life in the power business on the chemistry side of the house. And I have found over the years that there are darn few people, including NRC inspectors, that have very much sophistication about power plant water chemistry. And I didn't see a single course up here that seemed to deal with that subject.

I guess it's probably in some of the systems-type courses and so forth, but I've been frustrated many times literally having to get back to real basics to explain some chemical situation in a plant to a resident inspector or a regional inspector.

MR. JORDAN: And, yet, it's the root cause of some of our steam generator problems, among other things. I agree. I don't know of anyplace in our syllabus that we really do provide the water chemistry and good materials chemistry considerations.

MR. BELL: We've tried over the years. We've had a couple of chemistry courses come and go. We offered a course a few years ago called cold chemistry analysis that talked about water chemistry and various chemical

problems. We presented it for two or three years. And, quite frankly, there wasn't interest in it to keep it going.

Nobody has ever raised the question of that chemistry, a specific series of lectures on chemistry, ought to be part of the resident or operational inspection training program.

MEMBER CATTON: But that should be something you'd decide, shouldn't it? I mean, sometimes you have to force feed students.

MR. JORDAN: Yes. I'm sympathetic.

MR. WERMIEL: The industry requirements for water chemistry are so much more stringent than the NRC requirements.

CHAIRMAN SEALE: It's certainly become recognized as an important aspect of investment protection. And, yet, it seems like one of the first lapses of good practice where problems arise is to sort of forget about the chemistry. And to that extent, it might be nice for the inspectors to be aware of the fact that there's a problem, too.

Maybe the thing to start with is to see what the utilities have done, and that's a problem because it is very specific. Different people handle it different ways. And so there's not a single universal way of doing it, but

maybe you could pick their brains, at least see what they do in the chemistry area.

MR. JORDAN: It's an area we don't devote resources or much thought to.

CHAIRMAN SEALE: Yes.

MR. JORDAN: We occasionally get cranked over some chemical upset that occurs that downstream is going to have an adverse effect on this.

CHAIRMAN SEALE: Any other comments? Any member of the Committee want to make a statement?

MEMBER LINDBLAD: I'd ask you, Don and Larry, are you going to recommend that the Committee write a letter on --

CHAIRMAN SEALE: I was going to ask Ed that. Would you like for us to write a letter?

MR. JORDAN: About what?

CHAIRMAN SEALE: And about what is the question.

MEMBER CATTON: Do you think we're in a position to write a letter? I'm not sure.

MR. JORDAN: Well, the review is looking for suggestions, recommendations on areas covering places of emphasis. You've provided that verbally in the transcript. That's what we will use. That is sufficient. Your interest is clearly important to me. So I'd like to

solicit further discussions in a letter to me back with if not the subcommittee's reports, some continued dialogue that useful feedback occurred. That would satisfy me.

CHAIRMAN SEALE: Okay. Any other comments?

MEMBER CARROLL: I'd just like to make a comment I made last time. I sure think everyone around this table would profit from a visit to the technical training center, in spite of the fact that it's hard to get to Chattanooga.

MEMBER CATTON: Maybe we ought to have a -- Bob's subcommittee cught to meet there but be a little bit more specific on the agenda.

CHAIRMAN SEALE: That's one of the things that had me interested in --

MEMBER CATTON: I'd like to go more into the PRA because it seems to me that's kind of an evolving area and you really haven't fixed it yet. Maybe we could have some influence.

CHAIRMAN SEALE: And obviously you're going to be doing some things in this job task analysis area and so on anyway to coalesce your ideas and all. And, as other people look at it, we might be interested in looking at it as well.

MR. JORDAN: Why don't we work out a time milestone before we commit and do something dumb, --

CHAIRMAN SEALE: Yes.

MR. JORDAN: -- that we give you an opportunity to come and meet with us and for us to go through the presentation of what we plan to do, but, yet, have a --

CHAIRMAN SEALE: We would like to get something on these two extremes.

MR. JORDAN: Yes.

CHAIRMAN SEALE: We'll talk about that some more.

MEMBER CARROLL: And allow time to go visit the aquarium in Chattanooga.

MEMBER CATTON: There's a steakhouse there.

CHAIRMAN SEALE: Bill, did you have anything you wanted to comment on?

DR. KERR: I'll send you a written report.

CHAIRMAN SEALE: All right. Anyone else?

(No response.)

CHAIRMAN SEALE: Ed, I want to thank you and your staff. We've been very hard for you to tie down. And I realize that much of what you gave us today was what you were really prepared to talk to us about when we at one time did plan to come to the training center.

I think on balance it's desirable that it worked out this way to the extent that we have a larger representation of the Committee that was able to be here.

MR. JORDAN: Yes.

CHAIRMAN SEALE: You sense that our interest is real. And I'm glad that's the case because I think we all feel a very real concern and have some aspirations for what the training program might become.

We'll work with you through Doug in trying to set up further discussions. And, course, if you have anything from your side that you'd like to bring to our attention, why, let us know.

MR. JORDAN: Thank you. We feel --

CHAIRMAN SEALE: Any other comments?

MEMBER CARROLL: I just remember a class of people I once trained. And their reaction when it was all over was "I think you've made us so smart we're now dangerous." Always keep that in mind with training.

CHAIRMAN SEALE: That's true. Anything else?

(No response.)

CHAIRMAN SEALE: We're adjourned.

(Whereupon, the foregoing matter was concluded at 5:22 p.m.)

# C E R T I F I C A T E

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: Advisory Committee on Reactor Safeguards

Docket Number: n/a

Place of Proceeding: Rockville, MD

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

Irene Gray
Official Reporter
Neal R. Gross and Co., Inc.

# NRC Technical Training Program

December 7, 1994

Edward L. Jordan
Kenneth A. Raglin
Russell L. Anderson
Steven A. Arndt
Stephen S. Koscielny
T. Larry Bell

# Introduction

- Interactions with Other Organizations
  - Technical Training Information Exchanges with Canada, France, and United Kingdom
  - Training Technical Assistance Projects for Russia and Ukraine
  - In Touch with Industry Training Programs
  - Interactions with Other U. S. Government Organizations (DOE, Navy)
- AEOD Office Director Request for ACRS/ACNW Involvement
- Visit to TTC by 2 ACRS Members 10/4/94
- ACRS Briefing on AEOD Programs 10/6/94
- Desired Product

# Briefing Plan

- Technical Training Program Description
  - Program Elements
  - Needs Identification and Feedback
  - Staff Qualification and Training Programs
  - Technical Training Trends
- Overview of Technical Training Curriculum Areas
- Digital Instrumentation and Control Training Development Efforts
- PRA Training Summary and Development Efforts

# Technical Training Program

- Technical Training Division Mission
  - Coordinate with NRC Headquarters Offices and Regions in Policy Development and Implementation of Formal NRC Staff Qualification and Training Programs and Provide Technical Training to Meet these Integrated Needs
  - Develop New Courses and Modify Existing Courses to Meet New or Changing Needs Identified by the NRC Line Organization
  - Manage the Technical Training Center Facility and Assets
  - Provide Technical Assistance in Areas of Expertise and Provide Advice and Limited Technical Training Assistance to Foreign Regulatory Counterparts
- Determination of Needed Staff Skills Not within Scope or Staffing Capability of TTD
- Technical Training Center Facility
  - Simulators
  - Classrooms
  - Training Aids

# TTD Program Elements

- Reactor Technology
  - Reactor Technology Instructors
  - Qualified in Multiple Technologies
- Specialized Technical Training
  - Health Physicists
  - Program Managers
- Infrastructure Support for Reactor Technology Training
  - Simulator Engineers
  - Reactor Technology Instructors
  - Administrative Support
  - Contracted Simulator Support

# Methods of Providing Technical Training

- Custom Courses Using In-House Resources
- Custom Courses Using Contractors (Commercial or DOE Labs)
- Use of Courses by Other Agencies
- Individual Opportunities in Open Enrollment Courses (NRC Form 368 Process)
  - Used When Needs Are Insufficient To Justify Customized Courses
  - Used To Allow Staff To Receive University Training

# Staff Qualification and Training Programs

- Formal Qualification Programs
  - IMC 1245, Inspector Qualifications [**All Inspectors**]
  - IMC 1246, Materials License Reviewer Qualification [**Regional and NMSS License Reviewers**]
  - LOLB-MC-170, Examiner Qualification and Refresher Training [**Operator Licensing Examiners**]
  - AEOD Document, Headquarters Operations Officer Qualification Program [**HOOs**]
  - AEOD TTD Policy Document, Reactor Technology Instructor Qualification Program [**Instructors**]
- Special Training Programs
  - Reactor Engineer Intern Program
  - Senior Reactor Analyst Program [Under Development in NRR]
  - NRC Senior Fellowship Program
- Other Recommended Training [Softer Needs]
  - Generic Training Plans or Office Letters
  - Individual Development Plans

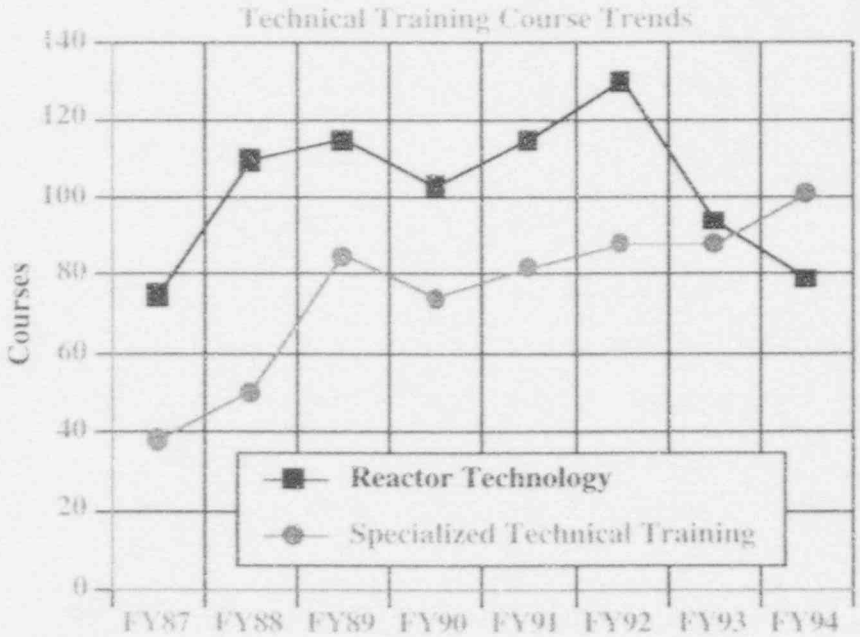
# BWR Operations Inspector Qualification Program (Typical of Others)

- Required Regional Training (Examples)
  - Code of Federal Regulations
  - Updated Safety Analysis Report
  - Regulatory Guidance
  - NRC Inspection Manual
  - Industry Codes and Standards
- Required Formal Training Courses
  - Power Plant Engineering Course or Equivalent Experience
  - Full Course Series in General Electric Technology
  - Fundamentals of Inspection Course
  - Inspecting for Performance Course
- Oral Qualification Board
- Training Required Within Two Years of Certification
  - PRA Basics for Inspection Applications Course
  - Effective Communications for NRC Inspectors
- Refresher Training
  - Fundamentals of Inspection Refresher Course
  - Simulator Refresher Course (Currently EOPs)

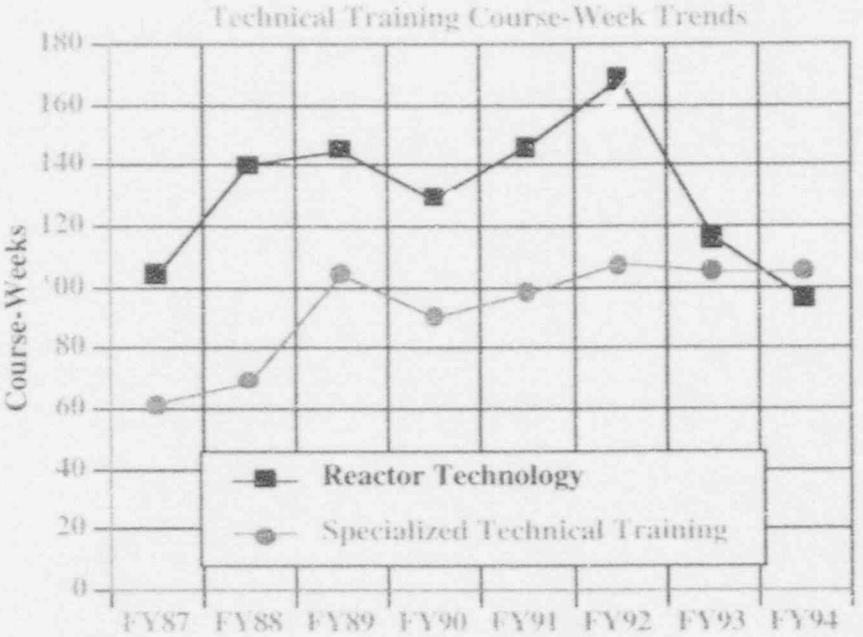
# Federal Workforce Restructuring Act of 1993

- Training Can Be Used to Advance An Employee's Professional Goals
- Training Does Not Have To Pertain to The Employee's Current Occupation or Profession But Must Be in the Interest of the Organization
- Numerical Impact of Change on Existing Technical Training Program Not Yet Known
- Commitment by NRC Chairman
- Commitment with Labor-Management Partnership Committees
- Allows for Wider Variety of Training Which Can Be Used To Improve Staff Knowledge and Skills

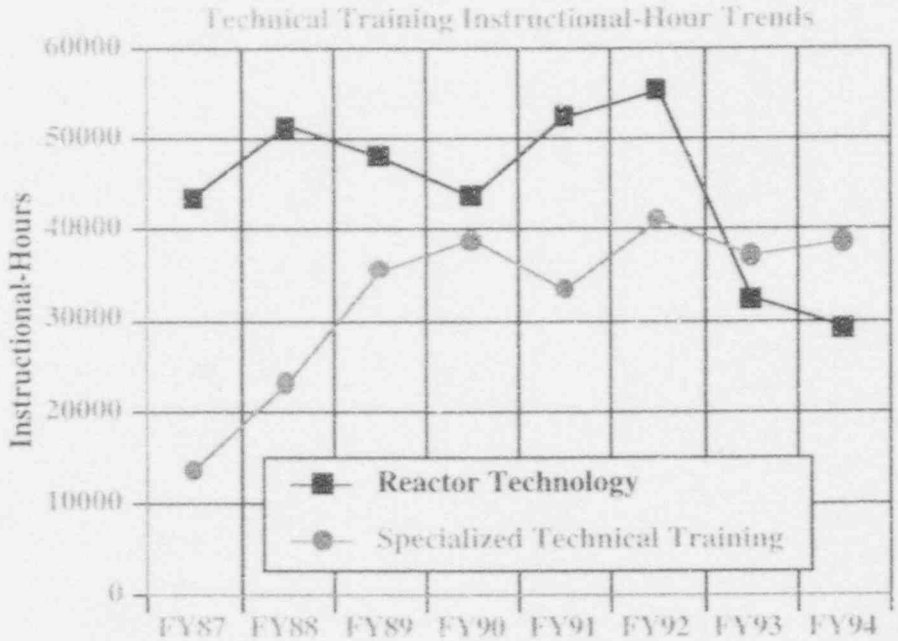
# Courses FY 1987 - FY 1994



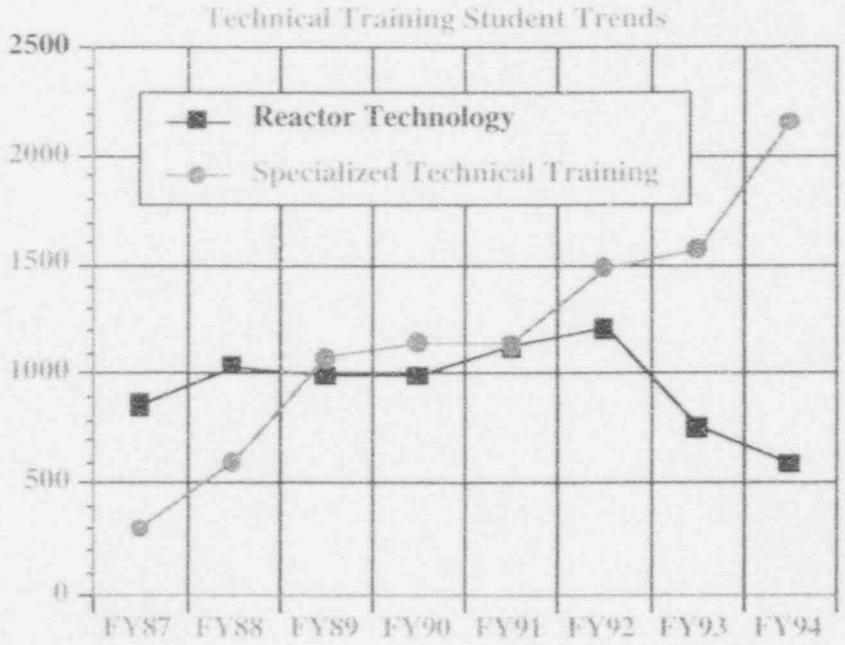
# Course-Weeks FY 1987 - FY 1994



# Instructional-Hours FY 1987 - FY 1994



# Students FY 1987 - FY 1994



# Needs Identification and Feedback

- Historical Trends
- Technical Training Needs Survey
- Cumulative Effect and Overall Capacity
- Training Advisory Group
- Strategic Planning from Training Advisory Council
- User Needs from Individual Offices or Regions
- Counterpart Meetings and Calls
- Work Groups
- Course Feedback

# Reactor Technology Training Overview

- Coverage of All 4 U. S. Light Water Reactor Designs
- Generic Reactor Technology Training
- Classroom and Simulator Courses
- Initial Training
- Refresher Training

# Reactor Technology Full Series

- **Systems Course**: System Design and Operation; Instrumentation and Controls; and PRA Insights

- **Advanced Course**: System Interrelationships; Analysis of Integrated Plant Response to Normal and Transient Conditions; Technical Issues; Facility Abnormal Events; PRA Insights; and Technical Specifications

- **Simulator Course**: Integrated Plant Operations; Use of Control Room Instrumentation To Evaluate Conditions; Evaluation and Application of Technical Specifications; Use of Plant Procedures; and Effects of Equipment Malfunction and Inappropriate Operator Actions

- **EOP Simulator Course**: EPG/EOP Structure, Interfacing, and Intent; Entry Conditions and Symptoms; Monitoring Critical Safety Functions; EPG/EOP Use and Philosophy; EPG/EOP, Operator and Plant Responses; and Normal and Abnormal Plant Operations

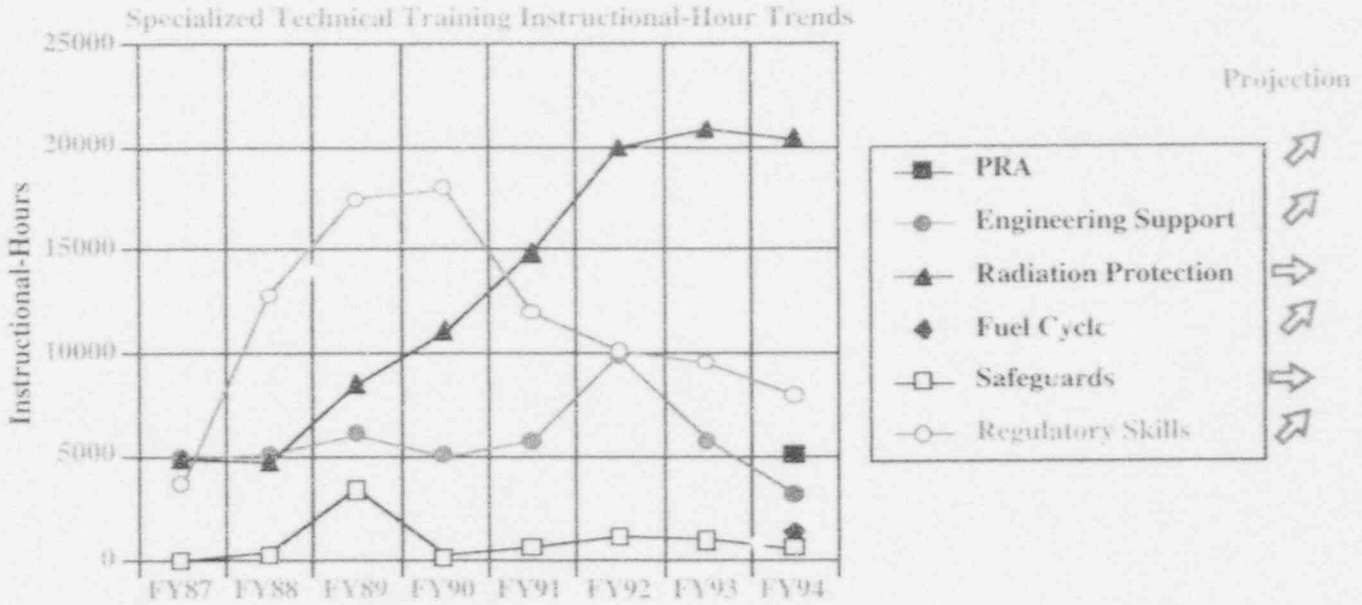
# Reactor Technology Curriculum Improvements

- GE Curriculum Modifications
- Westinghouse Curriculum Modifications
- Technical Specification Presentation Improvements
- Use of NEWS
- PRA Additions

# Specialized Technical Training Overview

- Probabilistic Risk Assessment [Later Focus]
- Engineering Support [Other than Digital I&C]
- Radiation Protection
- Fuel Cycle
- Safeguards
- Regulatory Skills

# Instructional-Hour Trend FY 1987 - FY 1994



# Engineering Support Training [Less Digital I&C]

- Background
- Typical Students
  - Reactor Operations Inspectors
  - Engineering Support Inspectors
  - Reactor Construction Resident Inspectors
  - NRR Reactor Inspection Personnel
  - NMSS Headquarters Transportation Packaging Supplier Inspectors
- Representative Courses
  - Power Plant Engineering
  - Motorized Valve Actuators
  - Welding Technology and Codes
  - NDE Technology and Codes
  - Inservice Inspection
- New Initiatives
  - Digital I&C (Later Discussion)
  - Welding and NDE Technical Managers Course
  - Needs Survey

# Radiation Protection Training

- Current Status
  - Health Physicists on TTD Staff to Support Program Development and Expansion
  - Stable Curriculum of 28 Courses Listed in Syllabus
- Typical Students
  - Reactor Health Physics Inspectors
  - Fuel Facility Specialist Inspectors
  - Materials Radiation Specialist Inspectors
  - Agreement State Inspectors
- Key Courses
  - Applied Health Physics
  - Health Physics Technology
  - Environmental Monitoring for Radioactivity
  - Diagnostic and Therapeutic Nuclear Medicine
  - Teletherapy and Brachytherapy
  - Safety Aspects of Industrial Radiography
  - Radwaste Management
  - Health Physics Topical Review
- New Initiatives
  - Introductory Health Physics
  - Health Physics Technical Managers

# Fuel Cycle Training

- Actions/Events Driving Curriculum
  - Action Plan to Revise Relevant Regulations and Associated Guidance and Standard Review Plans
  - Events at Fuel Facility Sites
  - Transfer of Oversight Responsibilities for Gaseous Diffusion Plants from DOE to NRC
- NMSS Memo (10/93) Identifying a Curriculum of 9 Courses
- AEOD (TTD) Developing 7 of 9 Courses; NMSS (FCSS) Developing Other 2
- Curriculum Targeted for Fuel Facility Inspectors, License Reviewers, HQ Staff, and Other Personnel with Regulatory Oversight over Fuel Cycle Facilities
- IMC 1245 Being Revised (NMSS: FCSS Lead) for Fuel Cycle Specialist Inspectors)

# Fuel Cycle Curriculum and Course Dates

- Required Initial Training
  - Fuel Cycle Technology (9/19-23/94 and 1/23-27/95)
  - Introduction to Nuclear Criticality Safety (2/22-24/95)
  - Hazards of Chemical and Mechanical Fuel Cycle Processes (4/24-28/95)
  - General Health Physics Practices for Fuel Cycle Facilities (8/21-25/95)
- Required within 2 Years of Certification
  - Mechanics of Sampling and Measurement for Fuel Cycle Facilities (7/24-28/95)
  - Management Systems and Structures for Regulators (TBD; NMSS:FCSS Lead)
  - Integrated Safety Analyses (TBD; NMSS:FCSS Lead)
- Supplemental and Specialist Training
  - Nuclear Criticality Safety (10/22-24/94)
  - Uranium Enrichment Process (7/24-28/95)

# Safeguards Training

- Current Status
  - Stable Curriculum
  - Courses Almost Exclusively Conducted through Other Government Agencies
- Typical Students
  - Regional and NMSS Physical Security Inspectors
  - NMSS Headquarters MC&A Inspectors
- Representative Courses
  - Introduction to Physical Security Systems
  - Advanced Physical Security Systems
  - Weapons Familiarization
  - Safeguards Technology Refresher
  - Neutron Assay of Nuclear Materials
- Preparing Agreement for Support from CIA

# Regulatory Skills Training

- Curriculum Area Crosses All Inspector Disciplines
- Emphasizes Inspection and Examination Techniques
- Representative Courses
  - Fundamentals of Inspection
  - Fundamentals of Inspection Refresher
  - Examination Techniques
  - Licensing Practices and Procedures
  - Root Cause Incident Investigation Workshop
  - Inspecting for Performance
  - Incident Investigation Team Training

# Digital I&C Training Developmental Efforts

- Background
- TAG Meeting of 4/94
- Establishment of Digital I&C Work Group
- Recommendations Will Require Review and Approval by Line Management

# Digital I&C Work Group

- Charter
  - Determine Training Needs in Digital I&C and Related Areas
  - Define Target Audiences for Training
  - Identify Courses To Be Developed and Course Objectives
  - Review Course Materials As They Are Developed
  - Recommend Changes to Curriculum
- Membership
  - Stephen S. Koscielny, TTD, Chairman (Instructor/Program Manager)
  - Paul J. Loeser, NRR/DRCH (Electronic Engineer)
  - John Calvert, RI (Reactor Engineer)
  - William H. Ruland, RI (Section Chief)
  - Milton B. Shymlock, RII (Section Chief)
  - David S. Butler, RIII (Reactor Inspector, Nuclear Engineer)
  - Paul C. Gage, RIV (Reactor Inspector, Electrical Engineer)
  - Russell L. Anderson, TTD (Branch Chief)
  - Steven A. Arndt, TTD (Technical Training Advisor)
- Meetings

# Quantification of Training Needs

- Most Important Group Needing Training Is Region-Based Inspectors
- Next Group Is Headquarters Personnel
- Third Group Is Resident Inspectors

# Training for Region-Based Inspectors and HQ Personnel

- Relatively Small Target Group
- Part 1: Off-the-Shelf Commercial Courses
  - Instrumentation and Control Fundamentals
  - Digital Electronics for Industrial Instrumentation
  - Basic Course for Programmable Logic Controllers
  - Principles of Software Engineering
- Part 2: Regulatory Perspectives Course (Later Slide)
- Some Sources of Off-the-Shelf Courses
  - Instrument Society of America
  - GPS Technologies
  - Rockwell Automation -- Allen Bradley
  - Data Technical Instruction
  - System Technology Institute
  - Instrumentation Data Communication, Inc.
  - University of Wisconsin

# Regulatory Perspectives Course

- Cooperative Effort with NRR As NRC Policy Is Established
- Will Provide Needed NRC Aspects of Digital Issues, Industry Weaknesses, and Lessons Learned
- Being Designed to Allow Conduct of Effective Inspections with Prudent Use of Limited Resources
- "Nuts and Bolts" Approach to Inspection Issues

# Proposed Regulatory Perspectives Course Topics

- Introduction and Reference Materials (NUREGs, NRC Documents, and EPRI Instructions on Digital Modifications)
- Regulatory Policy (Generic Letters, Temporary Instructions, Regulatory Guides, Standard Review Plans, Branch Technical Positions, and Inspection Manual Chapters)
- Inspection Planning Workshop (A Modification Package Will Be Used to Conduct an Inspection in a Seminar/Workshop Format)
- Inspection Report Preparation (Development of Final Inspection Report, Open Items List , etc. - Similar to Other Inspection Courses)
- Recent Plant Problems and Lessons Learned

# Training for Resident Inspectors

- Short Seminar to Acquaint Resident Inspectors with Issues
- Technical Component
- Regulatory Perspectives Component
- Subject Will Be Addressed in Future Meetings

# Related Training Activities

- Tutorials Completed by LLNL
  - Overview of Software Safety
  - Introduction to Software Reliability
  - Software Verification and Validation
  - Software Testing
  - Introduction to Real-Time Systems
  - Real-Time Performance
  - Formal Methods
  - Software Audits
- Tutorial Planned (also LLNL)
  - Data Communications
  - Programmable Logic Controllers
  - Diversity and Defense in Depth Analysis
  - Software Hazards Analysis
- In-House Briefings
- OJT
- NRR Senior Fellow Doing Graduate Work in Digital Instrumentation and Control

# PRA Working Group Recommendation

- Systems Approach to Training Method Should Be Applied to Other Major Uses of PRA within NRC to Tailor A Complete Program for PRA Training
- Systems Approach to Training Elements
  - Analysis
  - Design
  - Development
  - Implementation
  - Evaluation
  - Feedback
- Additional PRA Working Group Training Recommendations
  - More System Design and Operational Knowledge
  - Rotational Assignments to Branches with PRA Expertise or National Laboratories
  - NUREG-1489 ("A Review of NRC Staff Uses of Probabilistic Risk Assessment") Appendix C Training

# PRA Working Group Categories

- **Basic User**: Staff Who Use PRA Results and Require Information on How PRAs Are Performed and The Results Obtained

- **Advanced User**: Staff Who Work with PRA Models or Manage Contractor Efforts To Work with PRA Models Require More Extensive Knowledge

- **Expert Practitioner**: Staff Who Perform Quality Assurance and Expert Advisory Functions As Well As Develop New Methods Require Very Extensive Knowledge

# Typical Knowledge and Skills of Basic Users

- Detailed Systems Knowledge
- Familiarity with Basic PRA Methodology
- Use of PRA Information
  - Dominant Accident Sequences
  - Systems Contribution to Risk
  - Operator Failures and Recovery Actions
- Development/Implementation of Risk Based Inspection Plans
- Identification of Issues Warranting Further Study

# Typical Knowledge and Skills of Advanced Users

- Detailed Systems Knowledge
- Understanding of PRA Methodology (Including Probability and Statistics)
- Working Level Knowledge of PRA Models
  - Modify Event and Fault Trees to Obtain
    - Estimation of Conditional Core Damage Frequencies
    - Estimation of Event Frequencies
  - Modify Databases
- Familiarity with PRA Results from Many Plants
- Understanding of Level 2 Methods and Results
- Understanding of Level 3 Methods and Results
- Management of Contractor PRA Activities

# Typical Knowledge and Skills of Expert Practitioners

- Detailed Systems Knowledge
- Ability to Perform PRAs
  - Extensive Experience in Systems Reliability
  - Statistical Skills
- Provide Quality Assurance of PRA Activities
- Develop PRA Methods

# Current PRA Curriculum

- Orientation Courses
- Basic User Level Courses
- Advanced User Level Courses

# PRA Orientation Courses

- PRA Overview
- PRA Fundamentals
- Overview of Performance Assessment Techniques for High Level Waste
- Probability and Statistics for PRA
- Applied Statistics

# PRA Basic User Level Courses

- PRA Basics for Inspection Applications
- PRA Basics for Licensing Project Manager

# PRA Advanced User Level Courses

- Integrated Reliability and Risk Analysis System (IRRAS) Basics
- Human Reliability Assessment
- Seismic Margin Methods

# FY 1994 PRA Training Statistics

- Attendance for PRA Courses
  - Duplicate Names Eliminated
  - International Students Eliminated
  - Other Government Agency Students Eliminated
- Categories of NRC Staff and Distribution (162 Students)
  - Resident Inspectors (10)
  - Region-Based Inspectors (19)
  - Project Managers (11)
  - Managers/Supervisors (9)
  - Reliability and Risk Analysts (11)
  - Engineers (49)
  - Other NRC Staff (53)

# Curriculum Changes

- Job and Task Analysis
- Feedback
- Special Needs
- Office Level PRA Implementation Plans
- Risk Insights and Perspectives Inclusion in Overall Technical Training Curriculum

# Job and Task Analysis

- Pilot Program Initiated by PRA Working Group
- RES Generic Safety Issues Prioritization and Resolution Section
- NRR Event Assessment Section of Probabilistic Safety Assessment Branch
- NMSS Division of Waste Management

# New Courses Under Development As A Result of JTAs

- Accident Progression Analysis - (Advanced User Level)
- Accident Consequences Analysis - (Advanced User Level)
- System Modeling Techniques - (Advanced User Level)
- Risk Assessment In Event Evaluation - (Advanced User Level)

# Other New Courses

- Developed As A Result of Feedback
  - Advanced Integrated Reliability and Risk Analysis System (Advanced IRRAS) - (Advanced User Level)
  - PRA Insights into An IPE - (Basic User Level)
- Developed As A Result of Special Needs
  - Seminar on Poisson and Binomial Updating - (Advanced User Level)

# Future PRA Training Activities

- Expert Practitioner Level Skills
  - Recruitment Recommendation
  - University Level Courses
  - On-the-Job Training
- Office Level PRA Implementation Plans
  - Review of Training Requirements by Office and TTD
  - Job and Task Analysis If Required
- Job and Task Analysis
  - Management Review To Ensure Adequacy of Process
  - Future JTAs Will Incorporate Recommended Changes
  - JTAs As Requested by NRC Offices

December 7, 1994

# PRA Implementation Plan
# Public Workshop Summary

- PRA Policy Statement
- PRA Implementation Plan
- Highlights

# Summary

- Significant Attrition with Minimal Outside Hiring Projected for Next Few Years
- Increased Emphasis on Retraining to Enhance Skills and Match Skills with Needs
- PRA and Digital I&C Are Developing Areas
- ACRS Interest Is Timely
- ACRS Review Should Be A Continuing Process