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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the matter of:

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

Subcommittee on Reactor Radiological Effects

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

SUBCOMMITTEE ON REACTOR RADIOLOGICAL EFFECTS

- - -

PUBLIC MEETING

Wednesday, July 31, 1985

Room 1167

1717 H Street, N.W.

Washington, D.C.

The Subcommittee met, pursuant to notice, at 8:30 a.m., Dade Moeller [Chairman of the Subcommittee] presiding.

ACRS MEMBERS PRESENT:

D. Moeller

R. Axtmann

C. Mark

ACRS CONSULTANTS PRESENT:

M. Steindler

M. First

R. Kathren

SPEAKERS:

B. Kindley

D. Muller

R. Serbu

O. Lynch

ACRS STAFF MEMBER:

O. Merrill

PROCEEDINGS

MR. MOELLER: The meeting will now come to order. This is a meeting of the Advisory Committee on Reactor Safeguards Subcommittee on Reactor Radiological Effects. The meeting, for the most part, will be open to public attendance. However, portions of the meeting will be closed for the discussion of proprietary information of the Institute of Nuclear Power Operations, INPO.

As reflected in the agenda, it is estimated that this will occur at approximately 10:30 a.m. this morning after we take our break. I am Dade Moeller, Chairman of the subcommittee. The other ACRS members present today are Robert Axtmann and Carson Mark. ACRS consultants for the meeting are Martin Steindler, Melvin First and Ron Kathren.

The purpose of the meeting is to review the INPO radiation protection program, particularly as it relates to similar programs within the NRC. I probably should expand on that. It is really the activities of INPO related to assuring that the ALARA criterion is properly and effectively applied by the commercial utilities that are operating nuclear power plants.

The NRC has been working closely with INPO for several years in a coordinated radiation protection program, the objective of which is to minimize the radiation exposure and doses to ALARA levels at the commercial plants.

Dan Muller, Assistant Director for Radiation Protection, Division of Systems Integration, NRR, recently requested that the ACRS review the findings of an NRC two-year study, the purpose of which was to evaluate the effectiveness of INPO's effort. He also suggested that it would be worthwhile to have INPO discuss their activities with the ACRS, and today we have with us William Kindley, Deputy Director, Radiological Protection and Emergency Preparedness Division within INPO who will be making their presentation.

Related to these activities, NRC received in May 1985 an INPO Safety Operating Experience Report, SOER 85-3, entitled, "Excessive Personnel Radiation Exposures." This is a confidential INPO report and that is the item that will be discussed during the proprietary closed portion of the meeting. We have asked INPO to review that report with us.

I wanted to add also that from a personal point of view, there were several things that I hope we will have time to review during the day. And for Dan and Bill's information or to provide them with information, some of the items I would like to be sure we cover at some time would be INPO's activities related to internal protection because I have noticed several LER's just in the last month or so where workers at commercial plants have received significant -- not necessarily over-exposures, but significant internal contamination.

Another item I hope we'll have time to discuss is occupational safety and health. If INPO is doing anything in this area, I personally would like to hear about it. I say this because our conversations with radiation protection personnel at several of the commercial utilities have indicated that they believe adequate efforts are being provided to radiation protection but they many times questioned whether adequate efforts are being applied for routine occupational safety and health problems.

And in fact, again, if you look at the LER's you'll see hardly a month that goes by that some worker hasn't fallen off of a scaffold or a crane hasn't swung around and hit him or her and seriously injured them or killed them. So we would like to spend a little time discussing that.

And then a third item that I had which we will distribute is this one-page description of an event -- it's a summary of a meeting of May 6, 1985 to discuss respiratory protection for subatmospheric containments, and there is a very short half-page statement about the problem. And it pointed out that the following plants have subatmospheric containments: Surry 1 and 2, Beaver Valley 1 and 2, North Anna 1 and 2 and Millstone 3.

And of course, if they are at subatmospheric pressure, the relative quantity of oxygen, of course, is still 20 percent, but the total amount of oxygen is reduced. And

apparently there were concerns about people going into these containments with respirators on, and I would like to just probe with the expertise we have in the room and learn a little more about that situation.

The meeting is being recorded and it is, in a sense, formal, but I hope the formality will in no way interfere with us communicating.

Owen Merrill who is seated on my right is the assigned ACRS Staff Member for this meeting. A transcript is being kept and it is requested that each speaker identify himself or herself and speak with sufficient clarity and volume so that they can be readily heard.

We have received no written statements from members of the public and we have received no requests from members of the public to make oral statements at the meeting. However, if there is a member of the public here who desires to make a statement or who has something to contribute to the discussion, let Owen Merrill know and we will try to provide an opportunity for you to offer your comments.

Let me ask at this time before we begin with the agenda -- and let me just briefly review the agenda and then ask if either members of the subcommittee or the consultants have any comments.

This morning, as I say, from about in the next two or three minutes until about 10:00 or 10:15, whatever is

appropriate, we'll hear from William Kindley about the INPO program related to ALARA. Then we'll take a break. Then we'll go into the closed session to talk about the excessive personnel radiation exposures. Then we will break for lunch. Then we will hear from Dan Muller on the NRC Staff's evaluation of the effectiveness of the INPO program, and that will last from 1:00 to 2:30 or 3:00, whatever is appropriate. And then at that time we'll go into Executive Session and decide what action, if any, the subcommittee may want to take.

I am not thinking at this point that the subcommittee will have anything necessarily that we will want to do. If we find some glitch in the program or some burning issue that we think should be commented upon, we may want to write it down and formally submit it. But at the moment, I don't perceive the necessity of a written report.

I hope also during the discussions we can devote some time to indicators of performance, and I hope -- or I would urge that the subcommittee members and its consultants keep in mind throughout the day what are the indicators of performance. In other words, NRC is evaluating whether INPO is doing a good job; INPO has developed indicators of performance to determine whether things are getting better or worse at the plants; I'm sure NRC Staff has its indicators of performance. The ACRS has had several fellows over the past several months trying to develop indicators of performance.

Dr. McEvoy has devoted time to that, and his indicators are pretty much the same as INPO's and the Staff's. It's obvious you could look at collective occupational doses or the number of workers who exceed 5 rem a year. Those indicators are pretty straightforward. Other ones are more subtle. For example, INPO uses the volume of low level waste produced at a plant as an indicator of performance. McEvoy uses one of his that no one else uses, to my knowledge, the total curies of airborne releases for the year. Now, he obviously ties that into the nature and type of the plant because it will be dependent upon the type of plant. But he uses that as an indicator.

McEvoy also weights each indicator, gives each one an assigned weight -- and some carry more weight than others -- and he then multiplies each by a factor and gets a total to rate a plant.

Well, we want to devote some time to this because unless we can come up with some really meaningful indicators or unless INPO and the Staff have come up with meaningful indicators, then that might be an area on which we want to comment. And as I say, I personally believe there are some more hidden indicators out there that haven't yet been uncovered that we need to think about.

Do you, Bob, or Carson, have any comments or questions at this time?

MR. MARK: No.

MR. AXTMANN: No.

MR. MOELLER: The consultants? Martin, Mel, Ron?

[No response.]

All right. Then we will move on and call upon William Kindley to begin by reviewing the INPO program. And, Bill, if you want to stand over next to the projector or wherever you desire, that will be fine, and we will control the lights for you and so forth.

Let me say that we very much appreciate your coming and we very much look forward to hearing what you have to say. Everyone should have a set of Bill's handouts.

MR. KINDLEY: My name is Bill Kindley, I am Deputy Director of Radiological Protection and Emergency Preparedness at the Institute of Nuclear Power Operations. I appreciate your invitation to talk to you, the ACRS subcommittee, this morning. This morning what I want to talk about is industry progress in radiological protection that we have seen during 1984.

I am going to particularly address my comments to that. Although there may be a tendency to overlap into the closed session, I would answer your questions concerning that but I may postpone them until we get to the closed session. I don't have a set of prepared remarks; I'm going to talk from the slides here. I am doing this informally, as Dade has

suggested in the past, and then as I go along, I would prefer to handle your questions as I go along rather than wait for them to come back later.

If some of the questions get into some other areas I do have some other slides that may help answer some of those questions. And if we can take care of the delays --

MR. MOELLER: No problem.

MR. KINDLEY: Well, generally the ones I have here should handle the situation.

INPO appreciates what ACRS is doing as far as keeping abreast of our activities, into the point of Dade Moeller going on evaluations with us and being able to actually see firsthand what we actually do in the field and how we actually evaluate the plants, how we actually review oru process. We have also had members of the NRC Staff, NRR people, on these evaluations, and we work closely with them and certainly appreciate what the NRC has done with us to work on these different matters.

Anything I am saying today has to be taken in context that this is the industry's performance; this is not INPO's performance, and I don't think it's fair to say it's the NRC's performance either. But the industry primarily has done this. Certainly, there have been helpers from the NRC, we have been helped by INPO and by EPRI and many other people involved.

I think what we're talking about here is this is what the utilities have done, and I don't want to take credit for INPO's standpoint because if we were a catalyst and were happy about that, then it's actually they are the ones that did the work. INPO can't say any radiation exposure on their own efforts; it's only through working with the utilities and their efforts that actually reduces radiation exposure or reduces solid waste volumes. We can say facetiously that our visiting the plants probably increases the exposure because we do get into a lot of high radiation areas as part of the evaluation. But it's their efforts and I think we ought to keep that in mind. It's what they're doing that really results in the numbers that I'm going to talk about.

You asked about indicators of performance. Certainly, I'm using indicators of performance in this presentation. The last couple slides I've got are some range indicators of performance which are probably temporal in nature; ones that we will not keep going in the future. But they do, in 1984, reflect something that's worth discussing.

So let me go ahead and start on this.

[Slide.]

The first trend I'd like to talk about is total collective radiation exposure. What this graph shows here is a summation of all the exposures for all the workers, both contractor and plant employees for each of those years. And

this is for the whole industry. These are not averages, these are just a total adding up of all the exposures of all the workers in the industry.

I guess I should preface some of these things by saying that there is a number of sets of numbers floating around right now. NRC has certain numbers that they're using and they are going to be different from the ones I am talking about. And I think there are valid reasons for these differences in terms of what do we actually add up here.

We have attempted the best we can to get the actual man rem from the plants. We've done this through phone calls. We're going to improve our system next year in terms of getting formal reports from these people. Most of the people have told us, this is what we've told the NRC. So theoretically, we should be working from the same data base, but we've chosen to range the data a little differently than I think the NRC has, and this will come up as we go along.

For example, a few plants do not tell the NRC what the total collective man rem is. They do report how many people are in the range of 1 to 2 rem, 2 to 3, 3 to 4, and then there's an estimating technique that the NRC uses to come up with the total collective man rem.

Consequently, I think what you're going to find is the NRC's numbers are slightly higher than our numbers, because that estimating technique, if I understand it right,

uses the mid range of that range, like 1 to 2 would be one and a half, and if I'm wrong maybe I can be corrected on that, and then times the number of workers. Since the exposures tend to average closer to the bottom end of that range, this tends to give a slightly higher number. I think in 1994 we're talking about less than 1000 rem and it's probably not even worth discussing from an accuracy standpoint.

MR. MOELLER. Well, Bill, a couple quick questions that maybe Dan should answer. Why do several plants have this privilege?

MR. MULLER: Reporting requirements in 20.407 --.

MR. SERBU: Rich Serbu. All you have to do is comply with the reporting requirements in 20.407 and/or tech specs, and they don't require that additional reporting. If we ask them to do that, it would be an additional request of the licensee and we'd have to go through the whole nine yards.

MR. KINDLEY: This is something we're working together on. If we find a plant that hasn't reported to the NRC their total collective exposure, we try to encourage them to do that. There's a couple plants we were not successful with, neither NRC nor us last year, in getting that number formally reported. And I believe rightfully, the NRC does not want to go use a number that came in over the telephone. We are more relaxed about using telephone information. So I think that's part of what the differences are.

MR. FIRST: Do I understand that these are the same plants through 1984, so that there hasn't been additions to the data base?

MR. KINDLEY: No, sir, they are not the same plants. This is for all plants that are operating during that period of time.

MR. FIRST: Could you tell me offhand what the differences might be from year to year in the number of plants operating? Because I know that your numbers there are, you know, only about a difference of plus or minus one or one and a half percent from what would be an average, which suggests that either you have an irreducible minimum, or you have a difference in number of plants operating.

MR. KINDLEY: Well, yes, there is a difference in number of plants, because the number of plants is increasing along there. I can use two examples here:

In 1984, we are talking about on the order of 78 plants, 78 units, I think that is, rather than plant sites, 78 units. And in 1983, that number looks like 75, if I am adding my numbers right.

MR. MOELLER: I have the numbers right here. In 1980, it is 68; '81, it is 70; in '82, it's 74; and in '83, it's 75; in '84, it is 78.

MR. KINDLEY: And that is a key point, of course, because this looks like it is particularly level, and the

decrease of about 3 percent in '83 to '84 doesn't really look significant as you go across that.

I think that is a key number, that total collective manrem, because I think that can be related back directly to health through the various cancers per manrem, things like that. So this is a number that we are interested in seeing changed.

That could obviously go down in future years, and that says the health of the workers is improving, although relatively speaking, when more work is going on, it is spread over more people.

MR. FIRST: Well, wouldn't it be well to normalize this then on the basis of per plant or per worker, so that you could get a better idea of whether things are getting better or worse? As I look at that, as you say, it is flat. It is just as flat as it can be with statistical information.

MR. KINDLEY: We are going to do that in subsequent slides. I am going to get into it on a per-unit basis. But I did want to show this one. We feel this is a key number, and we are interested in that being reduced over time, and we are going to keep track of that particular number, although it isn't one of our indicators that we are using directly to measure performance of individual units.

As a industry as a whole, we feel we ought to be working on getting that number down.

MR. KATHREN: Bill, this is a double question

First, the numbers of workers involved, is this an increasing number? You don't have the mean individual exposure per worker on your handouts, so Part A, is this decreasing per worker?

And Part B, how much of this reflects the minimum level of detection of the dosimeter?

Do you understand what I mean by that question?

MR. KINDLEY: I think so. Let me take the first one.

We did not collect the information on the numbers of workers. That information is provided to the NRC, and they may want to comment on it, but I can reflect an inside NRC -- it looks like July 8th letter, that talks about -- a July 8th Inside NRC, which talks about the average exposures for U.S. plant workers hit a record low in 1984. And the number here that they are using was the average -- BWRs averaged .66, and PWRS averaged .52 rem per worker.

Again, maybe the NRC may want to talk about that, because we took these numbers basically from them. Apparently there was an increase in numbers of workers last year. There was something like 94,000 workers there.

I think we have to be a little careful about -- of using that exposures per worker as an indicator. I personally don't like it very much because all it takes is adding more

workers to the work force, and generally speaking, that tends to increase these numbers on total collective dose.

MR. KATHREN: That is why it has to be used in conjunction with this.

MR. KINDLEY: So we are actually starting the encouragement of utilities to reduce the number of people that they permit to receive exposure as a means of reducing the total collective dose. Because this is a management tool, in terms of trying to get the utilities to plan their work better. Just being able to throw a lot of people on a job with minimal planning and minimal supervision, as it seems that some utilities have in the past, it is not conducive to reducing exposures.

So we are actually going in the other direction and encouraging utilities to actually look at minimizing the number of workers they actually permit to go into a radiation area and hopefully where it is successful, we will see some impact on that in the next few years.

That is a relatively new effort. The first time we even mentioned it was this year and, of course, we don't expect to see actual measurable results for a couple of years. It is a concept that isn't fully understood by the industry yet, either.

So we don't have that indicator on numbers of exposures per worker, but we do look at it, we do keep track

of that information.

MR. MOELLER: Excuse me. Ron's other question on the minimum detectable?

MR. KINDLEY: Our answer on that is we are basically relying on information which they give us, the dosimeter information that they give us. There are programs in effect -- whether it's a NVLAP program that the --

MR. MOELLER: Excuse me. What is that acronym?

MR. KINDLEY: I'm not sure I know it.

MR. KATHREN: National Voluntary Laboratory Accreditation Program. It's administered by the National Bureau of Standards. And one of the phases of it is to provide a laboratory accreditation for personnel dosimeters.

MR. MOELLER: Thank you.

MR. KINDLEY: In addition to that, we look at that as kind of a minimum standard, that NVLAP program, and then when we go in, in our evaluations, we do look at how they are running the dosimetry program.

We are concerned about minimum sensitivities. Are they automatically throwing away everything under 50 millirem? We don't see very many people doing that any more. That number is down around 10 in most places for minimum sensitivity.

And again, I am talking generic from the industryl. But we look at that, we look at quality control aspects, a

comparison with pocket ion chambers, and again looking for indicators of dosimetry performance.

MR. MARK: When you speak of 10 millirem, over what period is that accumulated?

MR. KINDLEY: It's either a month or a quarter, depending on how you actually run your dosimeters.

MR. MARK: Well, do dosimeters really hold steady for a quarter?

MR. KATHREN: I think the new TLDs are very good.

MR. MARK: The stuff people wear, though?

MR. KATHREN: Oh, yes. The little pocket dosimeters, the pocket ion chambers, are very poor. Well, they are much better today, but they are still not as good as the TLDs.

But I think this reflects probably largely TLD readings, because the pocket ion chambers are not commonly used as the legal control or legal basis for exposure reporting.

Is that not right, Bill?

MR. KINDLEY: That is correct. TLDs are almost used exclusively for legal records. There's a couple of plants that are still using film, but pocket ion chambers are basically used as a control mechanism to keep track in between processing periods.

MR. MARK: Well, I guess they'd be all right for a

day's or an afternoon job or something.

MR. KINDLEY: That's right. And then they are reported.

MR. MARK: Well, that's what I was worried about. 10 millirem in a quarter in an ion chamber would get lost.

MR. KATHREN: Well, we have never seen that.

[Laughter.]

MR. MOELLER: Another comment. Bill -- and I am looking at indicators of performance -- but should not this be titled "Annual Collective External Radiation Exposure"?

MR. KINDLEY: Yes, sir, that is more accurate, but I think in all fairness we need to reflect that the internal exposures we have seen have been minimal, and even if you added them to this, you probably would not have a significant change to them.

MR. MOELLER: Right. But as an indicator of performance, do you keep a running account, for example, of the number of workers each year who exhibit measurable internal exposure?

MR. KINDLEY: The answer to that question, INPO does not as an indicator. What we do do as part of our evaluation process is we will go in to a utility, and one of the indicators of performance on an individual plant is to look at how many positive whole body counts they have. Anything that is detectable, which is statistically detectable, is something

that we feel is worth investigating. Why has that individual got that in him? Do they actually know that? Some people, they walk in the door -- if anybody picks it up at the plant, we have encouraged them to evaluate each case to find out why.

Now, one of the reasons that that is practical is that there are very few of these things that occur. The number of positive whole body counts is relatively rare around the industry, and usually we are just talking about a few percentage, and that's part of the reason why I say I don't think they would change these numbers, even if you added them.

MR. MOELLER: So you use whole body counts as an indicator of performance for individual plants, but not nationally?

MR. KINDLEY: That's right, because again when you average it over most plants -- and most plants don't have any -- it does not become a useful indicator. But it is a good indicator for an evaluator to walk in and look at that and say, okay, here is a good starting place, and then pull the strings to find out where they actually improve their internal dosimetry program.

MR. STEINDLER: Do you break down this annual collective exposure in age groups and by sex?

MR. KINDLEY: No, sir, we don't.

MR. STEINDLER: Does the industry?

MR. KINDLEY: I don't think they do. Obviously the

information can be done because they keep individual records there, but I am not aware of anybody that breaks it down by age group and sex.

MR. STEINDLER: Is the implication then that is not a useful measure of performance?

MR. KINDLEY: I guess right off the top of my head, I don't see how that would be helpful.

Now let me take your question and change it a little bit in terms of the lifetime doses. That is a number that we are more interested in. It's a number that the industry is getting more interested in reflecting themselves, what are the highest lifetime doses available.

I did a very brief look at that for an NRCP a few months ago. We took seven large utilities which accounted for about 40 percent of all the workers that had been exposed since the beginning of the industry. Again, obviously we are working on estimates of total workers, but the number of workers that they had.

In that group of seven, we came up with a relatively small number, and I don't remember the exact number, but it was something like on the order of 10 to 20 people that had more than 100 rem.

Again, now, we are talking about 100,000 workers. And some of these could very well have been duplicated because they keep track of contractors that would come into one plant,

and when he left his total lifetime dose, would go into these statistics.

If he went to another plant, his total lifetime dose there would be duplicated there.

So you have two people that may be over 40 rem lifetime, and it's actually the same guy.

We found relatively few people over 100 rem.

We also found -- and it was a question that Jerry was really asking -- what is the impact of keeping people under 5 rem per year on total lifetime doses? And what this spot-check showed was the only utility that had people at 100 rem was one that had only implemented a vigorous 5 rem per year administrative control level in the last couple of years.

The others had had it since essentially day one, and had people -- almost all of their people way below 100 rem. We are talking about the highest guy being 50 or 60 rem. But most of the exposures were down in the 20 rem lifetime.

That's a number that we are concerned about. Again, relating to the health risk of an individual.

Certainly age and sex have an impact as far as risk is concerned, but I guess I shouldn't go any further, because to my knowledge in that area, whether or not it's a 20 rem lifetime, which is more common than the higher ones, has an impact as far as age. You may know more about that than I do.

That was the long way around to answer your

question.

MR. STEINDLER: Okay.

MR. KINDLEY: Let me go on to the next slide.

[Slide.]

What this slide is showing is the average exposure per reactor for pressurized water reactors, and again showing the trends in 1980 through 1984.

Again, now, how we got this number is we took all the total collective manrem for all the pressurized water reactors and divided that by the number of pressurized water reactors.

This number is higher than the number that the NRC is using as reported in this Inside NRC. However, the reason is that we have not included the same number of plants that the NRC has. We have included fewer plants than the NRC.

We felt to get an accurate reflection of the industry we should only include plants which are truly operating. So plants like Indian Point 1, we did not include those, since that's essentially a shut-down reactor. Boiling water reactors were not included. We did not include TMI-1 and 2, either, just for that strict definition. We will go back and include TMI-1 if and when they get back up and operating again.

But, again, trying to look at operating reactors, we also did not include a new plant coming on the line until

their second full year of commercial operation, because that has a diluting factor on the numbers to bring in the new plants that have just come on the line with relatively low radiation levels in the plant, and then put them in the divisor there would bring that number down lower than I think is a true reflection of the actual operating plants.

So we have used fewer plants on using that kind of a criteria, where we haven't included them until they get to the second full operating year, and we don't include plants which are actually not operating right now.

This shows a declining trend. The reduction between 1983 and 1984 is 6 percent there.

If we extended this out for a 10-year period, you would see that '81 is a peak year, but we have an increase in '81 and then a decrease in trend since 1981.

MR. FIRST: Is the difference statistically valid? Is it statistically valid? Or is it just a chance occurrence? Again, except for 1981, we've got a pretty flat profile there.

MR. KINDLEY: I guess you are encouraging me to show you the other slide. The 10-year slide shows it more dramatically. Now you asked why are we only showing five years there, when we have 10-year data?

Well, INPO hasn't existed for 10 years.

[Laughter.]

[Pause.]

Show a slide, please.

Now, from a statistical standpoint, that may be a little better picture. We have looked at it over a 10-year period, and I think doing it from that standpoint, that declining trend is more evident.

MR. FIRST: Yes, it is more meaningful, too, I think. It shows the impact of INPO, doesn't it?

MR. KINDLEY: I think I have the answer to that question. It shows the impact of the interest in the utility management in radiation protection. There actually is an increased interest in effort to actually improve in this area, and what you are seeing is the utility is working at it, and the impact that it has when management does want to make changes.

MR. FIRST: You are suggesting that up until 1980, they didn't give a damn?

MR. KINDLEY: No, I won't suggest that, but I think there has been a significant increase in interest since TMI. And I think in all fairness to reflect back, following TMI there was a real commitment on the utility's part to improve their operations. INPO is just one of the things that came as a result of that. They are the ones that created INPO, and their interest in improving operations, which reflects on these indicators, and scrams is another indicator that we see

improvement outside the radiological protection area.

But I think we have to go back and say this reflects the interest of the utility management in improving their operations, and radiological protection is one of the areas that they put interest in.

MR. MARK: Let's see. You said these numbers reflect operating reactors, reactors that were operating for at least most of the year, and had been operating for a year or so already?

MR. KINDLEY: Yes.

MR. MARK: It doesn't include things like steam generator change-outs?

MR. KINDLEY: Oh, yes, sir.

MR. MARK: Well, that wasn't operating.

MR. KINDLEY: I'm talking about operating plants. To shut down for an outage to do work, that would be included in there, because that's essentially an operating plant. But if you're going to turn the plant off and not go back and use it any more, like Indian Point 1 or Humboldt Bay or TMI-2 --

MR. MARK: So the Surry steam generator --

MR. KINDLEY: Surry steam generator work -- exposures would be included in this category.

MR. MARK: Well, that would make a difference on some year or another.

MR. STEINDLER: Can you correlate that curve at all

with any regulatory changes?

MR. KINDLEY: I have not attempted to. So what I am doing is answering that question off the top of my head.

[Slide.]

This is the one for BWRs. But you see the peak just curves a year earlier in that downward trend. I think more key is the TMI timeframe. I guess I am not aware of anything that changed in the regulatory climate.

MR. KATHREN: So the regulations don't make any difference?

MR. KINDLEY: Well, other than after TMI. But the TMI backfits and things of that sort increased the amount of work that went on at these utilities and then, of course, it was followed on by steam generator replacements. An awful lot of steam generator work in the last five years. There are two pluggings, sleevings, there are 10-year ISIs are starting to come in because the plant is now getting that old, and there's major work. And then there's circulation pipe cracks that came into that, which probably reflects 1983.

If I could go back and look at '83 on BWRs, there's a lot of pipe crack work.

MR. KATHREN: Bill, if you look at this for a minute, you see that the peak here occurred in 1980 or 1981 shortly after TMI. That might reflect these retrofits that you mentioned and the decrease may also reflect the retrofits

in that. Because these retrofits were made, there is now a lower exposure to maintenance personnel or what-have-you. Would you care to comment on that?

MR. KINDLEY: Yes, I would, because I really don't believe it's the reduction in retrofits which reflects the decreasing trend. The reason comes back that yes, there is a reduction in retrofit, but the increased steam generator work, increasing inspections, and the two pluggings and sleevings, but 10-year ISIs, as I mentioned, the recirculation pipe crack. That amount of work, when you start looking at the manhours that we are putting in, or the number of people that they are actually using, the number of people increasing, which also reflects -- it's one indicator of the amount of work that they are doing.

So I think that although retrofits went down, this other work came back in.

MR. KATHREN: No, I was saying that the retrofits, while they increased exposure during the years 1980, '81, actually had a salutary effect in subsequent years because they reduced the average exposure.

In other words, if these retrofits had not been made, this average exposure might have been even higher.

MR. KINDLEY: I think we would have to talk specifics, because right offhand I am having trouble thinking about retrofit that actually reduced exposures in the plant.

MR. MOELLER: Well, what he meant was, though, let's say the year you do the retrofit, the occupational dose is up. What he is saying is once you have done that and you have got this new piece of pipe in or a new pump or whatever it is, in subsequent years, you might reduce the dose because there was less to be done with that new unit or new component.

MR. KINDLEY: Well, I guess what I am saying is these other jobs have replaced that. That's one answer.

The second answer is now that I've got the new pipe in there, therefore the radiation levels are lower.

There may be another way of looking at it, like a recirculation pipe replacement, they went in and decontaminated the pipe, they now go in and replace the pipe. Now the pipe has lower radiation levels, and now in the subsequent couple years there, but you see, that's a recirc pipe replacement job, and that's not one of the retrofits. That is why I am having difficulty.

MR. KATHREN: All right. Maybe "retrofit" is a bad word.

What I am suggesting is there may be a twofold reason for the reduction that is in part offset by this additional work that you mentioned, and the twofold reason may be:

Number one, I'll say actual physical changes to the reactor plant that resulted in lower radiation levels.

Second might be an actual reduction in radiation exposure of personnel because of new administrative requirements that I think were largely brought about in the wake of TMI. And these two reductions may have been offset by the additional work, steam generator replacements, what have you, that you have mentioned.

And I am just trying to get a feel for the components of this which seem to be very complex.

Perhaps if there were no things done as a result of TMI, this curve would have continued on up.

MR. KINDLEY: I can't talk too much in detail about that, because I am having trouble thinking of specific examples of TMI-required or NRC-required things that actually reduce radiation levels.

I am also having difficulty with the administrative procedures that they have issued that have had an impact on radiation levels. Through working with the NRC, I believe -- and correct me if I am wrong, Carl -- but basically there hasn't been any really new regulations in the radiation protection area in the last four or five years.

MR. KATHREN: Only the regulations, then, that's the only thing that the utilities adhere to and the NRC adheres to. They didn't, as a result of TMI, have a heightened awareness when they went into a plant? Maybe the inspection was a little more stringent or in depth?

I'm finding this hard to --

MR. KINDLEY: Okay, we're having communications problems. I am trying to answer the question you asked in terms of what was it that the NRC, you know, could the NRC require administrative procedures for backfit and have resulted in lower radiation levels.

Now if I take that back away because the increased awareness, the need to minimize exposures, have the utilities implemented new procedures and things of that sort, yes, they have, and I think they definitely do impact the protective radiation levels.

But I don't think -- most of those things I don't think originated directly because of NRC. It may have been indirectly because the NRC says hey, we are ready to do something if you don't. That's a possibility. But I don't think it's a direct result of government regulation. That's how I was trying to answer the question initially.

MR. KATHREN: Well, however it came about.

MR. KINDLEY: However it came about, I think, yes, particularly with the idea of administrative or management controls, I think those have had a large impact, and I will get to that later on, because I think I have got some back-up indicators that says, yes, there is increased awareness by management of the need to do this, and a number of actions have been taken which do come back and reflect a total

collective dose.

Contamination control practices is one example. But the industry has wanted to go clean up the radiologically controlled areas of plants. I find many people think of the radiologically controlled area in a plant as a highly contaminated area. In most plants, that's not true today. There have been major efforts to decontaminate the radiologically controlled areas. There are still contaminated areas within the controlled areas, but a major effort has been made to clean them up so that you can walk into most radiologically controlled areas in industry today in street clothes. You don't have to put on protective clothing of any ki.d, no shoe covers, no gloves, no lab coats. You can walk into these controlled areas because they have been cleaned up, decontaminated down.

Now that effort has also gone into trying to minimize the number of contaminated areas. An indicator that we use for individual plants, which is not one of the ones I'm talking about, is the number of square feet of contaminated areas in the plant. We will walk in and we will want to see the trend for the last several years or last couple of years on a monthly basis of the number of square feet in the plant that are posted as a contaminated area, and we expect that number to be decreasing.

Now, in doing that, of course, eliminating the need

for respiratory protection as you clean up the areas and eliminating the need for protective clothing, that certainly makes it easier for the worker to get in and do his job, and hence reduced radiation exposure.

Here, in a round-about way, improving contamination control does in fact impact total collective dose.

MR. KATHREN: I am pleased to hear you mention the examination of contaminated areas and to respond to what you said earlier, Dade, that is a good indicator of performance and is one, I believe, that was suggested in the DOE ALARA guide. It can also be used in conjunction with the product of the area that is contaminated and the activity per unit area.

So I would suggest that that is a very good indicator of performance, and I am pleased to hear that it is a decreasing indicator.

MR. MOELLER: Well, now, Ron, my problem there is I agree with you completely, but I have a problem. If you use the square feet of contaminated area as an indicator of performance, and we totally agree say you use that. If you also use the volume of low level waste produced as an indicator, don't you get more waste, the more decontamination you do of your plant?

MR. KATHREN: Well, you could argue that that might happen, but I would submit that if that did happen, at least the low level waste volume is indicative of a controlled

about going into a high radiation area to decontaminate the area because we can live with it clean there. It results in personnel exposure and also generates waste. I think that is the point you were trying to make. In the initial process you will increase exposure in some areas and you will increase waste volumes.

MR. STEINDLER: Is there a hierarchy of importance that you folks attach to this kind of thing? Is it more important to clean up the area than it is to reduce exposure

MR. KINDLEY: I won't say that we have a hierarchy, but certainly the bottom line in radiological protection is reducing personnel exposures.

MR. MR. STEINDLER: That is what I was getting at.

MR. KINDLEY: And I think the bottom line is that first curve of total collective dose. I am more concerned about the number of man rem put into a population group than I am with the average individual exposure because I think the regulations are such that you keep the individual exposures down. Now, maybe you are going to turn around and pick on me because I'm going to talk about 5 rem per unit in a few minutes, but within the kind of averages we are seeing in industry now, I guess I would like to see them lower.

But I think more importantly, it is the total collective man rem, is what we are trying to work on; but that doesn't mean that we can't work on these others as well, and

still I guess I would still argue that in working on the others, the bottom line long term is going to be to reduce the total collective dose.

If I clean up my plants, if I work on reducing waste volumes, the same things I do to make those happen will in the long run also reduce collective exposure.

MR. FIRST: Do I understand from what you are saying about the fact that if you clean up your plant, you will then have less waste to dispose of in later years, does this mean that once you clean it up, it stays clean? Martin referred to the fact that this wasn't the way it was in a chemical plant, and I don't want to put words in your mouth, but I assume it means that as you work, you inevitably produce waste.

Now, would that not be true in a nuclear plant that we have cleaned it up this year and then during the next year you produce more waste that has to be cleaned up on sort of a steady state situation?

MR. KINDLEY: I think what we are talking about is trying to live with the area clean, which means you not only clean it up, but also, before you start cleaning it up, you ha better already have figured out how you are going to keep it from getting contaminated in the future.

MR. FIRST: Well, what was it we cleaned up in the past? Can you inform me about that?

MR. KINDLEY: Well, let me take an example of a room

with several valves in it. The valves in the room were not designed to be leak free. Most valves aren't designed to be leak free, and over a period of time, they wear, and maybe they didn't tighten down the packing as often as they could or replace the packing, and the valve begins to leak. The water goes on the floor, the floor becomes contaminated, people move around in there, the contamination spreads to other pipes around the area, so now the whole room becomes contaminated.

To go in there and do work anywhere in the room, and any waste generated as a result of that work ends up being radioactive waste, although the source is sitting over here as only two or three leaking valves.

What we are telling the utilities is go and identify those valves that are leaking. Now, maybe you can't change the design. You might be able to improve your preventive maintenance, but one thing you can do is you could put a tray under those valves so that when they do drip, they drip in a tray and it doesn't run across the room. Or you could put a funnel under them with a hose over to a floor drain so that now when the valve drips, it is collected and doesn't get all over the floor.

So now you can clean up the room, and so when you do work in other parts of that room, you do not have to look at it as contaminated. You controlled the contamination at its source.

From the Navy standpoint, that developed into the use of glove bags, for most work done in the Navy is done in glove bags, so the areas are always clean. In the commercial industry, that isn't very practical because there is still a lot of rooms and it doesn't make much sense to go and try to do a job in a glove bag if that room is still contaminated.

So the progression we are seeing of going towards curbing, just build a concrete curb around a bank of pipe sets so it doesn't run across the floor. Some people have been very clever with angle iron and epoxy, putting it into concrete to actually stop any water drip, lots of tunnels, lots of drip trays to keep control of contamination at its source. So once you clean up the area, you do not have to go back and clean it up again unless, obviously, there is a problem.

That is the type of thing I am talking about, controlling it at the source so we can work clean. Eventually we would like to figure out how to keep it from leaking all together, but leak stopping and leak prevention programs are increasing in the utilities, actually not only in radiological areas but nonradiological areas, to stop leaks. Really, that costs money in these power plants, to have leaks. That is money going down the drain, literally, that could be used in generation of megawatts going out of the plant.

So there is a financial incentive from their standpoint, too, and I guess part of our job is to try to show

them how some of these things can end up saving them money as well as improving their operation.

Does that answer your question?

MR. FIRST: I think it does. I think what we need is a glossary as to what some of these terms mean because until you explained it so well, I assumed that cleanup meant you went in and you did what the word says, you wiped things down, you vacuum cleaned and so on. But now you are telling me that you are actually making some modifications to the plant even though they are rather primitive as you have described them.

I started to smile. It sounded to me like the way we used to handle our icebox when it had a cake of ice in it 60 or 70 years ago by putting funnels in drip tanks.

[Laughter.]

And it made me think: is this the way our nuclear industry is proceeding in 1985?

But anyway, thank you. I think it is a matter of understanding the terminology.

MR. KINDLEY: Yes. I apologize. I guess I am talking our colloquial language.

I wanted to go back and just comment that from our standpoint, looking at these exposures per unit, that we definitely feel that the trends do indicate an improvement in the last several years that BWR -- where am I, now.

[Slide]

On these exposures from PWRs and exposures on BWRs, I am showing a declining trend in the last several years, 12 percent reduction last year on the BWRs, and looking at the five-year trend -- and if it helps, to show the ten-year trends, too -- but we conclude that there is a clear reduction, a clear trend, and even considering the workload. But we do not see the workload changing that much. If anything, it may even be increasing in the industry, and we feel that there has been improvement in this area.

That doesn't mean that when we go in the plants, that we can't actually see further evidence of need for improvement. I think the industry is able, I think the industry is looking hard at taking up a challenge that was mentioned by Harold Denton. We are actually reducing exposures on the average of 10 percent per year for the next several years.

MR. KATHREN: I don't think that the BWR slide is necessarily indicative of a trend, at least not this five-year thing. If you drop out 1980, it is flat.

[Slide]

MR. KINDLEY: The trend is not as sharp as it is in the PWRs. I think we looked at the ten-year slide, and there is a reduction going on there.

MR. KATHREN: I think if you look at the ten-year, I

would be inclined -- and I bet you could get a pretty good correlation coefficient -- I would be inclined to say that there is an increasing trend in the BWRs.

MR. KINDLEY: Bob Alexander made that comment last year.

[Laughter.]

MR. KINDLEY: You see this increasing trend here? This is just the backfits.

MR. FIRST: Well, there is a very clear differentiation between the first five years and the second five years. In fact, I did a little arithmetic while you were talking, and the second five years are 60 percent higher than the first five years, on average.

I submit that these differences are probably significant, but not in the first five years or not in the second five years. I think if we look from 1980 to 1984, we are just seeing a random variation around the mean. We are only talking about a percent or two difference than the mean of the five-year average. You can call it a decreasing trend if it makes everybody in INPO happy, but basically I don't think there is any real basis for maintaining that. I think you are holding your own there on the basis of this particular criterion.

Now, it may really be an improvement because of the point you brought out before, namely, that you have ten more

plants in 1984 than you had in 1980, and I think that is a significant point.

MR. KINDLEY: Well, this is a per-reactor slide. This averages out.

MR. FIRST: Oh, okay, you are right. But even then, I think what I said a moment ago still holds. There is no trend there in 1980 to 1984. I think it is just a random variation around the mean, and I think it has a very low standard deviation. I think it is very reliable.

MR. KINDLEY: I'm not going to argue.

MR. MARK: Well, you are being unkind, if maybe not unfair. The first five years, that is when NRC came into the picture.

[Laughter.]

And the second five years is with INPO's help.

[Laughter.]

MR. KINDLEY: Well, I don't like your evaluation either.

[Laughter.]

MR. FIRST: Now, Carson, I wasn't being unfair. I'm not sure I could say the same for you.

[Laughter.]

MR. KATHREN: But just for interest, I did the mean for the last five years, and it is 1090, and the standard deviation is 94. So I think that really supports what Mel is

saying. If you get below 1000 next year --

MR. KINDLEY: I will come back next year.

But seriously, there is, I guess you could say, almost an unwritten goal that is being talked about as a 10 percent reduction per year, and it is achievable, at least for the next several years, and we see that from evaluations. We see a number of areas where further improvement can be made. And we are not trying to give the impression -- I don't think the industry would want to give you the impression either that, you know, we have made it, this is the end.

All we are saying is we think the trend is starting to go in the right direction on that, even with your comments there, and the industry intends to continue to working in that area and shooting for something like on the order of 10 percent per year for the next several years.

MR. FIRST: Was 1984 a full year or was that a half-year.

MR. KINDLEY: It's a full year. It's a calendar year.

MR. STEINDLER: The reduction you are looking for is 10 percent in man rem per reactor year?

MR. KINDLEY: Right here. I'm looking for a 900 number next year.

MR. STEINDLER: Okay. Do you have data or are your data sufficiently detailed so you can break that down in terms

of man rem per reactor year per hour worked?

MR. KINDLEY: No. No. We are going to have to use indicators like numbers of people actually exposed as an indicator of work volume. Volume of work -- well, work is a problem because we look at the amount of work out there and there is a lot of work going on, but how do you quantify that? We can't really quantify it. We feel qualitatively that the work level has not decreased in the last five years. If anything it may have increased, even considering the early backfits in the NRC.

We certainly don't think the workload is decreasing, from what we can see out in the plants.

MR. STEINDLER: The thing I am looking for is I can get a 10 percent decrease by simply not cleaning up all those square feet that you guys want me to clean up. How are you going to be able to call somebody on that? Having a 10 percent increase and that target has been achieved, that really is a meaningless number if that is the mechanism that is used to arrive at that decrease.

MR. KINDLEY: Well, I think you are going to have to go back and give us credit for the overall evaluation process because we don't just zero in on one indicator. As I indicated, we look at contamination control, solid waste reduction, dosimetry, all those different areas, and we look at improving all those areas simultaneously.

Dade saw the process there. We actually are pushing on all areas at the same time. We don't slack off on one at any one time. So we see across the board. While all the indicators we used here on solid waste volumes and exposure we feel are pretty good ones, when we go into the plant, we use these other ones as well that I have been talking about, so it is the evaluation process that I think is going to keep that balance that you are concerned about getting out of balance.

MR. MARK: These are averages for what, some 20-odd plants?

MR. KINDLEY: Yes, sir.

MR. MARK: What is the range from high plant to low plant?

MR. KINDLEY: BWRs last year, I think it ran something like 50 to 4000.

MR. MARK: Did you say 50?

MR. KINDLEY: Yes, 50 or 100 is the low one, and you take Big Rock Point -- and then I go to the plant with the highest exposure last year. We are running in a range of 50 to 4000, and 4000 is the top one. I remember that number.

MR. MARK: Are the bottom ones small plants or something of that sort?

MR. KINDLEY: Oh, yes, like Big Rock Point.

MR. MARK: Yes, that's what I thought, but if you take a 1000-megawatt plant and just take that group, can you

get down to a couple of hundred for the 1000 megawatt BWR?

[Slide.]

MR. MOELLER: Well, he has got the data on the slides, so let's wait. We are in no rush.

MR. MARK: Oh, okay.

MR. KINDLEY: My biggest problem here is understanding this machine.

[Pause.]

MR. MOELLER: Okay. Let's try once again.

[Slide.]

MR. KINDLEY: I'm sorry.

What this slide is plotting here, on the four BWR plants, in this range of best stations, what we have done is looked at a five-year history, of which BWRs have the best performance over a five-year history, going back to 1980, and then of course going back five years to reach each point. I think that number is about four plants involved there, four BWRs, which have consistently had a good history over the last five years.

Then, to get rid of the fluctuations in outages, we averaged three-year points. Each one of those points is a three-year average. We plotted those four lines, and then blackened in or blued in the boundaries of those four lines. So now we have got a band of performance for the best stations.

MR. MOELLER: Now are these all large stations?

MR. KINDLEY: We have taken out the Big Rock points in the process and the small ones, and these are the 500-megawatt, 1000-megawatt type plants. And you can see, I think this number (indicating), running at about five and six hundred, there is the bottom of it, and running up to about 800 there is the range of best plants.

Certainly, we ought to be able to achieve that at many plants.

MR. MARK: You ought to bring the whole -- look, there will be some plants with a terrible year, because they've got a big job to do. But would you imagine that you could bring the BWR industry down into that blue range?

MR. KINDLEY: Well, I don't want to predict or anything like that, but that certainly is a goal.

MR. MARK: But there's no absolute block against being able to do that.

MR. KINDLEY: I don't know of any, and certainly the industry's goal, with a ten-percent reduction a year, is aiming at getting into the block.

MR. AXTMANN: Can you look at those four plants and learn anything about why they are so good, compared to the average, because there must be a high for it, too.

MR. KINDLEY: Yes, you can. And the key factor that shows up over and over again and isn't very satisfying -- it

complies with high standards and that they are well managed. It's coming back down to the bottom line. These plants are cleaner. They don't have a lot of contaminated areas. They plan their maintenance work well.

Basically, on all indicators, you see a lot of consistency, not only in radiological protection, but in other areas as well. I think philosophically it is fair to say that a well-run plant is going to do well in radiological protection, just as it's going to do well in other things. But enough ties together there.

MR. AXTMANN: Would there be a correlation with scram frequencies?

MR. KINDLEY: I haven't run that correlation, but long-term, I think you would see that the plants that do the best in the overall operations are going to do the best from the scram frequencies and the best in radiological protection all along the way.

There is a clear tie-in in performance, whether it's the workers or the management. It takes both to improve radiological protection there, as it does these other aspects as well.

MR. MOELLER: Then you are saying also that even the best stations, though, can improve.

MR. KINDLEY: Yes, sir. I think it is a rare plant where we don't have some kind of recommendation on reducing

exposures or reducing waste volumes, and I think, in all fairness there, if we don't have one, it's probably because we need to improve our looking ability there. I think everybody can improve.

And again, that is a philosophical point. But the plants that are making the best improvements are ones that are not looking for what is good and done. They are looking at what can I do better next year? They are constantly looking toward improvement and not trying to shoot for, well, when I get to this level, I'll be okay; I don't have to improve anymore.

There has to be an effort to constantly improve. And in that process, they are finding things to do that they didn't in the past, and other people have run across. That effort to improve pays its own dividends.

MR. KATHREN: That slide is also disturbing in the sense that the industry average, I think, we feel, at least, hasn't changed over the last five years for BWRs. The range of the best stations seems to be slightly increasing, although it may again not.

What concerns me is the real difference that appears between the PWRs and the BWRs. The PWRs are showing, I think, a real reduction in the last five years. The BWRs showed a step function increase some five years ago and have maintained that level. That is that 60 percent that Mel mentioned.

Am I somehow looking at these data incorrectly, or is there some reason that you can give that would explain this?

MR. KINDLEY: I can take the position -- some people have told me; I don't know this for a fact -- that the sparger jobs in BWRs and the torus modifications that came after TMI had a big impact on exposure, right after TMI, and drove that number up.

In subsequent years -- for example, '83 -- you saw that peak, this loop up in '83 there. If we would take out the recirculation pipe replacement efforts in '83 and '82, you would see across there a continued decreasing line. We actually did more pipe work in '84 than we did in '83 at the plants, but that workload is definitely a factor there, and, you know, we can subtract out what plants say they spent on those big recirculation pipe jobs and then replot the numbers.

I am nervous on doing that, because I'm afraid if I start taking this out and this out and this out, you know, -- part of running a power plant is to keep it maintained properly, and we could do these modifications as they are needed. So we are going to look at the plants. I think we need to keep all those in there, but they definitely do have an impact, and I think the big increase in 1980 definitely reflects some of that torus modification work and a lot of

work in the drywells, the sparger work that's going on in the reactor vessel in a BWR, and that continued on a few years after that. And then we bump into the pipe replacement effort, following on the heels of that.

I think I forgot the original question.

MR. KATHREN: Well, you have answered it in part. If you could explain the difference and why there was this step function increase in the BWR levels, and that seems to have remained, and you have answered, I think, well with regard to the engineering modifications.

I don't have any problem with your answer. I am just thinking about it. That's quite an increase.

MR. KINDLEY: Let me comment that we found it interesting to look at this (indicating). Depending on how you want to calculate that number, that comes between a five and seven-year halflife buildup curve.

MR. FIRST: I think it would have been even more interesting if you had plotted the four worst stations in addition, because they obviously will be well above the industry average. Have you done that?

MR. KINDLEY: No, we haven't.

MR. FIRST: It would be too frightening, I suppose.

[Laughter.]

MR. KINDLEY: Well, that five to seven buildup strikingly is similar with the cobalt-60 buildup, in that what

we may be reflecting on the best stations is just simply an age problem of the stations. I don't know. That is just pure coincidence. We haven't done anything to try to verify that. But it was interesting when we said, "Why is that increase there? Why are the best stations increasing?"

I think the ones in the PWR don't do that.

[Slide.]

That is the same curve for the pressurized water reactors. The band is wider on those. There are six stations involved in that band, and that runs, as you can see, from about 100 up to about 400.

MR. KATHREN: Now how do you select those best stations?

MR. KINDLEY: We looked at their performance over a five-year period, which are the lowest exposure plants over a five-year period.

MR. KATHREN: I understand that. But you said there were six. Why didn't you take five or seven? Do you do some statistical deviation from the mean?

MR. KINDLEY: No. We plotted them all. We didn't get some of the worst ones in there, but we plotted a bunch of them. When we saw a break in the lines between the sixth and seventh plants, there was a space in there. We said, "Okay, these kind of grouped down together, and we will call them the best ones."

MR. KATHREN: Is it always six plants, then?

MR. KINDLEY: No. It was four in the other one.

MR. KATHREN: No. I mean it is always six plants in the PWRs?

MR. KINDLEY: No. I'm not making myself clear. We looked at plants over a five-year period. We averaged every year on a three-year average. So we had a bunch of points for every year based on a three-year average, and we plotted those for a five-year period, and said, "Okay, now, which ones are the lowest ones?"

MR. FIRST: These are not the same plants each year?

MR. KINDLEY: Yes, it is the same plants each year.

MR. FIRST: No. I mean, if you were to identify six plants in 1980, would they be the six plants -- the same six in '84?

MR. KINDLEY: Yes, sir, because we looked at the -- you know, some plants went like this (indicating), and we threw those out. We took the six that were consistently the lowest, and we looked at this next group up, and there was a natural break in the data there, so we took those and plotted those.

No, not very scientific. But looking at the data, it looked like clearly these were the ones that were performing better.

MR. MARK: And the same remarks were made of the BWR

plants that would apply here. These are the ones where you have the feeling they are well-managed anyway.

MR. KINDLEY: Yes, sir. These are some of the ones that show up with very few people on the station site, traditionally use very few contractors during outages, and well-managed plants. Sometimes you could probably guess who some of them are.

MR. MOELLER: And were several of the six plants operated by the same utility?

MR. KINDLEY: No. I think in this case, these were all operated by different utilities. I'm trying to remember for the six plants. The ones I can remember, I can pick four or five of them right off the top of my head, and everyone of those is a different utility.

MR. MARK: Did the same utility have plants which are both off the map and in this sort of group?

MR. KINDLEY: I don't know the answer to that.

MR. MARK: Because good management really ought to cover both units at a site.

MR. KINDLEY: I think what I can say is, most of these are utilities that only have one or two units. The utilities that have great numbers of plants, none of them fall in this category.

I wanted to quickly go through some solid waste numbers here.

[Slide.]

They both talk in cubic meters. If you will make the conversions, as I talk, into cubic meters, because our Board of Directors would like us to talk in terms of cubic meters instead of cubic feet. My slides are all in cubic feet, so you're going to have to make your own mental conversions.

Again, this is similar to what we talked about before, as far as the numbers of plants involved. These plants were selected on the same basis as for exposure. We have not included a plant until it was in its second year of operation.

Again, we feel that that represents a decrease. PWRs are down by 11 percent.

[Slide.]

The BWR trend is slightly up last year, essentially a leveloff from last year. We think overall that represents a decreasing trend.

The workload, obviously, we talked about in exposure, and the same comments reflect here. There is a lot of work going on. Again, we see a number of things that can be done in plants to reduce waste volumes, and I want to talk briefly about this subject, because one of the things that the utilities are nervous about is the waste that occurs in an area which is a controlled area, and how do you handle that

waste.

If we cleaned up the controlled area and there were no contaminated areas in there, that waste, we find, is not contaminated. It is clean waste.

Most of the waste in contaminated areas is clean. You actually go and take all the waste out of a contaminated area and check it, and what we find is somewhere -- about half or 70 percent of that has no radioactivity on it all, even though it came out of a contaminated area.

We are putting a lot of cubic meters in our burial grounds, and there is a lot of concern with burial grounds in reducing volumes. But it's clear to me, from what I have seen in utilities, that we are putting a lot of stuff into those burial grounds that is not radioactive.

MR. STEINDLER: Are these comparisons made on a consistent basis -- that is, those folks who compact waste get credit for compaction, and those that do not are equivalently adjusted?

MR. KINDLEY: No. This is straight volume shipped for disposal. So those people who do not compact would have a higher volume than those that do.

Now let me come back to that. I don't know of anybody that doesn't compact. All the utilities are actually compacting their waste. So I don't think compaction is a large factor.

Now there is some improvement that can be made on compaction by the use of inserts and things to get more in a drum, and then use of these super-compactors where you put three drums into one.

We don't take any credit or take any adjustment for that. So if somebody has managed to get an incinerator license there and then only ships out the ash, their volumes are significantly reduced.

MR. STEINDLER: Right. And you would consider that an improvement?

MR. KINDLEY: That would be an improvement, yes, sir.

MR. STEINDLER: Based on cubic feet.

MR. KINDLEY: That's right.

MR. STEINDLER: What is the importance of cubic feet? Economic?

MR. KINDLEY: No, because, you see -- you are right. I am mixing two things here. That's what your question is coming around to, I can see.

[Laughter.]

MR. KINDLEY: Because one of the factors involved here, too, is certainly the need to be able to get rid of this waste in a burial ground. So you want to give somebody who went to the effort to find an improved way of doing that credit as well. You want to give him the incentive to do it.

So in our looking at the different plants, somebody that is using increased compaction of the sodium techniques that I'm going to talk about in a few minutes, or incineration, you would end up giving them credit for that, and that would hopefully encourage others to do it, too. We may eventually get to the point where this may not be an indicator, you know, if we get too much of those kinds of things in it. Then we'll have to go off and find another indicator of performance as far as working areas and things of that sort.

So you are correct in what you are coming around to, that same comment earlier about the various factors involved in this indicator.

Let me go back to the problem that we are facing as a nation of limited barrel space.

One of the things that we have encouraged utilities to do is not to go bury stuff that is not radioactive. And so we have encouraged them, when you take stuff out of a radiologically controlled area, to go check each piece and verify and determine which is contaminated and which isn't, or verify the fact that it's not contaminated.

We are not trying to use this as a de minimis concept. We are actually trying to search for what is radioactive, because we know that most of this stuff is not radioactive, and we are using that -- most of the utilities

that are doing this are using a handheld frisker, and they check every piece thoroughly with the frisker to see if it's radioactive. If it's not, it is handled as normal waste. If it is radioactive, then it goes to compaction.

MR. STEINDLER: Do you have a measure of curies per reactor year?

MR. KINDLEY: No, sir, I don't have a number on curies that I could give you, but I think something is available -- not readily available, because we didn't ask for that number. So I guess the answer is I'm going to have to wait until the NRC reports come out.

MR. MOELLER: On that aspect, just a couple of quick comments. In meeting with a number of the radiation protection managers at say 20 commercial plants, a manager from one plant pointed out that a company came in and offered to sort the plant's waste, meaning scan it and separate it into contaminated and noncontaminated.

They offered to pay the utility for the privilege of sorting their waste, provided the utility gave them half of the components and pieces of equipment that they reclaimed, that otherwise would have been thrown away, and they came out ahead on the process.

MR. KINDLEY: What they find in the waste, and you probably won't be surprised, are some tools and respirators and things that shouldn't be in there. That pays for the guy

doing the checking, plus the volume reduction cost of not having to ship it off to burial saves money. So it actually ends up being a money-saving process for the utility. And I keep coming back to economics, but certainly I realize that the utilities are in the business to make money, like any company in this country, because we are based on a profit motive. We can go in and show them how to save money and improve performance at the same time. Then they are more apt to go pick up our suggestions and run with them. So we are looking for ways on how to use things like volume reduction to show them how to save money.

Now the problem -- and I'm coming in on this -- is some people are looking at this as once it goes into one of these areas, you have to treat it as contaminated, just like you have to treat water as contaminated once it came in contact with anything radioactive.

Hence, since there is no de minimis number, there is no level at which you can call it really nonradioactive. Everything must be treated as radioactive that comes into that controlled area.

Some regions have taken that stand and the problem we see in that, of course, is that is not looking at truth, since most of the stuff is not really radioactive.

MR. MARK: You said some regions?

MR. KINDLEY: NRC regional policies.

MR. MARK: You mean they have local options as to how they go about this?

MR. KINDLEY: I don't want to answer that question. I don't think I'm the right guy to answer that.

[Laughter.]

MR. MARK: I am afraid we might know the answer.

MR. KINDLEY: But they look at this and they say, wait a minute, how can you check that stuff out, because, you know, once it has been in a contaminated area, you have to treat it as contaminated forever. And, therefore, it has to be buried.

So we are in the middle of this, and I think the NRR or IE, one of them, is trying to come up with some improved guidance on that. And what we would definitely like to see is the guidance that the NRC puts out is to reflect the fact that in reality the stuff is not radioactive, and that what we are really doing is trying to identify radioactive material.

We are not trying to use some kind of a de minimis number, and make suggestions that they feel is needed on what kind of assurance you need that you aren't going to miss anything significant going out to the public. Because obviously neither utilities nor we nor the NRC nor anybody wants to get radioactive material out in the public dump.

We feel that using that sensitive frisker and using the numbers which most plants use for designating what's

contaminated and what's not, which is basically minimum sensitivity of that instrument, is a good means of checking it, and we are not going to miss anything significant in that process.

You may miss something that may be a little bit above that, just because people are people, but you are not going to miss anything significant. And the problems in the past that have showed up at dumps usually have been things that have been pretty high level stuff, and those kind of things you can't get near with the frisker. It would cause all kinds of commotion on the instrument.

So we think that is a good way to reduce volumes, yet we see some questioning of that technique coming in, and we are willing to talk to people about that. We'd like to see the NRC clarify and support that, and I think the people I have talked to at headquarters -- and now I don't want to talk for you people, but we have not understood from anybody that headquarters or NRR has had a problem with that concept.

Maybe you want to comment on that, Carl.

MR. MULLER: No, we have no particular problem with it, either, on that sort of an idea, either, no. The only problem one would have is it's a little bit like the fox guarding the chicken coop where if you talk about the private contractor who agrees to take half of the waste, certainly if he sees a valuable wrench, he might tend to overlook a little

bit of contamination.

MR. KINDLEY: Both the utilities that are doing it now are doing it on their own. They hire a couple people who do nothing but frisk waste, and they can easily support their salaries just on savings. But contractors have picked up on this, and certainly are trying to get into business. I think we would encourage the utilities to do it themselves and save the money.

MR. MOELLER: Excuse me, Bill. Roughly how much more do you have on this? Because we will take a break if it's more than 10 or 15 minutes.

MR. KINDLEY: Let me try to run through it, because I think you have brought up many of the questions that I was going to talk about, and I want to go on to the 5 rem issue, just show a slide on exceeding limits and talk about two other slides quickly, and I think maybe I can finish up in that time.

[Slide.]

This slide reflects the number of workers that receive more than 5 rem when they work at any single facility. Now what I found is that one fairly influential member of a radiation protection community had a copy of this particular slide and he said, "Which utility is this?" He thought this was only one facility.

[Laughter.]

MR. STEINDLER: Well, so which one is it?

MR. MOELLER: You shouldn't have let him go to zero in '84, because you can't do any better.

MR. KINDLEY: Well, that was a real industry goal, to take that on, but this actually is the total number of people that received 5 rem at all plants in the United States.

This does not include workers that got like 3 rem at one facility and then migrated to another facility and got three more. He would not be included in this category.

I don't think the data is very easily available in the past. We have talked to the NRC on that, but they are looking at their system and the numbers they came up with are less than what we came up with, and we don't think we've got them all, either.

So going back before 1983 and saying what is the actual total number, I don't think either one of us can do very reliably. We think in '84, however, from talking to utilities, that that number is about 150. When you include the people that went from station to station.

If you look at how many people got 5 rem at any one facility, any one plant, that was zero in 1984, and that was a result of an industry commitment to themselves, not to the NRC or not to anybody else, but they decided on their own they were going to do that.

That really reflects senior management attention to

radiological protection. The way that came about is senior management said basically we don't want anybody to exceed 5 rem. Go figure out how to do it, and the utilities figured out actually how to do it.

I am not aware of any in 1985 exceeding 5 rem from a whole body standpoint. We have got one worker that received the limit in '85 on skin dose, but we think that the number of contractors in 1985 is going to be significantly less than 150.

There was one major contractor where most of these people worked. He is committed to us and to the industry in writing that he is going to control his people to less than 5 rem.

We believe that most all of the utilities are included in their contracts with contractors that the individual cannot exceed 5 rem while he is at their site.

So, in other words, the controls on this come from -- can be done by the utilities in the way they contract with the people. So if a guy comes in --

MR. FIRST: You mean he can't exceed 5 rem for the year while they are on that site; is that what they mean?

MR. KINDLEY: Yes. They get his past history. If he comes in at 4.9 rem, they turn him right around at the door and send him away, because they won't give him that last tenth of a rem at their site.

In other words, we are trying to get the control at the utility itself, because it is hard to control people from the contractors, but most of the major contractors now -- GE and Westinghouse -- are saying we're going to control workers to less than 5 rem, anyway, and people at the utilities put that into contracts. We are adopting that policy.

So I expect, in reality, in 1985, that that number will be significantly less than 150, and barring mistakes, the number will continue to be zero in 1985.

I think we have got a strong commitment from industry on that.

We use this as an indicator partly because of NRCP and ICRP recommendations as far as individual workers should not exceed 5 rem, and I guess we started on this back in 1981. We picked a bad time, because we picked a time when the EPA was trying to come out with that, and there was a lot of discussion going on between the utility and the EPA. But last year, one of the last letters that Dennis Wilkerson signed out of INPO was to encourage utilities to make 1984 zero, and they responded to that. And that's where we're at today.

And I think it's a clear indication of senior management support of radiological protection in the industry. That is something that would not have happened pre-TMI.

[Slide.]

Let me go on to exposures exceeding regulatory limits.

I think before you say it, I am going to say that this is a level trend, 73-2 is a level trend. Because what that includes is the administrative people overexposures as well as the actual technical worker exposures. The two in 1984, for example, one was a worker actually exceeding 3 rem a quarter, and the other was a worker who got more than 1.25 in the quarter before they had the record handy.

If you take out the administrative one and you go back to 1980 and recognize that most of those were due to misplaced dosimetry at two plants, the same error being made multiple times at two plants, you see that that number runs about one to two per year, people that actually are exceeding 3 rem per quarter, are really exceeding the limits.

That is still a number that we think can be improved on. We think it can go to zero. There's no need for people to exceed limits, and one of the reasons why we issued this specific operating experience report, which we are going to talk about after the break.

In 1985, we are aware right now of one person who exceeded the limits. It was a worker that got a skin dose of about 10 rem from a highly radioactive particle that appears to be stellite. Apparently a grinding dust that went through and was activated and came out and got out on a worker on his

protective clothing, and he wore protective clothing, and when they found the particle, it was a pretty high level, and they calculated his skin dose, and it came up to about 10 rem.

Maybe again you people can give more detail than I can on that.

The interesting thing, we think, about that is the fact that this was a piece of stellite from small things like grinding dust and can cause a significant problem. Is that a good utility? Would you consider it a good utility if a person exceeds the limit with 17 years with that utility? And they were quite surprised by it.

[Slide.]

Quickly, two other indicators.

We put a lot of effort in training at INPO, and what we looked at, at the end of 1984, is some indicators of improved training. We have a standardized general employee training program. We put out a set of guidelines to the industry, encouraged everybody to adopt this guideline in their general employee training programs.

At the end of 1984, 65 percent of the stations in the country had adopted that guideline. That guideline does two things for them:

One, it results in an improved general employee training.

And secondly, it standardizes the training so that

they can accept training from other utilities from a generic standpoint.

Site-specific still has to be done at individual utilities, but this way a worker can be trained at one facility and go to another facility and then essentially be accepted without having to be retrained again.

There is an examination process, there is an administrative process, to verify that he still retains his knowledge.

Our interest in it, of course, is we wanted to improve general employee training in the industry, and at the end of 1984, 65 percent of the stations had certified that they had met the guideline. That number runs 70 percent today. We're thinking the last 30 percent is going to be difficult, because some people don't see the economic incentive when they are in a location of the country that usually doesn't get the workers from any other utilities, "What's the incentive for me?" And several of that 30 percent do in fact meet our guidelines, and have just not joined the program.

MR. KATHREN: Bill, is there any relationship between the exposure -- I don't know if you have done this -- between the exposure at a plant, say the total personrem at a plant, and either the training of the technicians or the numbers of technicians?

MR. KINDLEY: We have not done any correlation like that, and I would hate to speculate, but certainly we feel that improved training results in reduced exposure. But I don't think I have any data that I could use to show that.

MR. KATHREN: It would be an interesting thing to try to demonstrate. Everybody points out always, without any hard to support them, that increased training is beneficial. I believe it is, but I don't have any data, either.

MR. KINDLEY: We have seen specific examples. For example, you train workers on mock-ups. They go in and do the job, and the job runs very smoothly, and we see improved training of RP technicians, and I don't have the data, but from back in my Navy days, we had clear indications that between the quality of the radiological protection training program and the number of instances that are occurring -- I don't have data to try and correlate that.

MR. KATHREN: Just a quick question:

What fraction of your technicians seek certification or have been certified by the NRRPT, that outside certifying body? Do you know?

MR. KINDLEY: I don't know. That's not a number that we have collected. I just don't know.

The second one there, on the practical factors, I think is an interesting one. Five years ago, very few stations required every worker to actually put on a pair of

clothing, frisk himself, go through a control point. That was demonstrated, of course, but the workers didn't have to do it, demonstrate themselves as a part of completing the course. We put a big emphasis on the fact that every worker going through his initial GET should have to go put on protective clothing and frisk himself, and go through a control point and verify that he can do it right once before he passes the GET training.

At the end of '84, we had 95 percent of the plants in the country were requiring that, and we hoped to pick up the other 5 percent through our evaluation process. That is clear-cut now as part of our evaluation criteria.

The last one is a little misleading. It says only 6 percent of RP technician training program is accredited. That in fact is true. This is the INPO accreditation program that has been talked about in other aspects.

The emphasis in that accreditation is on the operator programs, so licensed and non-licensed operators. The utilities are turning their attention first to getting these programs accredited, and the RP technician, maintenance, I&C, chemistry technician programs are down the pike. The commitment of the industry, as you probably remember, is to have all programs ready for accreditation by the end of 1986, including our RP technician programs.

Let me go on to one last slide.

[Slide.]

MR. KINDLEY: What we have tried to do here is pick some of these other indicators and ask the individual plants whether or not they are using these kinds of things as an indication of the overall management involvement in radiological protection.

Whatever reasons that we got involved in the coordination plan with the NRC back in 1981, was a proposed rule requiring the utilities to set radiation exposure goals. One of our comments was we felt that through working with INPO, we could accomplish the same thing as they could with the regulation. And what that first column is, is, as I indicated in 1984, 85 percent of the plants are actively using goals to -- in their radiation protection programs to reduce exposures. Those are frequently annual goals. Those are job goals. Those are goals for outages; various different types of goals as a management tool to help them reduce exposures.

The second one is tracking personnel contaminations. As I indicated, this is next to our reviewing of trends of personnel contaminations. The track in this case doesn't mean just document. Many more utilities documented over 65 percent of stations. What we're talking about here is actually now, as you document them, look for trends. Track what's going on. Track the trends and use that as a means to go and try to evaluate the program.

The same thing on positive whole body counts. Of course, as part of the NRC rules, 100 percent of the stations document all whole body counts. What we're seeing here is 68 percent of them actually looking at the results of those whole body counts and trying to look for indicators of problems.

Perform independent assessments. What we were looking for here is somebody outside the radiation protection department not reporting to the plant manager that would go in and review the radiological protection program and who belonged to the utility. These are not NRC people, these are not INPO people. These are people that belong to the utility that are doing their own independent assessment of their program so they can find their own problems and fix them.

A number I find more interesting is 52 percent of the utilities have people who are health physicists, people who have a technical background in health physics doing this assessment. The other 48 percent follow the QC program which is required by the NRC. So of course, this will end up 100 percent. But the more interesting number I think is the 52 percent that actually have professionals that are going out independent of the plant, doing these evaluations. These are not consultants; they're people on the staff of the utility, usually at corporate headquarters.

The last one is use of radiological engineers or professional health physicists in a staff function at the

plant to help them develop and improve their program. Many of the programs a few years ago consisted of a manager and a number of technicians.

We are encouraging the use of professional expertise to put in that particular group, so they can go develop and improve their own programs, and we're finding that 93 percent of the plants are using some kind of staff professionals in their programs, one or more. This could be an ALARA coordinator. It could be a radiological engineer. It could be a staff health physicist. Somewhere in that category.

Some other things that we are doing, we have issued radiological protection guidelines. The guidelines are basically, we consider the key elements in a program. Those were issued in February of this year to the industry. The guidelines are not quite the same as our inspection criteria. There are evaluation criteria or whatever you want to call that. This is something that we expect the utilities to meet the intent of.

The NUMARC working group has reviewed this thing and has a recommendation to the Executive Committee that has a commitment to themselves that all plants will try to implement these guidelines. They are fairly detailed. They're more like a release protection manual, and you might say closest to a corporate health physics manual, something of that category.

We think it will be a help. A lot of the philosophy

we've talked about today is incorporated in there.

We held a workshop in June where we had 160 plant corporate radiological protection managers, and we basically talked about how do you involve people in all aspects of the plant in radiological protection. What is their part of it.

I'm going through these things quickly. We talked about evaluations. We have a coordination plan which is going to come up with the NRC that we talked about -- we will talk about a little more this afternoon.

These are some of the kind of activities that are involved. I think, in summary, we conclude that the radiological protection has improved in 1984, if you look at all aspects of the thing. We think that there is clearly a significant increase of management involvement in radiological protection over the last four years, and one of the things, when you start talking to senior management in radiological protection, one of the first things that comes up is, hey, we need to improve in that area, and hence the kinds of things we talked about, like a ten-percent reduction in exposure per unit in the future, and the same thing on the solid waste volumes, a ten-percent reduction per year in solid waste volumes.

The attitude I see is not one of, hey, we made it; we have now improved that area. It is one of recognition that there is more that needs to be done. And although the trend

is in the right direction, they still are not at the place where they want to be. And certainly from an INPO standpoint, we feel that there is need for improvement out there as well.

Let me end there, because I think I've used up more time than I intended to.

MR. MOELLER: I think what I would suggest is that we take a fifteen-minute break now, and then come back, still in open session, to handle wrap-up items. Then we will go into closed session for the additional presentation.

Thank you very much. So let's take a break.

[Brief recess.]

MR. MOELLER: The meeting will resume, and what we now have an opportunity to do is to pick up on questions that we have for Bill Kindley, and I have a few here which I would like to go through, and we will obviously let anyone here on the committee ask questions.

First, let me say, Bill, that I thought it was an excellent presentation, and the point that is good, or is so good, is that it is not superficial. In other words, even though you review indicators of performance, and even though you present a multiple list of indicators, you also show us that there is a lot of depth to it. It's not a superficial operation. It is one that has a lot of substance to it. And certainly, if anyone is covering the loose ends, as far as I'm concerned, you appear to be doing that and doing it well.

MR. KINDLEY: Thank you.

MR. MOELLER: In terms of just a list of questions, we do have -- or I have noted LERs for internal exposures that have been occurring, and you, of course, say that you are keeping up with those. But what intrigued me on some of these recent LERs, we have one from Robinson in which five of six employees who had been working in containment in the seal table area were discovered to have nasal contamination, and they first reported that they had 80 percent of their maximum organ body burden of cobalt-58. And it's interesting, this was in the GI tract and not in the lung, which I found interesting, how it got to the GI tract instead of going to the lung.

But it has a hidden comment, because the very next day or so, they issues a subsequent report and said that the body burdens were 30 percent, not 80 percent, because they looked at their whole body counter, or the computer software, and found out, you know, garbage in/garbage out. It wasn't properly calibrated and so forth.

But that one occurred, which, as I say, revealed hidden problems, and I wanted to ask what you are doing on internal contamination. And let me bring up one other aspect.

Here was one at Oyster Creek. Ten individuals were contaminated in the new radwaste building when a -- this was a report of July 19th, and I guess the event occurred the 18th

or the 17th or something -- but these people were contaminated when a damper was accidentally opened in the building's ventilation system, and apparently it blew, you know, some exhaust -- exhaust through the damper into the room where they were working.

And I am wondering, here is another one at Palisades where a roof hatch was removed, and it compromised the ventilation isolation capability, and again, it blew activity, and these people were contaminated due to removal of the ventilation supply damper.

MR. FIRST: This suggests that this was contamination that was already in the duct from some previous, and are these ducts not surveyed from time to time? Don't they know that it's there?

MR. MOELLER: Well, I got the impression it was airborne dust that would have gone up the stack, except they opened this damper or opened this ventilation opening, and it blew out into the room.

MR. FIRST: Oh, I see. I got the impression from the way you spoke of it that by opening the damper, some residual material that had been laying in the duct had suddenly been air-entrained.

MR. MOELLER: Oh? Well, you could be right, too.

MR. FIRST: We don't know, though.

MR. MOELLER: We don't know.

Now what can you do about that, where really the best laid plans of a rad protection organization would not necessarily have prevented either of these events?

How are you addressing problems like this?

MR. KINDLEY: Well, I can't speak to any one of the three specific ones there. I'm sorry about that.

But what we try to do on our evaluation program, I guess you can say, is look from a standpoint of defense-in-depth. We find that when you have problems, significant radiological protection problems, that frequently there are a number of things that were wrong before the problem ever occurred.

MR. MOELLER: Right.

MR. KINDLEY: And then this last thing, which got described in the LER, when added to that existing things that were not quite what they should be, results in the problem. And the kinds of things we're talking about are things like radiological work permits not really describing, to the extent they should, the precautions needed for that area.

Again, I can't address any one of these three, but I'm saying these types of things, and the same types of things that come up when people see exposure limits. We've done a more detailed look at those. But we generally find, when people are having problems and recurring problems, when you go into those plants, you will find a number of things wrong

already there in place. They may be poor practices by workers, which are tolerated by management, or the training may not be as good as it ought to be, or the surveys may not be as complete as they should be. The radiological work permits or the instructions to the individual worker may not be really the proper ones for the job he is doing. They may have been written too much in general; it may be written for a job which is trying to be adapted to this.

These types of things are the things that are in place, and then comes along somebody who turns on a ventilation duct or does something else, and then there's a problem.

Had any of these other things not been in place, if work permits had been properly laid out, and the workers had not been exhibiting some kind of poor practices that were being tolerated, if the technicians were trained to recognize, "Wait a minute. If I turn that on, that's liable to end up in a problem," those aspects would prevent those types of problems.

So as a result, when we go in on our evaluations, we are looking across the board at all those types of things. We look at radiation work permits everywhere we go in terms of, does the worker know what he is supposed -- what precautions he needs for the job? And the way we do this is, we go out to the job site, and we'll go in to the workers on the job site,

you know -- What does the work permit say with regards to protective clothing for this job? What are the radiation levels in the area where you're working? What are the contamination levels of the area where you're working? And we will evaluate whether the information flow to the worker is adequate.

We looked at poor performance by workers, and we asked ourselves the question: Why do we have poor performance? It usually falls into one of three categories.

Either the procedures for the job are not clear or are inadequate or they don't exist, or the workers have not been trained on those procedures, or lastly, his management doesn't really expect him to follow those, so he doesn't follow the rules. It usually falls into one of those three categories, and we try to identify which of those three categories it is, and then give advice to the utility on what they ought to be doing about it.

Certainly, it doesn't help to go tell the utility, "You ought to train your workers more," when the real problem isn't training of the workers; the problem is enforcement of the rules.

So in general, the way we try to approach these types of problems is looking for those indicators or those things that are trying to protect or try to prevent these kind of things from occurring, because there's always going to

be somebody that screws up. There's always going to be something, some piece of equipment that fails. Real life is that way. The world is not perfect, and it's not going to be perfect, and we're not going to make people perfect. So we need to have something in place that permits human beings to be human, so when he makes one mistake, he gets caught before he gets a significant exposure, whether it be internal or external.

Is that the kind of thing you're looking for?

MR. MOELLER: Yes, I think that helps.

Let me go on. These aren't necessarily in the best organized sequence.

In talking again to radiation protection managers at plants, I find that a significant percentage of the occupational does occurs during fire watches, during QA/QC reviews, or supervision of installed equipment, and they tell me during security, personnel receive exposures and so forth.

What are you doing to attack that? Or is that true, and what are you doing to address those problems?

You know, I guess on fire watches, if a particular alarm is out, they have to put a man there to watch for fires, and they tell me these people soak up the rem or rads or roentgens.

MR. KINDLEY: I am hesitating in my answer, because what we are used to seeing is maintenance work, as a whole,

being a category where most of the exposure is occurring. And, of course, that would include fire watches that you're talking about, and that would include the QC work as well.

We are taking an approach, rather than zeroing in on those individual pieces, more in terms of let's go look at the whole job. Let's go plan the job, train the people that we need to. Let's anticipate these kinds of problems that you're talking about. How can we eliminate the necessity for fire watches in the overall planning?

Dade, I don't have the same information that you do in terms of identifying those three categories.

MR. MOELLER: Well, they were just examples, and these people didn't have numbers, but they claimed that a lot or -- you know, a number of rem was occurring in these particular categories.

But you're saying, you look at the total project, all aspects.

MR. KINDLEY: Yes. Not just fire watches or QC, but the training of the maintenance worker, where he goes and does the job, as well as the planning in advance. Have they used lessons from past jobs to factor into the existing planning? All those aspects come into the type of review we are doing on those.

MR. MOELLER: Okay. In line with that, to what degree do you find these occupational dose projections of use

where people say -- well, particularly like, say, for steam generator replacement, and they'll do an estimate and come out with 2000 person-rem?

How useful are those?

MR. KINDLEY: I think they are valuable as management tools. What we find is, people aren't very good at making these estimates, and so they frequently don't come close to them one way or the other. But what it does do, in the process of making the estimates, coming up with goals, getting the maintenance people involved in that process, getting other people in the company involved, you get more people involved in the actual protection concerns than you would have otherwise.

So it ends up being a fairly valuable tool to involve management.

Now certainly there are cases where they have made an estimate and said, "That's too much. We need to do something different. Let's go back and replan the job."

I guess in the same way that utilities have the most experience in using goals, some of them are actually doing that. When they run up against a number of them, we say, "We ought to be able to do it for less than that estimate."

One of the problems in the estimates and goals is the lack of historical data. We didn't have a lot of historical data, and we are just now starting to accumulate

it. I think the NRC has got a project at Brookhaven trying to accumulate the data, and hence it's hard to make estimates, because one thing we know for sure, if you take the number of man-hours times the radiation levels, you get too high a number that just doesn't work for an estimate. That's one way you don't estimate, is to take man-hours times radiation levels, because generally the man-hour number is from the maintenance guy, and he has padded it to make sure he's got enough man-hours for his budget, and the HP technician out taking the survey has recorded it as he has been dutifully been trained to do, the highest radiation level in the work area.

So you take the product of those two numbers and you end up with an inflated number. So if you're using that as an estimate technique, it's easy to make your estimate. But a better way is to take past experience and ratio the past experience.

MR. STEINDLER: Can't you provide for yourself the universal fudge factor?

MR. KINDLEY: Some utilities do that.

MR. STEINDLER: Multiply everything by .8.

MR. KINDLEY: More like .3 or something like that. That's more in the category of what we're talking about. Some utilities actually do that. They have developed that, or they have developed a millirem for work hour kind of number, that

this is what it takes, not what the survey is saying, but this is what the real number of accumulation that they expect the guy to get there, and those kind of number they have picked up from experience, so that if a guy is going to work in an area -- well, don't take the survey reading; take this experience number that a guy accumulates exposure at a certain rate, which is much different than the radiation survey number. So those fudge factors are factored into the different techniques to improve the estimates.

MR. MOELLER: Another broad category is, to what degree do you look at the occupational safety and health programs at the utilities? And let me expound on that for a moment.

I looked at your indicators of performance of plants in general, not indicators of rad protection performance, but the general plant performance. And one of the items you record is lost time accident rate. But you don't record fatality rate, you know. It is just lost time accident rate.

MR. FIRST: Well, a fatality equals a certain number of lost time days, and that gets factored in on that. According to the National Safety Council way of doing it, a fatality is a certain number -- Ron says it's 10,000.

MR. MOELLER: Could you comment on that?

MR. KINDLEY: I could comment somewhat. Let me say a little bit that the division I work in does not actually

participate in those inspections. We talk in terms of more INPO-wide, and I don't have quite the detail on this as I might have in radiological protection.

We have received a lot of advice from our Advisory Council that there is a correlation in American industry between industrial safety and performance, so we looked hard at those figures for the industry. And we, in our evaluation process, we do an industrial safety review of the plant, just like we do radiological protection, and we record the kinds of problems we see in terms of, could it lead to accidents in the plant, or maybe the staging is not erected right, the misuse of ladders, the lack of barriers, not enforcement of hardhat or safety glass policies. We reflect on those, and we also look at some of the medical injury records to see, is there a correlation now between what type of injuries people have versus, for example, eye problems, because we see a lack of safety glasses policy. And we try to point out to the utility, "These areas that you may need to improve."

The indicator that got picked on that, I'm not really clear why we picked the one we did. I am a little confused, because I thought I had understood that fatalities ere not involved in lost time accident rates. I had been told that that's a separate category. If someone dies as a result of an accident, he may not be covered under lost time accident rate. Maybe I'm wrong.

MR. KATHREN: I am aware of several different indices, and I think the National Safety Council one does include fatalities, and that number of 10,000 hours may be high.

MR. MOELLER: Okay. I have it here, and I will pass it down. It is your lost time accident rate, and it says, quote: "Lost time accident rate is the number of worker injuries involving days away from work for every 200,000 man-hours of work," unquote. And there is no footnote saying that one death equals 10,000. And it worried me, because I know Bob has been looking for it, and so have I, for fatality rates at utilities, accidental occupational fatality rates, and I was a little surprised that you didn't do it.

MR. KATHREN: Could I ask, who looks -- when you say "we" look at the plants, who looks? Is there a professional industrial safety engineer or professional industrial hygienist in this, or is it just a management overview of safety?

MR. KINDLEY: It is more the latter, a management overview. I don't believe we have anybody on our staff that is a professional industrial hygienist. I could be wrong. We do have a number of people on our staff that worked in industrial safety at utilities, and thus are relatively familiar with the basic things that you ought to do at a utility.

MR. KATHREN: Isn't that like saying that I have a company, and I have a number of people who worked in mechanical engineering somewhere, but they are not mechanical engineers? You see where I'm coming from?

MR. KINDLEY: Well, let me try another analogy. Maybe I'm shooting my own self down here, but I am not a health physicist, and I've had no formal training as a health physicist, but I have worked in that area for a number of years, and I feel I am reasonably familiar with the techniques involved there. So I'm not sure the analogy to an engineer is the same thing.

I think you can learn from actually working on the job there in the utilities and gain a pretty good knowledge of what it takes to run an industrial safety program for a utility. So I take a little bit of issue with you there, just from my own experience.

MR. KATHREN: But do you have people available to you whose industrial safety experience is equivalent to your health physics experience?

MR. KINDLEY: I think the answer to that is yes, because we have available to us the utilities' experts that they have on their staffs, and we do deal with them. And yes, we have learned something from those people as well. So from that aspect, that's correct.

We go to other utilities. We can go to the same

utility and ask his industrial safety expert on these different things as well.

MR. MOELLER: Well, I guess the axe I was grinding was that I had received the impression that occupational safety and health was largely ignored or, let's say, not given very much emphasis at operating commercial nuclear power plants, whereas rad protection is given quite a bit of care and support.

MR. FIRST: On that score, may I ask if OSHA inspects nuclear plants, or are those exclusively under the jurisdiction of the Regulatory Commission?

MR. MULLER: My understanding is that OSHA inspects nuclear plants while they are under construction, at some length, quite an effort while they under construction. But after they are in operation, either they don't at all, or if they do, it is very minimal.

MR. FIRST: There may be an explanation, Dade, for this.

MR. MOELLER: Okay. Shifting on, they are talking about adding hydrogen for the control of stress corrosion cracking in BWRs, and we have a subcommittee meeting coming up in October on that.

To what degree are you or have you already explored this potential effort in terms of doses or exposure rates?

MR. KINDLEY: I am avoiding your question, because

INPO's charter is such that we don't do research. We don't get into whether or not this is the right thing to do from a technical standpoint.

Once the Electric Power Research Institute comes out and says, "We think this is a good thing," and it is demonstrated to work, we would encourage utilities to continue to go use it. But from the standpoint of us evaluating it technically --

MR. MOELLER: No, I didn't mean that. When they start using -- and they are already doing it on an exploratory basis, but I gather that many BWRs are going to be moving toward injecting hydrogen into the primary coolant for purposes of controlling stress corrosion cracking. And the reports I have read say that the doses in the turbine building, for example, could readily be increased by a factor of five.

So I wondered if you are tooling up to look at the implications of this in terms of occupational exposures.

MR. KINDLEY: Yes, sir, from that aspect, we are. Apparently, there is an enhanced carryover of nitrogen-16 in the form of ammonia or something like that.

MR. MOELLER: Right.

MR. KINDLEY: That's what I understand.

MR. MOELLER: Right.

MR. KINDLEY: And that increases radiation around

the turbines.

We go in primarily while the plant is operating, so we are going to be particularly concerned about the turbine building and how high the radiation levels are outside the shields outside the turbines.

Our guess is, that's not going to be the problem. The problem is going to be when individuals have to go work inside the shield during operation to do certain types of things, and those are the ones we are particularly going to look into, what can be done to minimize that exposure; what kind of exposure rates are the operators getting.

I don't have any data for you. All I can say is, we've talked about that and trained our evaluators that, when they run into that situation, that certainly is something to go look at, because it's a new thing that we ought to catch early.

MR. MOELLER: Okay. What do you see as the research needs in radiation protection? I realize that's not your job, but are you hampered at any step of the way for a lack of data that someone might conduct a research project and give you some data that would help you do a better job?

MR. KINDLEY: No, I don't think we are hampered, Dade, from lack of data. I think we have adequate information, because a lot of what we emphasize is the operational manager aspects of running a plant, and there's a

lot of information out there already on how to improve ways of doing things, a lot which has not been implemented.

Certainly, we talked about historical data on exposures that would be useful to some of the plants. That's a different question than you asked about INPO, as far as our evaluation process. I don't think we are dependent at this point in time on research, because we are using a lot of the EPRI information on radiation buildup.

I think you will see in the future a lot more emphasis coming out of INPO on using different techniques to minimize radiation buildup in plants, basically coming out of the work that EPRI has done, but which has not really been implemented in the utilities, and we are going to be pushing from that standpoint.

But I can't think of anything from a research standpoint that would be a direct help to us. Certainly there are indirect things that help the utilities.

MR. MOELLER: Well, let me give you one specific and see if maybe it will be an example of what I was driving at.

You are attempting to control occupational dose as well. Now there are a number of things that could be done, and you are active in many facets of the problem.

Well, one thing you could tell the utilities is, we want robotics to do the following six operations, you know; these are your highest contributors to occupational dose. We

want you from now on to use a robot to do this.

I guess what I'm driving at is, how do you determine your priorities and how do you know not to require them to use robots or to require them to use -- well, you can't require them, but to encourage them to use robots.

Or take decontamination. You are working on, again, the practical aspects. But how do you know when you have -- how will you know when you have reached the stage where it's time now for them to all decontaminate their primary systems? You know, that's the next best way to bring the doses down. How do you determine this? Or robotics or better primary chemistry or whatnot?

MR. KINDLEY: We rely a lot on the Electric Power Research Institute, EPRI, for that kind of information, and the NSSS vendors themselves in the robotics systems.

What we try to do is not to decide on our own that certain techniques should be used. We look around at where have they been successfully used, and where they have been successfully used, we push specific techniques.

Now that answer would not be complete if I did not go to the other step and say, we also encourage utility management to continue to look for improved ways of doing the job. But there is a source of generation of these new techniques -- with the techniques, the goals, the indicators, the trends and things in the evaluation that we're constantly

encouraging them to improve -- that people with the technical knowledge in the utilities, which are probably the best ones to identify how they can go8 about solving specific problems or what they need to solve specific problems, can then go off to EPRI, to the NSSS vendors, and cause these new things to come about. You know, how can they reduce the exposures from this job, Westinghouse or GE? They need some improvement on chemistry.

Then when those things come out and they've shown they can be successful there, we try to pick them up and encourage others to use them as well. And our basis is not to go and invent something new, but to encourage management and the utilities to improve and be the source of that inventiveness. And then when something comes up and somebody is using a good thing, for us to encourage others to do it.

From that standpoint, our job is primarily operations and management, as opposed to actual research and that type of aspects.

MR. STEINDLER: So you are waiting for management to get the message on what needs to be done?

MR. KINDLEY: No, I said part of our effort was to encourage management to constantly improve, to work at finding improvements.

MR. KINDLEY: Well, I'm talking about some specifics. It seems to me a well-defined fact that there isn't

a valve made that doesn't leak. Now, if your effort has been to convince management to look at all the leaky valves they have and do something about it, I would say your effort has been a disastrous failure. The valves still leak; right? I don't see that that is moving the problem along at all.

Let me turn the question around slightly. On the basis of the things that you can pinpoint because you look at the industry as a whole, have you been able to identify the design changes that would, say, reduce over-exposure incidents? And if you have done so, who have you transmitted that information to to perhaps begin to implement design changes or retrofits or what have you?

MR. KINDLEY: I can answer the specific one on over-exposures. The answer to that is no, we have not found design changes which are really needed to prevent personnel from exceeding exposure limits. But let me address the more general question, do we find design deficiencies.

Yes, certainly we run across design deficiencies, things that could be done better. In a number of cases we encourage the utility to go address the problem. We will identify the problem which looks to us probably needs a design change, but we will address the problem and get the utility to come up and commit themselves to a solution to the problem, which sometimes is to get an improved design.

MR. STEINDLER: Well, what fraction of the annual

exposure to an average site, an average unit -- I don't know what that is but I will let you decide -- is due to inadvertent over-exposure?

MR. KINDLEY: Oh, miniscule.

MR. STEINDLER: Even though those over-exposures may run into the tens of R-plus?

MR. KINDLEY: No, sir. The most recent ones, the whole body over-expsosures are 3, 4, 5 rem, down in that category. The skin exposure is 10 rem, which is slightly above the 7.5 per quarter. But the total collective is that 550 on PWRs and 1000 on BWRs, and we are talking about one or two incidents a year for the whole industry. That is a miniscule part of that total dose.

MR. STEINDLER: So what you are saying is there isn't anything that you have discovered or uncovered on the basis of looking at the general industry or industrial practice that would lead you to conclude that it would be worthwhile doing something about inadvertent over-exposure specifically.

MR. KINDLEY: No, sir. From a design standpoint that is what my answer was. I don't see any design changes needed to prevent inadvertent over-exposures. I think they can be eliminated through management action. I don't see any reason why they can't be prevented, from the kind of things we have looked at. All of them were preventable and we know how

to go do that, and it is a matter of getting it implemented. But we don't need new designs or change in designs or retrofits to prevent people from exceeding exposure limits.

MR. STEINDLER: How about the need for, for example, better instrumentation? A guy walks into an area that his technician has just surveyed at 3 R per hour, except that the guy didn't go far enough, and he steps off the end of the ladder into a 50 R per hour field, and he probably would not have done that if he had known what the radiation level is.

Now, that may not be a significant incident in terms of frequency, but it would certainly have solved the particular reportable effort for that period of time if you had some way to alert this chap that things didn't go well.

Now, you can argue on two sides. You argue on the management side that says, well, you ought to train your radiation technicians to be a little more careful in how they do that, certainly. I guess I am trying to explore to see whether or not you are also pushing on the other side, for example, to talk to somebody about inventing or, in fact, perfecting fairly inexpensive personnel dosimeter that reads well enough to alert the chap who is wearing it.

That is a silly example, but I am trying to distinguish between management cures or management solutions, and hardware, instrumentation, the robotics, et cetera, which would be broadly applicable. You apparently don't get into

that second area yourself.

MR. KINDLEY: Well, let me broaden that answer. In just purely addressing the issue of exceeding limits, I am sticking by my answer in terms of I don't see the need for design changes or new instrumentation in the cases of even the one you referred to about stepping off the ladder under the reactor vessels in the PWRs. There is adequate instrumentation to do those surveys, and they could have been done right, and I don't think an improved instrument would have really helped in those situations.

I think the deficiency in those cases was not the instrument; I think it was the guy using the instrument in those cases. He had adequate capability of measurement. But let me move to a different area.

MR. FIRST: Well, before you do, I would like to comment on this area if you are going to an all together different topic.

MR. KINDLEY: No, let me move away from exceeding limits on the need for instrumentation because there is an area where we have encouraged the development of new instrumentation, and that is in the personnel monitoring. It is very difficult to get 1000 contract workers to frisk themselves properly before they go home, particularly when they are all lined up ready to go home at 4 o'clock in the afternoon.

To get them to do a proper personnel monitoring is very difficult. Not that it can't be done, but it is certainly difficult, and we recognized that several years ago, that if you really want to verify that these workers aren't going home contaminated, it would be easier if we could get some kind of a device, a portable monitor-type thing that they could go into and be checked without relying on their ability to check themselves. The incentive is to do it too fast and leave.

So we talked to several vendors about four years ago, saying that one of the problems we see is personnel frisking. We need a better way of doing that, and we encouraged the vendors to go out and improve their instrumentation in that area.

The technology was there. It wasn't that we needed new technology. It was just a matter of putting it together in a way to detect contamination on people at the same level with this hand-held frisker. Now, in recent years, the last year or so, we have seen two or three models come out from the vendors which appear from the results of checking in a couple of utilities they are able to do an equal job to that hand-held frisker and in less time. It turns out they can check somebody out in 20 seconds rather than the two to three minutes it takes to frisk.

Here is an area where we saw a need for a new piece

of instrumentation and we encouraged the vendors to actually go develop this implementation. We obviously told them we thought there was a market for it out there if somebody could come up with something to replace frisking.

That's not answering your question with regard to exceeding exposure limits, but it is an example where we have seen the need for improved instrumentation and actually went out and encouraged the vendors to do that. We have got a couple of good practices out on that subject, and I guess we have funded some work from EG&G on some test procedures on how would you test this particular device.

So we are not ignoring the whole subject there, the need for improved instrumentation. Where we see it, we will encourage that. I guess we wrote a letter to EPRI on beta monitoring, as another example where we feel improvement can be made in measuring betas.

But looking very narrowly on the question you asked about keeping people from exceeding limits, I think I stand by my answer on that. I don't think we need research on that. I don't think we need design changes or new instrumentation; we need to enforce what we know right now.

MR. STEINDLER: Okay. Was the business of contamination being carried to workers' homes a significant issue in the industry?

MR. KINDLEY: I don't think it has been a

significant issue. I don't think there have been enough cases identified on that. What we are saying is there should be a good check when a guy left the station, and the most effective way to do that four years ago was with the hand-held frisker. But recognizing the potential for people doing it wrong in a number of cases where we did see it needed improvement, we said long term that's not the answer. Long term, the answer is to get a piece of equipment that will take out that human element.

MR. AXTMANN: Mr. Kindley, I haven't had a good feel for how you spend your time. I guess I'm not putting this in the best possible way. I don't have a feel for whether you spend most of your time at INPO headquarters, you and your group -- and I don't know how big your group is -- how much time you spend out in the field. Could you give us a feel for what your organization is like? We have seen you but I don't have much other information.

MR. KINDLEY: INPO as a whole is around 400 people divided into eight different divisions. We have four basic things we are trying to do. One is evaluations, one is accreditation, one is reviewing industry events and trying to identify precursors and to assist the utilities in improving. Some of those overlap.

Probably I think on the order of roughly just under a fourth of those people are involved in the accreditation

effort. About an equal number are involved in the analyzing industry events. Probably more than a third is involved in the evaluation effort, and that overlaps with the assistance. Some of the same people do the assistance. And the rest of them end up as managers and staff people that support that.

In the radiation protection area, we have 40 people in that division, which includes three different subjects: chemistry, radiological protection and emergency preparedness. And the effort is -- in terms of bodies, it is just slightly more than in the radiological protection area. There may be on the order of 13 or 14 people in that group, where the others have slightly less.

As far as the number of bodies actually working in radiological protection in that department, it runs about that order.

Now, those people are primarily involved in the evaluation aspect of it, and they will spend between 35 and 40 percent of the.r time in the field at the utility sites evaluating programs. The time back in the office is split up in terms of writing those reports on evaluation and doing probably on the order of an average of two weeks preparation for the next trip.

We get the procedures in advance. We get data in advance. We review that for individual plants so when people come on site, they do have some good feeling for the way they

operate on site, what their procedures are and what history they have had in the past. Spaced in between all those is support of the event analysis business, doing assistance visits. The same people are doing those aspects.

Accreditation is handled pretty much separately. They have their own experts in radiological protection. They actually were transferred from the Radiological Protection Department to the Training and Education Division. But that gives a feel for the particular evaluator.

Now, department managers spend time in the field on quality control of people and training of people. I don't spend most of my time in meetings like this. That is a relatively short amount of my time involved. Most of my travel time, again, is back in the plants looking at what the people are actually doing in training.

MR. MARK: When you do a plant evaluation or survey or whatever the word is, how long a spell do INPO people spend at that plant for one such rundown?

MR. KINDLEY: Two weeks. They will be there two weeks. And that usually totals nine working days. A team of 15 to 20 people. That covers all areas, not just radiological protection. One of those guys on the team is radiological protection. One looks at the chemistry programs, and then there are trainees involved.

We have industry people come along and look at what

we are doing, people from not that utility but other utilities assisting us, and they may be in the radiation protection area, generally on the management side.

MR. AXTMANN: That is very helpful.

MR. KATHREN: Now, you said you had roughly 13 people involved in this kind of activity?

MR. KINDLEY: In radiological protection alone.

MR. KATHREN: And they spend about 40 percent of their time --

MR. KINDLEY: Thirty-five or forty. We like to keep it to 35, but they have been finding it's pushing 40 because of staffing problems.

MR. KATHREN: All right. That says you spend somewhere around half a man year, if my arithmetic is correct, out in the field.

MR. KINDLEY: Half a man year?

MR. MOELLER: A third of a man year for each one of those people.

MR. KATHREN: Oh, five man years. Excuse me. My arithmetic wasn't correct. It's only an order of magnitude.

[Laughter.]

So that is 250 man weeks, roughly, and there are how many operating reactors?

MR. KINDLEY: Well, we have about 50 or 60 sites we go to. I don't have the exact number. We look at two units

at a site if it's a two-unit plant.

MR. KATHREN: So if they spend two weeks at each, that says they are hitting them about twice a year; is that right? That's a round-about way of getting to that.

MR. KINDLEY: Well, we try to hit a plant on the average of once every 15 months.

MR. KATHREN: But if I used your numbers, it says you should be hitting them twice a year.

MR. KINDLEY: Partly you are using those numbers in terms of hitting the assistance visits, as well as the evaluation.

MR. KATHREN: As well as the evaluation. Okay.

MR. KINDLEY: Yes. So we will end up assisting a plant. We may double up on some plants. It is rare that we send two guys to one plant unless we have a guy a training. If the guy is in training, it will be two guys. At some plants, we do feel the need to send more than one evaluator. And I'm not going to talk about who those are, but --

MR. KATHREN: Okay. So they get this nine-day intensive examination. Now, the individual that does this, what kind of background and education, typically, does this person have?

MR. KINDLEY: Typically, this individual is a plant radiation protection experienced individual. They have on the average of ten years commercial power plant experience.

MR. KATHREN: Is that on RPT or is it professional?

MR. KINDLEY: No, it's professional. We have very few technicians. I don't think we have any technicians that have been able to become an evaluator. Generally we don't get through the interview for hiring. We have interviewed a few and decided that they just don't have enough technical background. So we are looking at a professional who is probably -- many of them are health physicists. Engineer is the next category, some sort of engineer. Nuclear engineering is popular. Then you get into the very different types of technical background. Physicists, biologists, that kind of thing. They have had first-hand experience at actually trying to run programs, as well.

So we have that. I think we are running somewhere on the order of like 150 years experience if you add up everyone's experience in that department. You come up with about 150 years.

MR. MOELLER: And before you can be an evaluator, what Bill was saying, you have to be a member of the team, then an assistant evaluator, and finally they let you be an evaluator.

MR. KATHREN: So there is a training process.

MR. KINDLEY: There is a qualification process.

MR. MOELLER: Back at headquarters -- I am speaking because I went on one of their evaluations. This 35 percent

of the time in the field, when they are back at headquarters, they are simply doing the analyses of the data at headquarters. They could have done that in the field. So you could almost call it a part of the field activity.

MR. KINDLEY: For preparation work, we actually get the plant procedures from the plant, and we get their data sent to us, copies of it, and we actually review that on a very plant-specific basis. So I think that is what you are talking about, Dade.

MR. FIRST: I would like to go back to this matter that Dr. Steindler had brought up a few moments ago about the need or non-need for improved instruments, equipment, et cetera from the standpoint -- the point you made bothered me a little bit, that we don't need any improved equipment or research. What we need to do is to improve the performance to enforce the rules.

Now, this makes me think back to the days of industrial safety, where the safety men went out and analyzed the accident, and it always turned out to be personnel error. He shouldn't have put his fingers under the press. That's why he got them cut off. If he had not put them in there, he would still have five fingers. And I could go down with other examples of that, but I think I have made the point obvious.

I don't think that is the right attitude. If you get to an irreducible minimum of accident situations, you

can't just blame it on personnel error. You have to look at the situation much more critically and say how can we prevent personnel error from occurring that results in a dire consequence?

I think this philosophy is quite characteristic of what I might refer to as the philosophy of the smokestack industries, and I would include the power industry in that category. That's old fashioned thinking.

MR. KINDLEY: I think I misled you, because I was talking very distinctly about exceeding personnel limits. And we go to this event analysis aspect of INPO's job, which we're going to talk about, the snipping and operating experience event. Many of those have hardware changes in them, how do you improve -- this plant had this particular problem. One of the solutions is a hardware change.

Don't take what I said about just personnel exceeding limits and expand that across what all INPO does. I think that's why I may have misled you in terms of that.

We do have a lot of recommendations on hardware in their snipping and operating event reports for the type of thing like we're talking about, where clearly something is easy to be done and it would fix the problem.

What I was trying to address in that question is, when I looked at the people exceeding exposure limits, I don't see anything like that, that's going to prevent that one or

two a yea:, but we have the knowledge and equipment needed to prevent those. We just didn't use it as good as we should have.

So I separate that category because I may have talked too narrowly and gave the wrong impression. But I think obviously the ACRS gets some copies of those SLERs. If you go through and look at those in the area of radiological protection, you will find recommendations for hardware changes.

MR. MARK: What success do you have -- you have found a hardware change. Some plant with a good record is using a piece of equipment which other plants could take advantage of, and you would then perhaps recommend that. And what success do you have in having those recommendations taken up? Do you feel fairly good about that?

MR. KINDLEY: I feel fairly good about that. I don't think it's quite the hardware change. But this pH control in PWRs where you use a coordinated lithium/boron pH control for, in effect, increasing the pH of the plant --

MR. MARK: I wasn't really meaning hardware specifically. But you have found a good idea, and you put it into the stream, and you say, "Here's an idea you fellows should be aware of and should b following."

MR. KINDLEY: We find that that works pretty good. I'm using the pH one, because I think the first meeting that I

talked to you people at, you brought that up as a good practice. At that point, not very many people were using that technique. In fact, one of the other people testifying that day was actually using it and saying he wasn't, which, I guess, Bob Scharr tried to correct at the time.

We have encouraged that practice, because EPRI has demonstrated through that data that it actually reduces radiation level buildup. Today, there are only three or four plants, PWRs, that are not using that, and that primarily is tied back to the NSSS vendor, who will not come out and make a recommendation on that. Some plants from that vendor are using it anyway.

But here's an example where we are up above 90 percent adoption of that good practice, and go back when we first talked at this ACRS meeting -- what was it; two or three years ago? -- very few plants were actually implementing it at that time.

I think there are other examples like that that we could point out. The sorting thing we were talking about earlier, many plants are anxious to go to that and are still nervous, and I think I may have misled you. I was talking to Jay during the break, and we don't have communication with Headquarters people, I think is fine -- we're all in basic agreement on that -- but it's nervousness coming back from the Regions, is where we are seeing it, and I think Jay feels I

overstated the case, and that well may be. He may be more up to date on that than I am, and you may really want to address that issue to him.

But that's another example where we saw people using it successfully, and a lot of people would like to use that technique. And subject to working through some of these small problems, I think they would be willing to adopt it quickly.

These are inserts in drums. When you put plastic in a 55-gallon drum, push it down with a compressor and take the compressor off, the plastic expands again.

Well, if there is some way to keep it from expanding, you can get more stuff in that drum. So we have advocated the use of -- some utilities are using an insert that goes down and catches in one of the rims of the drum and holds that plastic from springing back, an anti-spring-back device is the word for these things, and that increases the amount of volume you can get in a drum. And those got picked up and used pretty successfully.

Those are just a couple of examples of the type of thing.

MR. MARK: I wanted to ask also, to what extent are you in, well, sporadic touch, anyway, with practices, as in Europe or Japan or places where some of the same problems might have been approached effectively.

MR. KINDLEY: We find the Canadians have solved a

lot of problems that we can use, information from them on the CANDU reactors. We have put out a report to all of our members, talking about how the Canadian plants actually minimize personnel radiation exposure and the type of techniques that they use that are applicable to the U.S. That got a lot of interest.

We have picked up a few things from other countries as well, who are looking primarily in the chemistry area, to do some more work in that, with the Swedes, in the area of chemistry and radiation level buildup.

MR. MARK: So occasionally one of your staff or you goes on a trip for education or interest or whatever.

MR. KINDLEY: Oh, we don't do it just for the fun of it. We actually.

MR. MARK: No, but I mean --

[Laughter.]

MR. MARK: Information-gathering.

MR. KINDLEY: Information-gathering, that's right.

[Laughter.]

MR. KINDLEY: Yes. We've had people in France. We've had people in Sweden. We've just had a group come back from Japan that are looking for both techniques which can be adopted, and certainly we had a couple of us who went up to the Pickering plant and talked to the Ontario Hydro people and got a lot of good ideas from them. So we're trying to use

that international experience as well.

MR. MOELLER: Are there other questions?

MR. KATHREN: Just one. Going back to your very first slide -- I've been asleep for the rest of the time.

[Laughter.]

MR. KATHREN: No, actually, all kidding aside, how much or what proportion of that does -- I assume that is whole-body external exposures, so there is no hand or special extremity case -- how much of that would be relegated to neutrons, and what about the problems of non-penetrating exposure?

MR. KINDLEY: Neutrons is something that I am in the process of trying to collect some information on right now. NCRP has asked that same question about neutrons in power plants. And what we are finding is, the neutron exposures are very minimal. The only time you get neutron exposure is when you go inside the containment during the time the plant is operating. Very few plants do that, or if they do do it, they don't go into the areas where there are particularly a lot of neutrons.

The records from the plants show very few neutron exposures. And how good those numbers are, I think they are pretty good from a dosimetry standpoint, but they actually were dutifully recording time and radiation levels, which is the primary means we get neutron dose exposure. It's the rems

involved times the amount of time the guy is in the area, so most of those -- that's what most of those numbers turn out to be.

MR. KATHREN: So if I could put a word or two in your mouth and say 95 percent or more of this level --

MR. KINDLEY: 99.

MR. KATHREN: 99 percent, okay. Now what about non-penetrating, which specifically might refer to betas?

MR. KINDLEY: We don't see a lot of beta exposure out there either. The betas primarily show up during the maintenance work. And from what we are seeing from the records out there and the way they control the exposure during the job, again I don't think there's a lot of -- I don't think that number is very large. It's larger than the neutron number, but I don't have a real good feel for that. It certainly would not be included in the event, because that's whole-body penetrating.

MR. KATHREN: Right, okay.

MR. KINDLEY: But I don't think that's a large problem out there.

In the area of instrumentation, which we will be coming back to, I wish there was better instrumentation in that area, to measure betas, particularly the low-energy cobalt-60 and cesium betas, and that's one of the reasons why we wrote to EPRI, suggesting that they look some more into

that area. But to the best I can tell, I don't see a problem in that area.

Now I am nervous about saying that, because the cobalt-60 betas and cesium betas are very difficult to detect, and most plants don't have high-energy betas around. So there's clearly a possibility that there could be more there than I think.

MR. KATHREN: Well, you could make a lot of arguments also that if it's going to get into the detector, it's going to be detected. And usually beta instruments are not energy-dependent, because they are measuring, you know, what energy deposition there is in the chamber. I'm thinking of ion chambers here.

You could also argue that the measurements might be excessively high from the exposure standpoint, because the individual is usually garbed in a couple layers of protective clothing, and, you know, you can make all kinds of arguments.

MR. KINDLEY: Yes. And that's why I don't think there's a problem, because most of the time when people are working in open systems, they are wearing protective clothing, and respirators get used many times, too, so the eyes are protected as well.

But the thing that makes me nervous is the low-energy cobalt and cesium betas entering the ion chamber where they may not be able to get in there, yet they are still

energetic enough to get through that dead layer of skin.

MR. KATHREN: Right. So what I think I'm hearing you say is that this is one area in which there may be, in fact, a real research need, not only of the better instrumentation problem, but rather a characterization, if you will, of the fields and the exposure potential to personnel.

MR. KINDLEY: I think that's basically correct. As I say, that's the reason why we wrote to EPRI and suggested that they look into doing more work in this area.

MR. KATHREN: It's beyond an instrumentation problem.

MR. KINDLEY: Yes. For example, Duke Power, apparently, has got a new instrument that they came up with that does a pretty good job of measuring betas. It turns out that the RO-2, when you compare it with the extrapolation chambers, gives you pretty good beta numbers, even in these lower areas.

So there's a lot -- I don't want to say that this is an area that's out of control and we don't know what's going on, because I think there are a lot of factors that say that it is under control, because we do have instruments -- they are picking it up -- that we've checked out. We do cover the people with protective clothing. We are talking about low-energy stuff that's not very penetrating, so it doesn't take much when added to the skin to stop it.

But I guess I'd like to know more about it, and from that standpoint, I agree, this is an area that we feel that there is need for improved instrumentation, improved dosimetry, and like I say, that's why we wrote to EPRI. And I don't see anybody here from Minogue's group, but we talked to the research people -- that's what I'm trying to say -- research.

We have talked to Minogue in the past about this kind of area of betas and with the NRC as well.

MR. MOELLER: Okay. Well, we have devoted a lot more time this morning to the open session, but it has been time well spent.

I think we have several options available. It is roughly ten after twelve, so one option is simply to break an hour now for lunch, and we would resume then in closed session in an hour at about 1:10.

Now how long will it take for the closed session? Can you do it in an hour?

MR. KINDLEY: I have not prepared anything for the closed session. I just came to answer questions.

MR. MOELLER: Fine. Well, why don't we say thirty or forty-five minutes for it. And what is your schedule on leaving? Is it okay if we did that, if we took lunch now and did it later?

MR. KINDLEY: I don't have a problem with that.

MR. MOELLER: Okay. We will resume in closed session at 1:10. We will go until some time, and we'll take a break, and at 2:00 o'clock, we will resume in open session. The 1:10 session will be closed.

So we will resume, then, at 2:00 o'clock in open session and hear from the NRC Staff.

Dan, is that okay with you.

MR. MULLER: That's fine.

MR. MOELLER: Okay. So the reporter, we will need you back at 2:00 o'clock. Thank you.

[Whereupon, at 12:11 o'clock, p.m., the meeting was recessed, to reconvene at 1:10 o'clock, p.m., in closed, unreported session, to further reconvene in open session at 2:00 o'clock, p.m., this same day.]

AFTERNOON SESSION

[2:05 p.m.]

MR. MOELLER: The meeting will resume.

The last formal presentation is on the evaluation of the effectiveness of INPO's radiation protection program, as exemplified by the practices of the utilities. That will be presented by Dan Muller, Assistant Director, Division of Radiation Protection, NRR.

Dan. And we each have a handout of Dan's presentation.

MR. MULLER: I am going to make just a few introductory remarks and then pass the baton to Rich Serbu. One of the better parts of being a manager is you can delegate authority.

The NRC entered into a memorandum of agreement with INPO -- I guess it was in about 1982 -- agreeing to cooperate with INPO in a number of areas. One of these areas turned out to be radiation protection, and we subsequently entered into a coordination plan with INPO where we would evaluate the success of industry generally in the subject of ALARA-type programs.

This coordination plan has now been in existence something over two years. The original coordination plan anticipated a two-year evaluation program of the industry's success generally for the years 1983 and 1984, so we are in

about mid-1985 now and the data is coming in, so we are able to evaluate the 1983 and 1984 programs.

Rich is going to go over in detail the indicators that we have identified as being useful.

Dade, you earlier in the meeting asked your subcommittee and the consultants on whether they felt that there were any other good indicators. Well, I guess I would underline that, too, and ask you for your advice on the value of the indicators that we are using as well as any constructive criticism you can give us or any advice you can give us on anything else we might use in evaluating the industry's success.

Also, we have the decision to make on whether this is worthwhile to continue, whether this coordination between us and INPO is worthwhile to continue. At the present time, our inclination, looking at all of the data, much of which you saw that Bill presented, we will present data of somewhat a similar nature, and generally we feel that the program has gone pretty well in the last two years.

Certainly one can't find a definite downward trend in radiation doses or something like that and say, ah, that's a result of INPO's work. It just isn't that easy. There are probably about eight or ten different things, as Bill has indicated, that enter into what might be a trend in radiation protection.

So we recognize that, but we feel nevertheless that our cooperation with INPO seems to be a pretty good way of going, but also I would like to hear your advice on whether you feel this coordination is a good way of generally achieving an effective radiation protection program in the industry.

So Rich now will go over in detail some of our indicators of the success of the program.

MR. MOELLER: A quick question, really off the subject, but you mentioned that this is one of several MOUs between the NRC and INPO. Could you remind me what the other MOU subjects are?

MR. MULLER: Yes. One is on training.

MR. MOELLER: Okay. Training and the accreditation program.

MR. KINDLEY: The evaluation programs, working with I&E on -- in terms of INPO evaluations versus the PAT team evaluations, and then there is a basic one about these SERs and --

MR. MARK: What about NPRDS?

MR. KINDLEY: That is -- I don't remember the details. If that is in there, it is included in the one on engineering to begin with.

MR. MARK: I have another question. What does this cooperation or evaluation or whatever is a good name for the

program cost the agency? Twenty man years per year or two?

MR. MULLER: That is really hard to say because I think --

MR. MARK: Well, how many people?

MR. MULLER: Well, effectively, Rich Serbu is on it full time or half time or something in that range. The branch chief and the section leader and I are spending some time, so it has probably cost the agency about a man year per year.

MR. MARK: So he is full time.

MR. MULLER: Well, no, he is about half time, and then I am taking the rest of the three of us for some fraction of that time, so I will give it a rough one man year per year. But the argument is that if we weren't doing it this way, we would be doing something else on the program, so I'm not sure it is really costing the agency anything.

MR. MOELLER: Okay, go ahead, Rich.

MR. SERBU: I'm Richard Serbu. I'm health physicist. I work in the Radiological Assessment Branch.

MR. MARK: Did you learn on the job or were you trained as a health physicist?

MR. SERBU: I come from the same school as Bill Kindley.

[Slide.]

MR. MOELLER: Let me compliment you, Rich, on -- it is not health physics training, but you give us the proper

cover on your handout, the date and your name and so forth. We appreciate that.

MR. SERBU: Yes, about the third or fourth time, I finally got it right.

[Laughter.]

The briefing guide contains the following information, just some introductory remarks, some background information, which includes the latest generic issue, management control system update, which references all the documents and the current status of the generic issues it is associated with, plus some of the problems associated with the generic issue.

The second would be coordination plan update, an outline of the criteria. The major part is criteria and preliminary indications of our evaluation. Fourth is a bunch of data charts and an Attachment 4 that lists the basic data.

Now, you could use that when you were querying Bill on a number of those things. That has all that information in it. And finally, some conclusions or semi-conclusions. They are preliminary conclusions at this point. And the last thing were some further actions, where we think we will go from here if we are going anyplace from here.

[Slide]

MR. MOELLER: Now, when was this written?

MR. SERBU: Which one?

MR. MOELLER: The evaluation program, or is it being developed now? What you just outlined. When was that?

MR. SERBU: The evaluation program, the data per se or evaluation findings are in the process of being developed now. What you are seeing is a very preliminary effort. We don't have a lot of the data. We have not processed a lot of the data. Some of the trends haven't been fully analyzed. We haven't done analysis.

You will see in the dose areas seven ways from Sunday just aren't done, and there is a reason for some of this, and I will get into that a little bit later. But it is very recent.

MR. MOELLER: Well, will this be put out as a NUREG or something?

MR. SERBU: Originally we had intended to put it out as a NUREG, and we have downgraded that after discussions with the division director and Harold Denton. It would be all right to go as a Commission paper. There are some problems with the recent audit detail information that we don't have available right now. It will probably go out as a Commission paper.

MR. MULLER: Substantially, we have a commitment to finish all this by September. We will effectively prepare the Commission paper, which is going to be a report which will include our recommendation on continuation of the coordination plan, and the basis of all of that will be a lot of the data

in rough form that Rich is showing you.

MR. MOELLER: So you are saying it might end up as a memorandum to the Commissioners?

MR. MULLER: Yes.

MR. MOELLER: But not as a document available for the technical community or the utility.

MR. MULLER: Probably not. Certainly available to the ACRS, though.

MR. MOELLER: And who will follow this? You say you will finish it by September. Who will follow it after September?

MR. MULLER: My answer was the silence that I gave you.

MR. MOELLER: Oh, you don't know.

MR. MULLER: I really don't know at the present time. Seriously, there is some feeling that people like Rich and whoever his supervisor will be in the next assignment will still carry this. You know, Rich will go with the baggage of the INPO coordination plan.

MR. SERBU: Yes. The reorganization and resources and management available to me at that time will impact how or if I can get this done, even. So I am probably going to have to extend this past September if I don't end up working for Frank and Dan.

MR. MULLER: Well, the reorganization is still like

six or eight weeks off, so there is a fair amount of time yet to finish this up.

MR. MOELLER: Okay.

MR. SERBU: I will start off. Over the two-year evaluation period, based on preliminary trends, it looks like industry has achieved a level that we would term as successful for having integrated the radiation protection programs that integrate ALARA. The basis of this is our preliminary indications on eleven basic trends, and a number of subcategories within these trends.

Information sources that we used in the evaluation program are industry information that routinely comes in the NRC, required-type reports, which is this first one. The second one is the evaluations performed by regional inspectors. These are on-site inspections, generally. And the third one is information provided by INPO.

We have received a similar summary briefing, and we didn'thave the benefit of getting the graphs or charts or anything at that time, so we don't have Bill's information, so that is part of the Freedom of Information Act problem and the regulatory problem associated with that.

Ron Kathren pointed out the deviations and all that stuff. The data has to be qualified. Well, we can really qualify our data. It is preliminary. It hasn't been fully compiled and analyzed. The INPO data we haven't gotten, and

we may not be able to get it. Some of that, five of the criteria, as a matter of fact, are very subjective types that only INPO can get. We can't get it because it would require additional reporting requirements for licensees, so it would be very difficult to justify.

The detailed information that backs some of the information that INPO has is not readily available to the NRC. I have seen all the data. They have been very willing to allow us to see it and make copies and distribute it to NRC.

The last one was the five criteria are ones we are not going to get.

MR. STEINDLER: The data you are talking about is exposure data?

MR. SERBU: The data I am talking about I will be talking about shortly, and I will go through all the data. Eleven criteria, six of those -- as a matter of fact, my next slide answers your question.

MR. STEINDLER: My question will be, how do you know that the data you have got is any good?

MR. SERBU: If it isn't, we are in trouble. The data we have is based on NRC sources, 20.407 reports, tech spec-required reports, and information analyzed from those in NUREG 0713. Semi-annual reports.

MR. STEINDLER: How do you know those data are any good?

MR. SERBU: We have the same reliance. We went through this. I think I see what you are getting at. If INPO gets data informally and gives it to us informally, it still may be just as valid as the information that we get through official channels, but I'm not certain of that.

MR. KATHREN: I think what Marty is trying to ask is: if I as a utility under the provisions of technical specs to my license or the regulatory requirements give you a number, how do you know that that number is, in fact, correct? Is there any spotchecking? Or maybe I don't give you a number and I should have.

MR. SERBU: How do we validate data that we receive from industry? I am not well versed to answer that. I have been on several inspections. I don't think we check on, for instance, dose compilations. I don't remember ever doing that.

MR. KATHREN: So, in other words, I could tell you as a licensee anything, and you would say: Great.

MR. SERBU: Not quite that. There are some cases where we do check on, for instance, technical specification compliance is inspected. There are inspection modules that cover all that. But as far as Reg Guide 1.116 type data or 2407, I'm not too sure.

MR. MULLER: For what it is worth, you know, the person that does send this in sends in also a signed statement

that this is true and honest to the best of his belief.

MR. STEINDLER: For the kind of question I am asking, that isn't worth much.

MR. MULLER: I don't know. I have signed one or two of those, and I feel -- you know, you at least check up a little bit on the thing you are signing, what is beneath what you are signing.

MR. STEINDLER: The reason I am asking the question is two-fold. One is you say qualification of data, and I thought that was what you were going to eventually get to. And secondly, the quality of the data in terms that we were just talking about here are somewhat related to the kind of conclusions you can legitimately draw from them. So I thought I would at least inquire as to what you knew about the quality of the data.

MR. SERBU: Okay. I will put the same faith in this data as I would in a licensee statement in applying for an operating license. It has the same statement.

MR. FIRST: Well --

MR. SERBU: Does that wreck your confidence?

MR. STEINDLER: Well, no, because the second one that you mentioned can be checked, and if a guy does a groundwater calculation, for example, you can go out there and drill a hole if you have to. Sometimes you do. That's a different story. It depends on what you do with the data.

MR. SERBU: Well, we audit dosimetry and we can verify total doses. Things like that. We could audit dosimetry and check the people in the different categories, 0-100 and 100-200. That is done. Not 100 percent, but that is done.

MR. STEINDLER: Well, I won't belabor the issue.1

MR. FIRST: Let us recall the fact that when we started talking about control room habitability, it finally dawned on everyone that no one of these systems had ever actually been tested, but that they had been signed off on every inspection, so here is data that is coming in regularly which had no real meaning in terms of accomplishing anything, and I think that those of us who were on the subcommittee that talked about this originally sort of got a little suspicious of some of the verifications that are passed around on paper.

MR. KATHREN: And I would point out in response to the statement about signed affidavits, I seem to recall some questions about reactor operator licensing where there were certain sworn statements and affidavits, and I don't want to go into that. I just want to call it to your attention.

MR. FIRST: So the question is on the table. What is the answer?

MR. SERBU: We have about 20 years of data that is all in the same category.

MR. STEINDLER: Fair enough.

MR. SERBU: I am already itching enough from the sunburn I have. This isn't doing me any good.

[Laughter.]

MR. MOELLER: Well, you know, it is interesting here that in terms of environmental surveillance, for example, NRC has its own van that they send out, and they independently collect, you know, oranges or apples or whatever, you know, milk, and they independently obtain their own numbers. I don't know that they put a phantom person in a plant with a monitor, you know, or a phantom dosimeter.

MR. LYNCH: My name is Oliver Lynch.

Distinguished representatives from IE could probably make some remarks on this, but having watched inspectors go around, I'll tell you, they go through all that data and make sure that the forms are filled out correctly and that they agree with the numbers and things like that, so I think there is some verification on the inspection side.

MR. SERBU: The resident inspector, particularly.

MR. LYNCH: Yes. So I have faith in those numbers, as accurately as they can be recorded, so to speak. I don't think anyone is trying to pull the wool over anybody's eyes.

MR. KATHREN: I think that's a very good point, the I&E.

MR. MARK: Besides, Dade, if in any given year some utility's number goes up, you know it must be honest.

[Laughter.]

MR. STEINDLER: Carson, if it builds up by a factor of 10, then it is probably honest, but if it only goes up by 10 percent, you don't know how much it should have gone up.

MR. SERBU: A couple other qualifying remarks. We need to work with INPO on establishing some common reporting basis for the data, as Bill pointed out. A couple of the plants were -- they have eliminated back through five years of the data. We have eliminated from this year's data but not from previous years, so there are a few minor inconsistencies in the data, and we haven't in every case done the five-year data assessment. We have run back quite a ways in some other cases and just haven't looked at the shorter term.

MR. MOELLER: Help me with these criteria. Now, what is Criteria No. 5, your second one. It says instances of internal and external contamination, that the information is not dirctly available to the NRC. What do you mean?

MR. SERBU: All right. Starting off -- I will get to that in a moment, Dade. These are the criteria that INPO is tracking, that they are supposed to provide more summary and detailed information on. As a matter of fact, we didn't get any copies of that today again.

MR. MOELLER: These are the criteria in terms of rad protection that they are tracking?

MR. SERBU: These are five of the eleven criteria

that we had originally agreed would be representative of power plant performance in radiation protection and ALARA.

MR. MOELLER: You originally had agreed. Have you changed any of the eleven? Have you added or subtracted?

MR. SERBU: Well, there were ten originally and we added SALP to that.

MR. MOELLER: And have you modified any of the other then?

MR. SERBU: Some of the others have been modified slightly. For instance, reporting square footage of contaminated areas and things like that were a little bit difficult for us to do, so we agreed with a few of the changes proposed by INPO on that. I will try to cover them.

MR. MOELLER: All right. Well, go ahead and we will listen.

MR. SERBU: This was just a quick show and tell. I will cover these again later on in the briefing. Dose goals, dose tracking information, internal and external contamination instances, tracking, rad training program statistics that Bill covered very well, and rad engineering utilization and use of radiological auditing are ones that the NRC right now has no direct access to.

INPO does, through their special reporting system under the evaluation program. They are not able to provide this data to us because of the concern over the FOIA problem.

MR. MOELLER: But in other words, take rad training program statistics. You have no mechanism or you are essentially forbidden to ask a utility how many people took what courses?

MR. SERBU: No, that's not the case. At this moment we can't dig up that information because we have no extraction and tracking system. Most of these we can integrate into routine inspections in an ALARA module without requiring utilities to do any extra or additional reporting, which is the big problem with getting extra information. If we integrate that into the ALARA modules, we can probably pull it out, but that is a year or two's process. We would have to work through IE and the regions, coordinated out of an NRR central function, which I'm not sure will exist.

MR. MOELLER: But INPO has it, and they are quite willing and they are providing it to you.

MR. SERBU: Right. You have seen it already. Bill showed it to you.

MR. STEINDLER: Is it true that there is information available on every one of those plants that you right now can't have direct access to? In other words, do all reactors track internal and external contamination on a recordkeeping basis?

MR. SERBU: I would prefer to cover that a little bit later on. The answer to that particular one is no, they

don't, but the NRC has no integrated method of finding that out because we don't check it at every reactor that we do an inspection and radiation protection at. INPO specifically asked for that data from every reactor. We don't look for it and don't ask for it and don't require it, and that is true of all these others.

We probably could extract it from inspection reports, PAT team reports, SALP assessments.

MR. STEINDLER: But someone is getting the information someplace.

MR. SERBU: In most cases that is true. You are going to get me off into the rad data base, but I think you will see as I go along. I will try to cover each point.

[Slide]

Here is what I was paid to come up and do, actually, to talk about the criteria themselves. If you wonder what the original wording of a criteria is, one of the attachments lists all eleven criteria in their present form.

Dose goals and use of dose tracking Bill covered, and as near as we can tell, it looks like they are in use at about 85 percent of the plants, although the usage is not what we would really want from what we have seen from inspections, from observations with INPO.

In one instance I cited up there a plant used averages. This may be kind of just going through and average

your last five years. If you have a real high average, you have got a good goal.

The idea is to use goals as a management tool. That is what we are looking for, to see that that happens. Industry has a long way to go in that area, and I think there is some progress evident.

The second criteria is the one that is the heart of the matter, occupational dose. Occupational dose reflects the success of programs.

The things that we feel are most important are collective dose, the total dose in the nuclear power industry. Doses to individuals. The average dose, for instance. Thirdly, the number of people exposed. Keep those three things in mind. That is what all the rest of this stuff is oriented to.

MR. MOELLER: Now, the ones named in number two are the highest, like St. Lucie, the 1263 is one of the highest BWRs? Is that what you are telling me?

MR. SERBU: The plants listed here are the highest ones that I could dig out that were over 2000 and over 1000.

MR. MOELLER: And St. Lucie, that is one of the two units or the average for both?

MR. SERBU: That's one unit.

MR. MOELLER: So the higher of the two units. Okay.

MR. SERBU: I think they just reported it as two and divided it. The information on the -- oh, it's not here. I'm sorry.

MR. KATHREN: I am confused a little bit, which is frequently the case. You said individual doses. Do you mean the mean dose to an individual or do you mean the individual collective dose from BWRs?

MR. SERBU: No, let me go back through those three things again. It is real important. The things that we feel are important are the total dose -- power reactors operate and they generate occupational dose. That big number associated with health effects. That is an important number. That is the collective dose or total dose.

MR. KATHREN: Well, could we use just one term so I don't get confused?

MR. SERBU: Use collective dose. The second one is individual doses. If you are an individual and you go in there, what is the dose to an average individual. We want to keep those as low as possible.

MR. KATHREN: All right. That is the mean individual dose.

MR. STEINDLER: No, it's the average.

MR. KATHREN: Average is the mean.

MR. STEINDLER: No, it is not. Not by definition.

MR. SERBU: Mean, median and mode.

MR. KATHREN: So which is it?

MR. SERBU: It is an average. We are giving you an average number. You take the number of people working and the total dose and divide it. That's an average.

MR. KATHREN: You sum the doses.

MR. SERBU: I haven't even gotten to that yet. All those charts are coming up.

MR. KATHREN: Oh. Well, then maybe this is premature. I just want to kind of get the terminology straight. And what is the third thing you look at?

MR. SERBU: The total number of people exposed, which is obviously important.

MR. FIRST: Did you have a lower limit for exposure, as we were talking briefly this morning? I mean is everybody in the plant exposed, or just those that have a reading over a given value? Am I making my question clear?

MR. SERBU: The numbers of people we used, are they those that were dosimetry or are they those that received a measurable dose?

MR. FIRST: We mentioned this morning that some had a diminimus level, and the question was would they be included or not since they really weren't exposed individuals in the true meaning of the phrase.

MR. SERBU: All right. This is from Barbara Brooks' data.

MR. MOELLER: Well, the data reported by Barbara Brooks generally only includes people who were badged and who had a measurable dose. The reason for that is to keep them from just badging a bunch of people to reduce the average.

MR. FIRST: Fine. Thank you. That answers the question.

MR. KATHREN: But you don't make any discrimination on the basis of job type or classification?

MR. SERBU: We do make discrimination on the basis of job type of classification. There are five categories: maintenance, special maintenance, operations, refueling and rad waste. For instance, dose is dumped into those categories. There are operators, health physics techs, maintenance workers and two other categories.

MR. KATHREN: Is that further on?

MR. SERBU: No, I'm not even going to cover that. That's not germane to the industry trends at this time. Barbara Brooks' 0713, Volume 5, will carry that. That's in the final stages, or final throes, depending on how you look at it.

[Slide]

I will start into this data. This is on page 5 of your handout. Oh, I swore I wasn't going to use that one.

Here are some total collective dose or the period of interest, the last five years, and I have also included back

as far as we had data. It shows that -- let me cover a number of categories, four categories. Number of workers, man rem, megawatt years -- not that important to us at this point -- and number of reactors.

Number of reactors is number four, and you can see that is going up. We discussed it earlier today, 78 reactors on line. That is constantly increasing. Number of workers is increasing. Total workers. That is to be expected. Megawatt years looks like leveling off or going off a little bit. Not important. I'm not going to dwell on the power generation related statistics.

Man rem is the most important one, number two. It looks like after a long period of a nice, steady rate of rise, it is starting to level off, and if you look at the short term, maybe even starting to decrease a little bit. These are the total values. I am going to cover average next time.

The idea is to get a general idea of the trend because that is what we are doing, evaluating industry on the trends right now.

MR. MOELLER: It is interesting there, and again, it's not our main purpose, but essentially from 1980 the amount of electricity generated has been just about constant, which is surprising. I thought with more plants we would be getting more electricity.

[Slide]

MR. SERBU: Next into average values. This is averaging your collective dose for boilers in blue, pressurized water in green, and red is light-water reactor. Again, you can see generally an upward trend, and if you look at the short term, the last five years, it looks like it is leveling off again.

This year is a downward trend after a slight upward trend last year after a downward trend for slightly the last two years. Whether it is statistically significant or not is hard to say. It is within one standard deviation, probably.

MR. STEINDLER: That is per unit regardless of size or how long it has been in operation?

MR. SERBU: Per unit and regardless of operations, except we eliminated two plants, Humboldt Bay and Indian Point 1.

MR. KATHREN: I hate to nitpick again, but if you will look at 1978, the BWR curve touches the average, but the PWR curve is much below it. I don't see how that can be, scientifically. Maybe it is that reliability of data that we discussed earlier.

MR. SERBU: I think it's reliability of the graphics artist on this one.

MR. MULLER: A little earlier, they all crossed at the same point, though.

[Laughter.]

MR. SERBU: The same graph has been before this committee for the last five years, by the way.

MR. KATHREN: It is the first time I have seen it.

MR. SERBU: Average number of workers. To me this is one of the most interesting ones. One of the tenets for radiation detection where I came from was that you always tried to minimize the number of workers. A good way to keep dose down. There has been a steady rise, and in the last few years, it looks like they are kind of going up. I think the leveling off point is somewhere here around 1200 or 1300. But this year showed a pretty good rise over what we had seen the last year.

MR. MARK: These are workers who received exposure to radiation?

MR. SERBU: Right. Occupationally-exposed workers.

[Slide]

Average dose per worker per year. One of our three major indicators within dose shows definitely a slight downward trend. Whether statistically significant or not I can't say at this time. This is a preliminary analysis. But it has been dropping slightly -- oh, it was about .49 and 66 this years for Bs and Ps. Again, the five-year period of interest, it's definitely going down.

[Slide]

In summary, to show you what all these trends are,

the average value trends, workers per reactor per year for the period of interest started to level off at around 1200 and show a slight increase this year. Man rems per reactor leveling off probably maybe with a slight decrease over the last five years. May rems per megawatt year, level or slight decrease. Dose per worker, a very slight decrease in the long term and in the short term.

Overall trends in occupational dose indicate a definite improvement in the industry.

MR. KATHREN: All this says to me is that the reactors are getting bigger and using more people, but the doses per worker are remaining about the same.

MR. SERBU: Doses per worker are dropping significantly. I think about 100 millirem out of 1600 out of about 500 are what, 10 percent, something like that?

Well, like I'm saying, we haven't fully analyzed just what that means; I am giving you first impressions.

MR. STEINDLER: Excuse me. Is it your functional conclusion that, in fact, the dose per worker is going down? Is that something that you're going to bring back up again, to draw some conclusions from, in turn?

MR. SERBU: We're going to look at that one particularly to see if dose per worker is going down, to see if it's statistically meaningful.

MR. STEINDLER: These data don't show that.

MR. SERBU: We have not analyzed it to show that.

MR. STEINDLER: All I guess I'm saying is there is not enough information here to draw that conclusion. If you have looked at that data and said yeah, this is a conclusion which is reasonably valid, then I can go on -- you know, then I can take you on from there. But on the basis of this graph alone, if you conclude that the dose per worker is going down and then you draw subsequent conclusions from that, I'm going to have a bit of trouble with it.

MR. SERBU: Well, take a look at the charts back in the very end of your handout, in Attachment 4, and take the very last page. If you look at the last five years, right about in the middle, average dose per worker in rems, .67, .66, 2, 2.6, 2.56 -- you've got a big enough scatter so that the range of error obviously encompasses the last number. So if you do a strictly mathematical analysis, it doesn't tell you too much.

What we have to do, besides doing the mathematical analysis, is incorporate things that are related to this such as where there outage is, what men were in outages, how did they do, and do that analysis. That's how you start it. If we can find any correlations there we can make conclusions.

But based on experience, if you can drop an average dose of 100 millirem per year, which is 20 percent year, that seems to be a good indicator. Just from experience.

MR. KATHREN: I would say from 1978 on, the change has been insignificant in what you're calling the average dose per worker. It looks to me very flat. What has gone up has been the average number of personnel with measurable doses per reactor. But what that means I really don't know.

If the average number of personnel with measurable doses goes up and the average number -- and the average dose remains about constant, you would expect to see the collective dose go up, and that hasn't really been the case. Well, it has if you look at 1978, that's your base year. But that's not where it should be. The break should be at about 1980. Something doesn't add up with these data, and I very seriously question this. It just doesn't add up or multiply out.

MR. STEINDLER: Well, I think it will become clear if you could include in here some kind of reliability or statistics on the spread. Then I think you'd be able to see what I think will be your conclusion; namely, that there is indeed so much slop in these numbers, these averages, that the difference between .67 and .56 is indistinguishable. And at that point, you would have a tough time defending the notion that, in fact, there is a trend.

MR. SERBU: Okay. One thing I can point out is there is not a trend that is clearly upward. That in itself is something meaningful to us right now.

MR. STEINDLER: No, even that you can't say. If you

don't have enough information to say that there is a trend, then you don't have enough information to say there is any trend in any direction.

I think the conclusion will probably come out that the data are flat; that is, that the trend is flat, as far as you can tell. But you can certainly say that there has been no dramatic rise, if that's the kind of information.

MR. SERBU: That's one of our conclusions.

MR. STEINDLER: Well, if that's your conclusion then I think you're fairly safe.

MR. SERBU: I threw in BWRs and PWRs that have the highest doses for 1984 to show you what these are. And these probably affect significantly the average doses for Ps and Bs, but we have not had time to do an analysis to see how that would work out.

Problems with boilers have been pipe crack repair; with PWR steam generator repair, particularly Robinson. And the biggest point here I guess is the collective dose has stayed about constant even though we have more plants and more people working, which is an anomaly as far as you've pointed out. But that's something we have noticed and we're going to look at. I thought enough of it to note it particularly.

Any further questions in that area?

[slide.]

Criterion number 3 is one that Bill has already

covered, number of overexposures at power reactors, and workers exceeding 5 rems at one facility, meaning in one shot at one facility.

MR. FIRST: How do you define overexposure?

MR. SERBU: Overexposure is 10 CFR 20.202. Essentially three rem per quarter and 1.25 rem per quarter, depending on whether they have paperwork or not.

As Bill has shown you, there has been a sharp drop in overexposures over the period 1980-84, and for 5 rem exceeding, hardly anybody anymore except transients and vendors who INPO has tracked under a different system. Which we are not tracking them, by the way.

MR. STEINDLER: Do you have enough data to put together a similar table where you cut off at, say, 3 rem?

MR. SERBU: I think --

MR. STEINDLER: If 1984 goes to zero and you want to continue to find out how the industry is doing, you redo this whole system only you knock it down to 3 rem and see how far you're going down, or how fast you're going down. Do you have that kind of information?

MR. SERBU: I think that capability exists.

MR. KATHREN: Don't they report to you the number of people between 2 and 3 and 3 and 4, et cetera? So I think it does exist.

[Slide.]

MR. SERBU: The next one is solid rad waste volumes. There may be just a slight downward trend; maybe not. That is definitely affected by outliers because there are a few plants that have very high solid rad waste volumes.

Our data is definitely not consistent with what INPO has, and we need to probably get together with them and see if there's some common reporting format that we can come up with. This was the data table I used drawn for me by John Mims who then got in an automobile accident and then couldn't talk to me about the table, but I calculated averages and total volumes for Ps, Bs and Ls. Graphically it came out about like this.

[Slide.]

As far as total volume. Averages follow the total volumes pretty closely.

MR. KATHREN: Oh, that is the sum of the two.

MR. SERBU: Right. Total volumes. This is derived from NUREG/CR-2907, 10 CFR 50.36 reports, and Reg Guide 1.21 reports.

MR. AXTMANN: And what happened in 1983?

MR. SERBU: I am not sure. If you throw out a steam generator there's a lot of volume in one of those, so I think they threw out a few of those that year. I'm not too sure.

MR. MOELLER: Were any steam generators shipped?

MR. SERBU: No. Turkey Point stowed onsite,

Robinson onsite, but a tremendous amount of rad waste --

MR. MOELLER: Oh, okay. From it. All right.

MR. SERBU: And could be correlated with our NUREG/CR-3540 steam generator radiological assessment, if we have time to do that.

MR. KATHREN: You don't look at liquid or gaseous discharges, then, as a waste volume?

MR. SERBU: We didn't look at that as part of this evaluation, no. It was one of the initially suggested criteria back three year ago, however.

MR. FIRST: Are the data for those available? Water and Air? Or is this something where you'd have to generate a new request?

MR. SERBU: I think the NRC has the data. We would like to load it in a big data base and then be able to manipulate it.

MR. MOELLER: There is an annual compilation of all airborne and liquid releases.

MR. FIRST: That's what I said. It could be put in the same table if you wanted to see the total picture of waste.

MR. MOELLER: yes. Airborne and liquid is in curies, so we wouldn't know the volume.

MR. FIRST: But you could follow the trend.

MR. SERBU: If there is one, yes.

The fifth criterion was using contamination instances which Bill Kindley has discussed. Being an INPO source of data; we have no way to get this data. The problems with using contamination instances are that different facilities have different levels or standards what is contaminated and what isn't, and what a contaminated area is. It's difficult to keep track of square footage of contaminated areas. If you go into an outage it's a bad trend for you since it's obviously going to increase the areas greatly.

But generally, what we see over five years is that licensees are starting to control contamination in an improved manner. They are tracking contamination instances, they're checking uptakes from airborne radioactive.

Source of radiation are essentially direct radiation through surface contamination and airborne radioactivity. If you can control those three things and have a good solid program to do it, you probably can have a good radiation protection program ignoring regulations even. Those are the things you concentrate on. These are indications of those efforts plus management concern.

We could probably get this data through our resident inspectors, through routine inspections, again through the ALARA module inspections.

[Slide.]

Criterion 6 should be of a little more interest.

The extent of contaminated areas. We prepared a performance evaluation essentially for the regions after much discussion with the regions, and came up with an evaluation process where they looked at extent of contaminated areas, which is criterion 6, and radiation protection staff stability, criterion 10.

The regions particularly wanted criterion 10 added in there because they felt it reflected potential in performance of a radiation protection/ALARA program.

The overall ratings for criterion 6 were satisfactor plus.

MR. MOELLER: Excuse me. Back on item 10, the staff stability -- this means how long they have worked there?

MR. SERBU: There's a large number of criteria associated with that. 13 and 14 outline the categories here. Essentially, we looked at 58 to 60 facilities. Each region took the plants in its area and evaluated them for these two criteria. In some cases like under contaminated areas they excluded recently licensed plants because there wouldn't be any contamination problem at all, obviously.

Ratings were performance appraisal type based; outstanding down to extensive improvement needed, as you see. Distributions are as shown with most plants being in the excellent to satisfactory categories, in these two areas. Now, this is not an evaluation of the radiation protection

program; it's two tiny segments of the radiation protection program.

Criterion 10 has a similar distribution; mostly excellent and satisfactory. We found not too many that needed extensive improvement, which I would say would be unsatisfactory performance myself. And a few in the improvement needed category.

Each of these categories was well defined by probably 10 or 15 descriptors that said what outstanding is. So for instance, one item was the number of violations. Another one would be management attention; another would be regulatory attention to make things happen. I do have a copy of how that format is laid out.

Most of the ratings were done onsite as a part of a special ALARA inspection; in other words, an existing ALARA module was utilized to do these two criteria.

MR. KATHREN: On that contaminated area item, was there an objective thing that had to do with how much activity was floating around and where? Or was it more of the soft things? And when I say soft I mean --

MR. SERBU: I understand.

MR. KATHREN: Less objective, perhaps.

MR. SERBU: The criteria were kind of semi-objective. The only hard criteria you can use for, for instance, contaminated areas is something like square footage

of contamination, or for staff stability turnover rate and things like that. Where it was possible we put those in. The regions did use those in some cases where the information was available. Others were --

MR. KATHREN: Well square foot of contaminated area is not in itself a good measure because it doesn't address the level of contamination or the kind.

MR. SERBU: Right. So we left it up to a person who is experienced at that particular facility who inspected at that particular facility to go through these objective and semi-objective criteria.

MR. KATHREN: In other words, you may have an inconsistent basis. If I am an inspector, or I'm doing the evaluation in one plant and Marty is doing it at the other, it depends on our personal definitions of these things.

MR. SERBU: No, that's not quite a representation. If I look at it and give you a few ideas, maybe that will make some sense.

First of all, a number of evaluation factors, generally 8 to 10 of those. In contaminated areas it was change and extent of contaminated areas; increasing, decreasing, remains the same; relative numbers and extent of these areas, control and cleanup efforts, procedures, policies, programs associated with it; management control of plant cleanliness, of radiological cleanliness; impact on

operational maintenance doses; performance trend and rate of progress; and other categories.

Then for each of those they would go through into another section and look at the outstanding, excellent, satisfactory, improvement needed categories and see where they matched up best. For instance, in satisfactory, performance as expected for a competent and experienced facility; performance in programmatic efforts do not require significant improvement; problems are minimal and seldom repeated; projects and problems in these areas are prioritized and managed well; only routine regulatory attention required in these areas; improvements are met on schedule; performance exceeds basic regulatory requirements.

This in turn -- these would be done by an inspector familiar with the particular unit and reviewed by an immediate manager, usually the radiation protection facilities manager. That gave us the consistency. They wrote in a large number of comments which we could try to analyze later on.

MR. KATHREN: How did that give you the consistency?

MR. SERBU: Well, it's better than no consistency at all, let me put it that way.

MR. KATHREN: Each guy went out and, using these broad guidelines, did his own thing.

MR. SERBU: This is designed along the line of standard management performance appraisal systems, and it has

the same flaws that those have. But in lieu of not being able to evaluate the criteria at all, they're far superior to any other method. You get as objective as you can, and we threw out a number of things and we added a number of things. I feel that they are representative.

MR. MOELLER: Do you compare your ratings with INPO for the same plan?

MR. SERBU: In this area, INPO didn't do any ratings. In 6 and 10, we rated these by ourselves.

MR. MOELLER: INPO doesn't rate the control of contaminated areas?

MR. SERBU: No. Or staff stability. They compile statistics on their radiation protection staff and things but not to the extent that we went into this.

MR. MOELLER: Well, you could help me with something else. I have a Region I evaluation of industry success in achieving ALARA, and on criterion 6, they rate some plants "S." I suppose that's Satisfactory. "E" would be Excellent?

MR. SERBU: Yes.

MR. MOELLER: And what is "IM"?

MR. SERBU: Definitely improvement needed.

MR. MOELLER: Oh, needs improvement. And what is "IU"?

MR. SERBU: Extensive improvement needed. Politicized a little bit in the process.

MR. MOELLER: All right. Go ahead.

MR. STEINDLER: Let's see, on the basis of those statistics that you've just given us on criterion 6, which you rate as satisfactory plus, --

MR. SERBU: That is the region's rating. The regions rated these.

MR. STEINDLER: Yes. That doesn't raise, I assume -- I assume satisfactory plus is sufficiently good and it doesn't raise any flags about, Hey, we have to do something.

MR. SERBU: Oh, no, no. There are some flags raised in a number of the reports. There are areas definitely of interest. As a matter of fact, we think contamination control is one of the weak areas that could use more attention in spite of the fact they are at a satisfactory level.

MR. STEINDLER: Satisfactory plus is weak.

MR. SERBU: No. Again, we're looking --

MR. STEINDLER: I'm sorry. I'm trying to see what kind of --

MR. SERBU: It's the plants in the lowest satisfactory and IM/IU categories that give you the problems. And anybody that's satisfactory or excellent probably is not going to create any regulatory problems.

What we're looking at are standards of excellence. If you have a minimum compliance program and you meet the regulations, does that mean you're great under this

coordination plan? That's not what we're looking for. We're looking for -- striving towards standards of excellence, not interim compliance.

MR. KATHREN: If I met all of the regulatory requirements, where would I be rated?

MR. SERBU: Nothing else? Probably around IU, IM.

MR. KATHREN: If I only met the regulatory requirements I'd be rated "extensive improvement needed"?

MR. SERBU: I'm talking off the top of my head and I hate to do that.

"IM, performance reasonably well most of the time. Performance is adequate to enable routine performance of work at facility. If all aspects of radiation protection were run at the same effectiveness, radiation safety requirements and goals would not be met." So I guess satisfactory would give you regulatory compliance.

Improvement needed, it says, the way they developed this is "occasional violations of regulations, occasional procedural violations..." --

MR. KATHREN: What does satisfactory say about violations of regulations?

MR. SERBU: You can still have them but they are rare.

MR. KATHREN: But they are rare. What does excellent say about violation of regulations?

MR. SERBU: "Few regulatory findings in these areas, no violations, few procedural deficiencies or procedural violations." That's something an inspector is obviously very familiar with.

MR. KATHREN: Okay. Those are more or less relative and objective.

MR. SERBU: Right, I'm giving you things out of context. It's extremely difficult to evaluate a whole system in 10 sentences.

MR. MOELLER: How much more do you have, Rich?

MR. SERBU: At this rate? About two hours.

No. Just a few more things, actually. I've only got two more pages.

MR. MOELLER: Okay. Well, move ahead and we will take a break when you finish.

MR. SERBU: Okay.

MR. MOELLER: I guess I still did not understand stability, although you did say that that meant a turnover rate would be one of the items under stability. If that is there, that's all I need.

MR. SERBU: Stability includes, "turnover rate is low enough to insure experience levels are maintained at a high level, high enough support career progression to prevent stagnation."

MR. MOELLER: Okay. Go ahead, then.

MR. SERBU: I can leave that with you if you like.

Okay, 7, 8 and 9 were covered by Bill Kindley. Rad training is one of the things that we are quite impressed with. Several of us have been out and been through INPO training programs at facilities, or INPO-certified training programs, and they seem to be well on their way to doing a good job there.

Use of rad engineers is a weak area; these are nominal rad engineers; they are not really performing rad engineering functions. A lot of them are ALARA reviewers, they track dose data and things like that. I don't know what percentage that would be, but it's definitely an area that industry can improve in.

Independent assessment of HP programs. As Bill said, about half have experienced HP people going at it, and about half are QA people who look purely at QA compliance and procedure compliance.

Radiation protection staff stability, satisfactory plus. Probably a little more highly rated than contamination control by the regions. They seem to be fairly pleased with that. Several reasons for that. Newer plants were convinced to comply with some guidelines prepared by NRR that the Radiological Assessment Branch did calling for high level radiation protection assignments according to plant measures.

SALP trends, 11.

[Slide.]

MR. STEINDLER: Could you tell me what SALP is?

MR. SERBU: Oh, we will get to that. Systematic Assessment of Licensee Performance. This in itself is a summary of two things; inspection findings essentially, inspection efforts, and licensing efforts.

MR. MOELLER: Just to calibrate a little bit, SALP is a broad program that is conducted by NRR and the regions on the general management performance of plant licensees. And this is just one small part of one element of SALP. I think SALP probably has about a dozen elements, and radiological control is just one of them.

MR. STEINDLER: And the higher number the better off or the worse off?

MR. SERBU: No, it's the other way. A SALP rating of 1 is real good; less NRC management attention indicated. SALP level 2, normal NRC inspection attention indicated; level 3, additional attention indicated.

The trend has been definitely downward for PWR's. They've been getting better. And someone else noticed about doses that PWR's seem to be responding well. Plants I've been to definitely seem to be improving with time.

Boilers' SALPs have apparently about leveled off. I don't know what that means. This is a good indicator of a very broad range of things; management attitude, violations.

MR. STEINDLER: Does this correlate fairly well with overexposure?

MR. SERBU: Haven't done correlation with overexposure. No, I don't know.

MR. MOELLER: Is there a tendency to rate a plant that has few overexposures, or if you know their collective does is low is there a tendency then to give them a low SALP rating on rad controls?

MR. SERBU: I think generally there is a correlation between low-dose plants and their SALP rating. The highest ones have -- the ones with 1 ratings are places like Kewaunee or something like that that are down, you know, 400 or 500 or less.

MR. LYNCH: I would point out that the SALP rating is not independent of the rest of this.

MR. SERBU: That completes the basic data that you have. One page or two pages of conclusions are left.

MR. MOELLER: Okay, go ahead with those then and we will take a break when you finish.

MR. SERBU: Now, our conclusions, our preliminary conclusions, are based on --

[Slide.]

a different perspective than Bill Kindley had, perhaps. This is based on attitudes or outlooks, experience in DSI personnel, of INPO personnel and INPO programs, regional

input, and on participation in inspections and in INPO evaluations on our part, also. So we've kind of seen both sides of the program.

Generally, from the composite of data and doing the evaluation program, it looks like performances are probably at a satisfactory level. Many trends are definitely improving; some not so clearly but many are improving.

Poor performers affect the overall industry trends, and this tells us something --

MR. FIRST: Don't you think those two are somewhat at odds with each other? How can you have performance at a satisfactory level when there are clearly poor performers still in the pool?

MR. SERBU: That's a relative term. That was a poor choice of words on my part. They are not really poor performers. As you can see, everyone is performing at a satisfactory level.

There are some poor performers in specific areas, as you can tell from contamination control. We identified one that was in really bad shape, and six or seven that needed improvement. That's what the poor performers is aimed at.

MR. FIRST: Okay. In some specific areas. So it should be interpolated there.

MR. SERBU: Overall, programs are all satisfactory in the nuclear power industry. We can't attribute the

improvement to any particular group; there are some of them that are involved. Inspection of ALARA programs in the regions, health physicist appraisal program we did in 1982, INPO's efforts, the utilities, of course, as Bill pointed out; ANI has been mixing it up in there; our NRR licensing reviews have insured that every plant has had an ALARA review for design and organization and programmatically.

The rulemaking precipitated a scamper on the part of industry to come up with programs that were equivalent to those that we are proposing in NUREG-0761 and Reg Guide 8.XX. And there has been at high levels an increased management attention to radiation protection/ALARA. Harold Denton gave a speech at AIF in Orlando, and Victor Stello gave one on the West Coast, both stressing the same thing about where the radiation protection industry should enhance.

MR. MARK: I find myself uncomfortable with your primary main conclusion, perhaps influenced by things we heard this morning. It would read more relevantly to me, I think, if it said we think we see some improving trends but more improvement is needed.

MR. SERBU: That sounds reasonable to me. Like I said, this is preliminary. You caught me a month short on the data analysis for projecting.

Okay. Areas that we identified -- and these are only some; I can't guarantee that these are going to stay or

that there aren't more to be added. General improvement, use of goals as a management tool. Use of ALARA/radiation protection in work planning. The use of rad engineers, for instance, as they're intended, they can function and be used i preplanning and analyzing tasks before you start work.

Contamination control -- doing a little better at tracking personal contamination and uptakes and trending those, which industry apparently is starting to do, according to INPO.

Contractor radiation protection control has been kind of a weak area, and as you heard Bill Kindley, they're trying to get a little bit better control over contractors by starting dose control and things like that, to find that a little better.

Upper level management support for ALARA at reactors -- while that has improved greatly at the corporate level, we still see a lot of resistance at the facility level. In some cases, again, it would be a case of what I outlined as poor performers that would deserve most of the attention.

Rad waste control/rad waste reduction. We're not sure; it doesn't look like there is any great decrease, but it looks like rad waste remained about the same. But we think that the amount of rad waste generated might even be increasing. Compaction may be offsetting that. We're not sure, but it could use some more attention.

MR. STEINDLER: What do you mean by rad waste control? Are you talking about confinement?

MR. SERBU: No. By control, just workers taking anything and everything into a containment area and then it's all contaminated. Training programs. For instance, that one reflects a large number of things. Training management attitudes, programmatic efforts.

MR. STEINDLER: But the consequence is a larger waste volume.

MR. SERBU: Right. Plus greater potential for spreading contamination.

And dose tracking and dose control. A lot of plants are going to computerized systems now that are enhancing this. We'd like to see them start tracking task doses a little better. It kind of forces you to plan, or it helps you to plan. It helps you establish a database that you can feed back in in later work planning. So that's an essential part of the ALARA process; dose tracking and dose control related to ALARA.

As far as the evaluation process and the coordination plan, we found that INPO does most but not all of their evaluations during non-outage periods. And it's like going to Church on Sunday; it's a good time to go. But other times, in an outage things are hectic, there's a great deal of operational pressure to get jobs done, you've got a large

number of contractors on staff, the plant staff has gone from maybe 300 to 1300 as you saw from the charts. A lot of these are not as thoroughly trained as the plant people; some are better in some instances.

Radiological controls and maintenance activities during an outage should be viewed. I think it would enhance our evaluation process. And we talked to them about this.

ALARA engineering control measures as far as an integrated work planning system incorporating radiation protection, maintenance and operations is another area INPO could probably emphasize. Bill talked about going to see a maintenance engineer four years ago. Times have changed. I've been along and they interviewed every maintenance manager now, and the guy does know something about it. But taking those guys who now know something about it and getting them to use engineering controls, procedures and methods other than what they've traditionally used is the next step.

The biggest problem we've had so far has been the INPO FOIA concerns, and their concerns over the regulatory use of any detailed data that may give us. This greatly hampered the flow of information between the groups. It's kind of been one way.

This precipitated the NRC's having to go dig up all this radiological data, compile it and analyze it separately rather than taking INPO's data and validating portions of it

and accepting the rest as good data.

MR. KATHREN: If the data is available to you, why should there be a Freedom of Information concern?

MR. SERBU: The data is not available to us.

MR. KATHREN: Then where do you get it from?

MR. SERBU: The data INPO generated -- well, let me back up a little bit on this. Originally, we had decided to analyze 11 criteria. INPO was going to do a certain number of them and NRC was going to do a certain number of them.

MR. KATHREN: Yes, I went through all that with you. But I thought I just heard you say that INPO doesn't want -- I must have misunderstood you -- that INPO doesn't want to give you the data so you go out and get it yourself.

MR. SERBU: Essentially, yes. Right. Rather than take INPO's data and validate it, we now are in a position where we have to generate it ourselves, which is probably best in the long run for the NRC.

MR. KATHREN: Are you duplicating their efforts?

MR. SERBU: Yes. Part of the coordination plan is to avoid duplication of effort, and we are now duplicating their efforts.

MR. KATHREN: I see. That would seem to be a very important point.

MR. SERBU: And from this we have learned probably for other coordination plans and coordinated activities that

NRC probably in every case ought to maintain a redundant source of information. In our case, radiological data.

MR. KATHREN: So you're saying you should duplicate it?

MR. SERBU: We think that's probably best. It helps validate the data and it prevents you from getting into a bind timewise, extending programs, wasting resources.

MR. STEINDLER: You don't validate the data if you get it from the same place.

MR. SERBU: But it's different types of data in some cases.

MR. FIRST: In some cases it's the same, however? I mean, you have a mixture?

MR. SERBU: Where it's exactly the same --

MR. LYNCH: You might indicate, for example, on exposure information where we get ours and where INPO gets theirs, and the timeliness of it.

MR. SERBU: Oh, a good point. INPO receives actual dose data, for instance. Where we get, as Bill pointed out, estimates, they receive it in the first part of the year and are done analyzing it early in the year, and we don't analyze that quickly when we do find it. For instance, one plant finally last week reported its data, and obviously the NUREG summarizing it won't be out until January, February or March of next year.

MR. KATHREN: Aren't these plants supposed to provide you with this information within a certain timeframe?

MR. SERBU: Yes, they certainly are.

MR. KATHREN: Are you saying that they aren't doing it?

MR. SERBU: I don't know.

MR. KATHREN: Well, I'm confused. You're saying you don't get the data, and I asked you the question and you say, I don't know.

MR. SERBU: Barbara Brooks handles receipt of the data. That's a different office.

MR. KATHREN: And you don't talk to Barbara?

MR. SERBU: No. Charlie H[illegible]nson is in the Radiological Assessment Branch who handles the dose analysis for essentially NRC for power reactors, the summary type tables that you see.

SPEAKER: Each utility submits an annual report summarizing their exposure data, and that is submitted on an annual basis within a certain timeframe. And if they do not, Inspection & Enforcement is notified and we follow up to insure compliance with the regulations. Generally, they do comply. It does require time to analyze that data and to get the NUREG report out.

MR. KATHREN: And how much sooner does INPO get their data than you get yours?

SPEAKER: Well, because INPO can ask for information on a quarterly or semi-annual and the regulations require annual reportings to the NRC.

MR. MARK: Are you finished?

MR. SERBU: Essentially. I have one last viewgraph on further actions if you want to see that. If not, it's not that important.

MR. MARK: I have a couple of questions. ' those figures you showed us on workers, do those include all the contract workers?

MR. SERBU: I think all contract workers are included in that.

MR. MARK: The ones who have to be badged onsite are included in the total worker column, even if they only stay three months?

MR. SERBU: Yes. Barbara Brooks did something with that data this year. I'm not sure what, but I know that they are counted in there. Maybe they have eliminated counting them redundantly; I'm not sure of that.

MR. MARK: My other question, we have seen total numbers of man rem for workers. Is there any information as to -- for a given plant -- as to when its man rem come in at a high rate and when they come in at a low rate? Are they mostly during outages, or fairly flat or what?

MR. SERBU: We can tell on an annual basis as those

go up and down. We can find out when outages are and correlate it to those. The industry does, on its own, track outage dose -- dose per outage day and dose per non-outage day at many plants. That information is not available to us. I don't even know if INPO tracks it.

MR. MARK: Do you have it? I'm not asking for it. I'm just wondering if you look at it.

MR. KINDLEY: We know that most exposures occur during outages, just from reviewing their records. Exposures from doing operations is small. Maybe the NRC's records can reflect that when they look at the five categories and we see that extensive maintenance -- that kind of accounts for a large fraction, whereas the operational people compose a small percentage. That sort of reflects what goes on during the year. While they're operating exposures are not as high; when they check out for an outage is when people go into the higher areas and that's when exposures are generally --

MR. MARK: Right. And so the attention for radiation control should also focus on these outage situations, or put a lot of weight on them anyway.

MR. KATHREN: Carson, there have been at least two published studies that I'm aware of. One was done by the Atomic Industrial Forum funding it by a contractor, and I can't remember the name of the author, and it's about 8 to 10 years old, where they looked at and published in a nice,

blue-covered thing. They looked at when people got their exposures, under what kinds of tasks, for both PWRs and BWRs.

Subsequently, I believe I have seen another one within the last year or two, and I'm only going to guess here and say I think it appeared in that new publication, Radiation Protection Management. But that may not be correct, or they did this same kind of thing and updated it.

And clearly, in both of those studies, as I recall, the exposure was to people during the outages, the scheduled maintenance outages.

MR. MARK: And so it is also perhaps true that mostly contract workers carry out these rems.

MR. KATHREN: I would say yes.

MR. MARK: There was some maintenance crew --

MR. KATHREN: In fact, it's kind of a little thing in the industry that you want to give the contract workers the high doses so you save your own people for later on.

MR. MARK: Delightful.

MR. MOELLER: While you are speaking of studies on that subject, one of the ACRS fellows did a similar study; Caspar Sun, five years ago, roughly. It was published in Nuclear Safety.

MR. KATHREN: Maybe that's the one I'm thinking of, then.

MR. MOELLER: Okay. Any other questions for Rich

before we take a break?

What I think we'll do then is take a break. Will you want to check some more with the NRC Staff, or do you want to go immediately into Executive Sessions? I presume we can go immediately into Executive Session.

Okay. If we do that, then we won't need the court reporter anymore. So why don't I recess, then, the formal portion of the meeting, indicating we will take a 15-minute break, we will resume in Executive Session, and it will still be open to the public with my anticipation that perhaps after a half hour or so we will wrap it up. Thank you.

[Whereupon, at 3:30 p.m., the recorded session of the meeting was concluded.]

CERTIFICATE OF OFFICIAL REPORTER

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of: ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

Name of Proceeding: Subcommittee on Reactor Radiological Effect

Docket No.:

Place: Washington, D. C.

Date: Wednesday, July 31, 1985

were held as herein appears and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission.

(Signature) Suzanne B. Young

(Typed Name of Reporter) Suzanne B. Young

Ann Riley & Associates, Ltd.

Attach: ACRS/RRE

1984 INDUSTRY PERFORMANCE IN RADIOLOGICAL PROTECTION

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

U. S. NUCLEAR REGULATORY COMMISSION

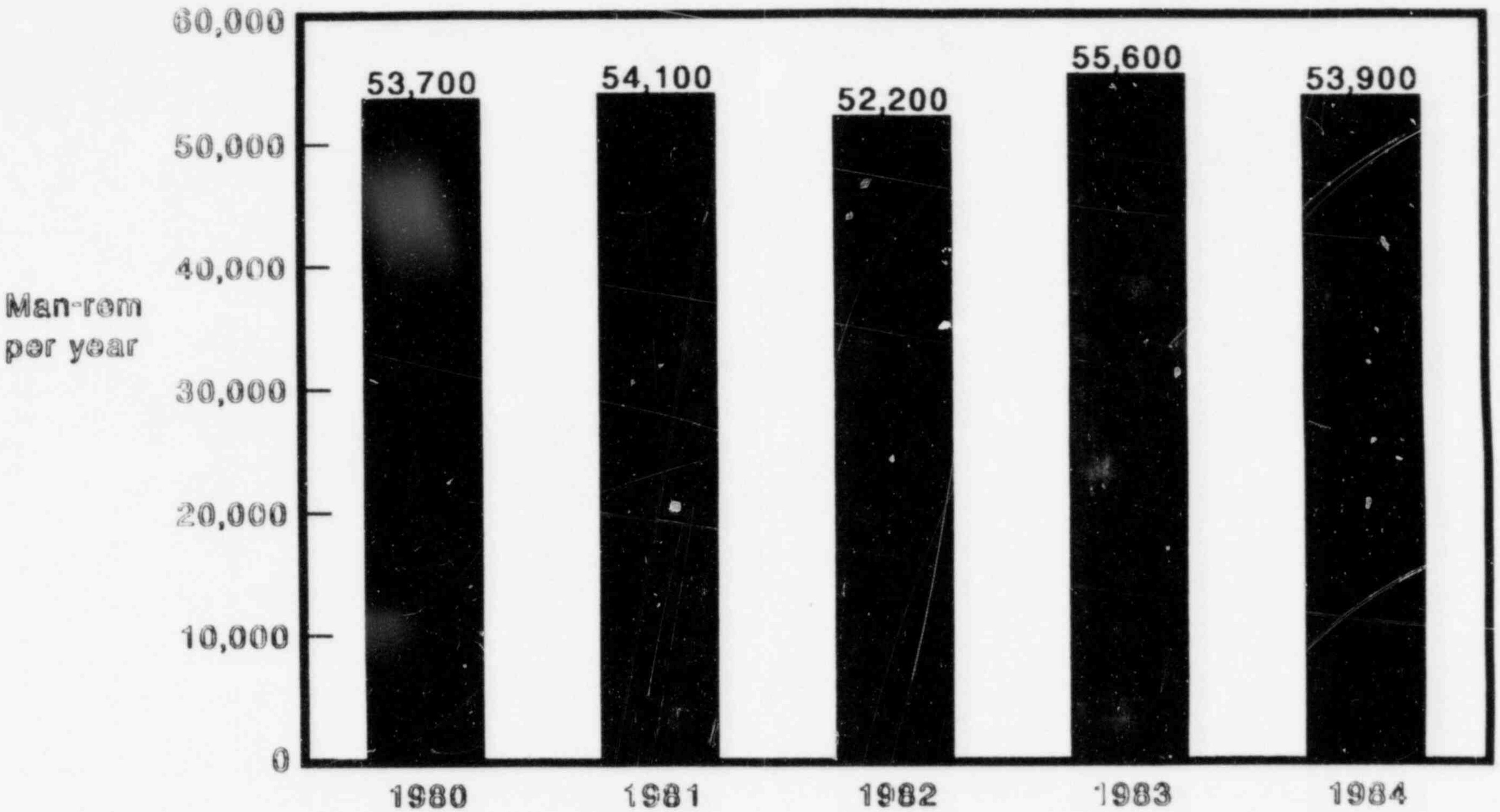
BY

W. R. KINDLEY

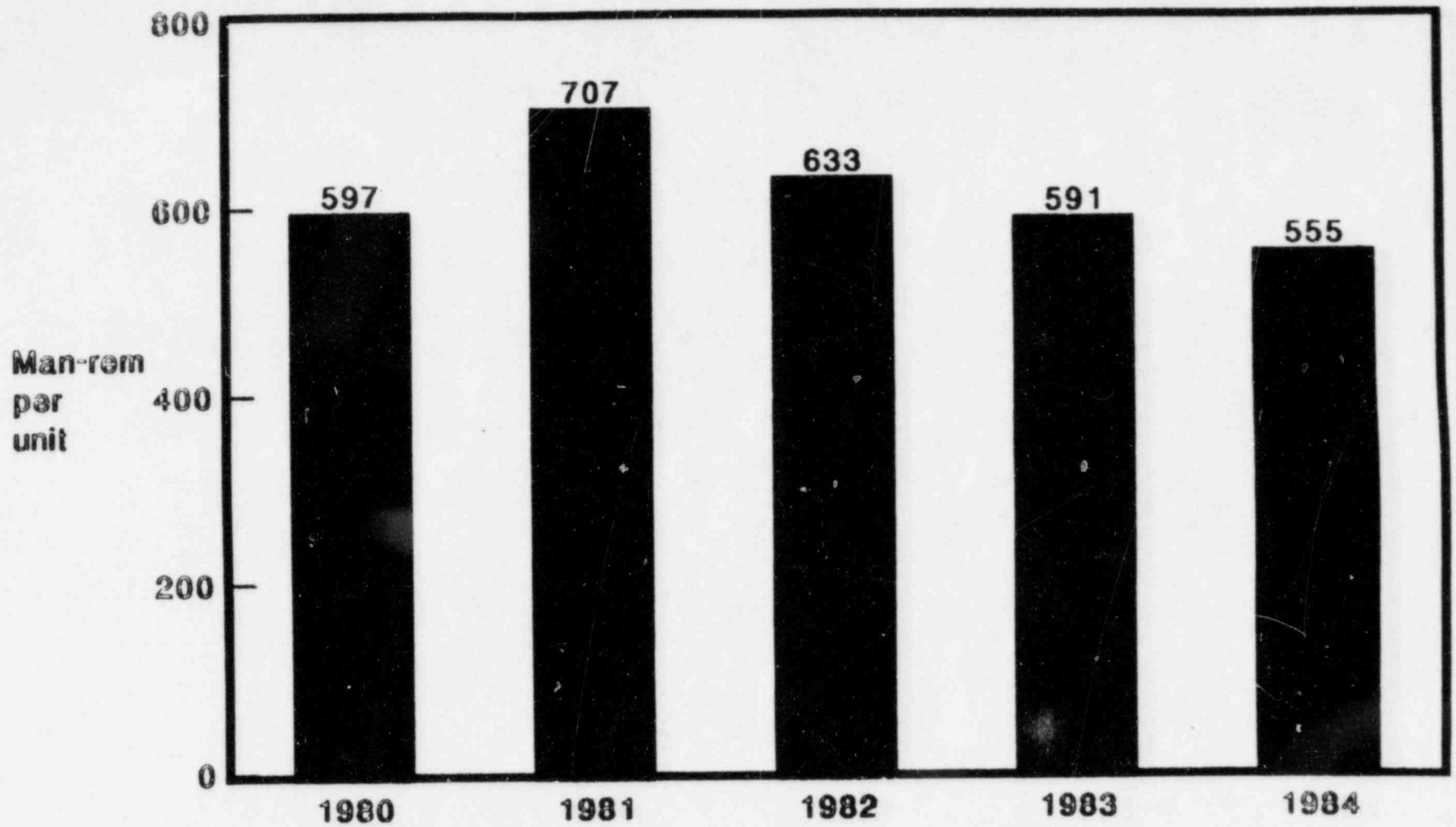
INSTITUTE OF NUCLEAR POWER OPERATIONS

JULY 31, 1985

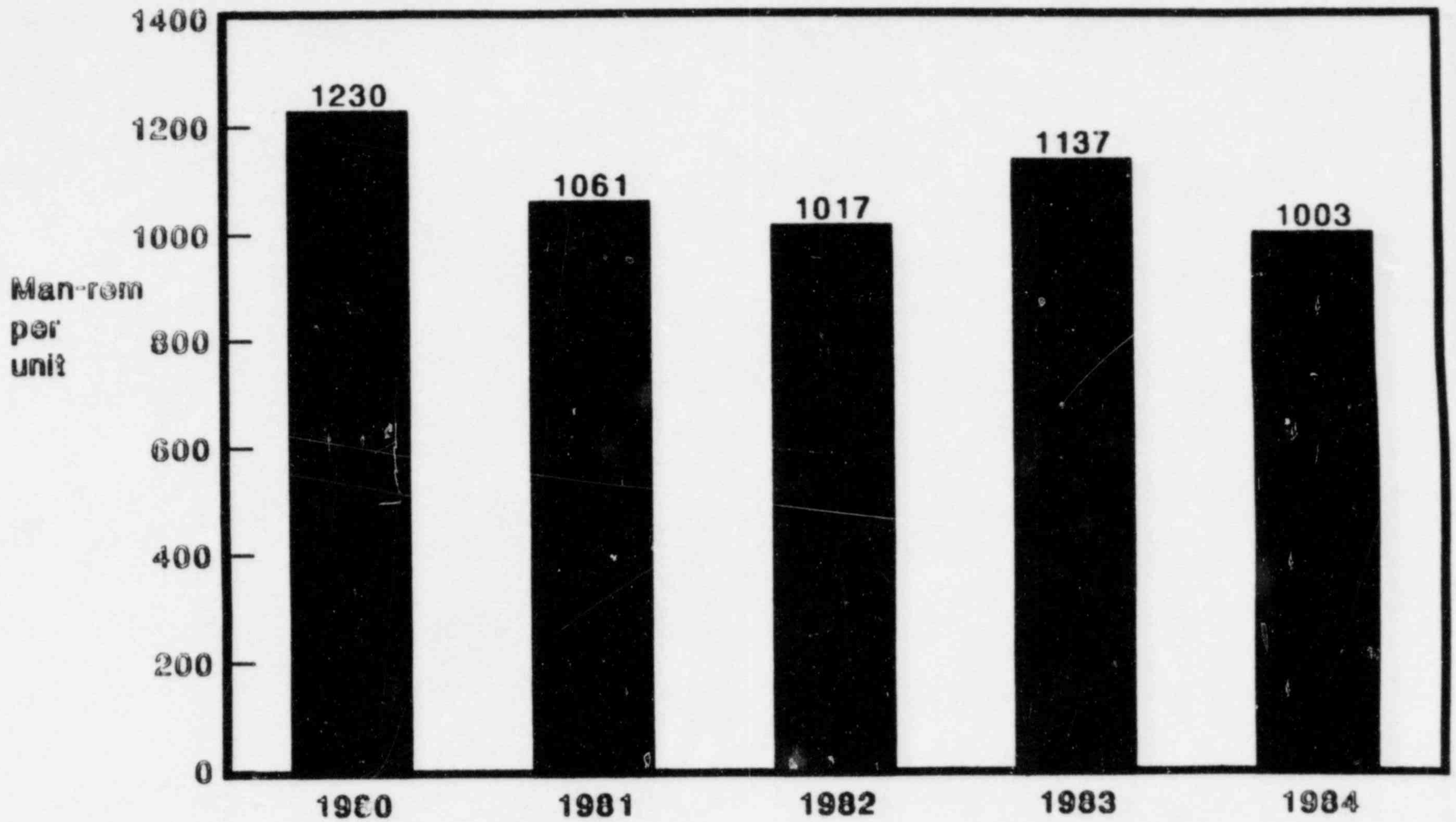
Annual Collective Radiation Exposures



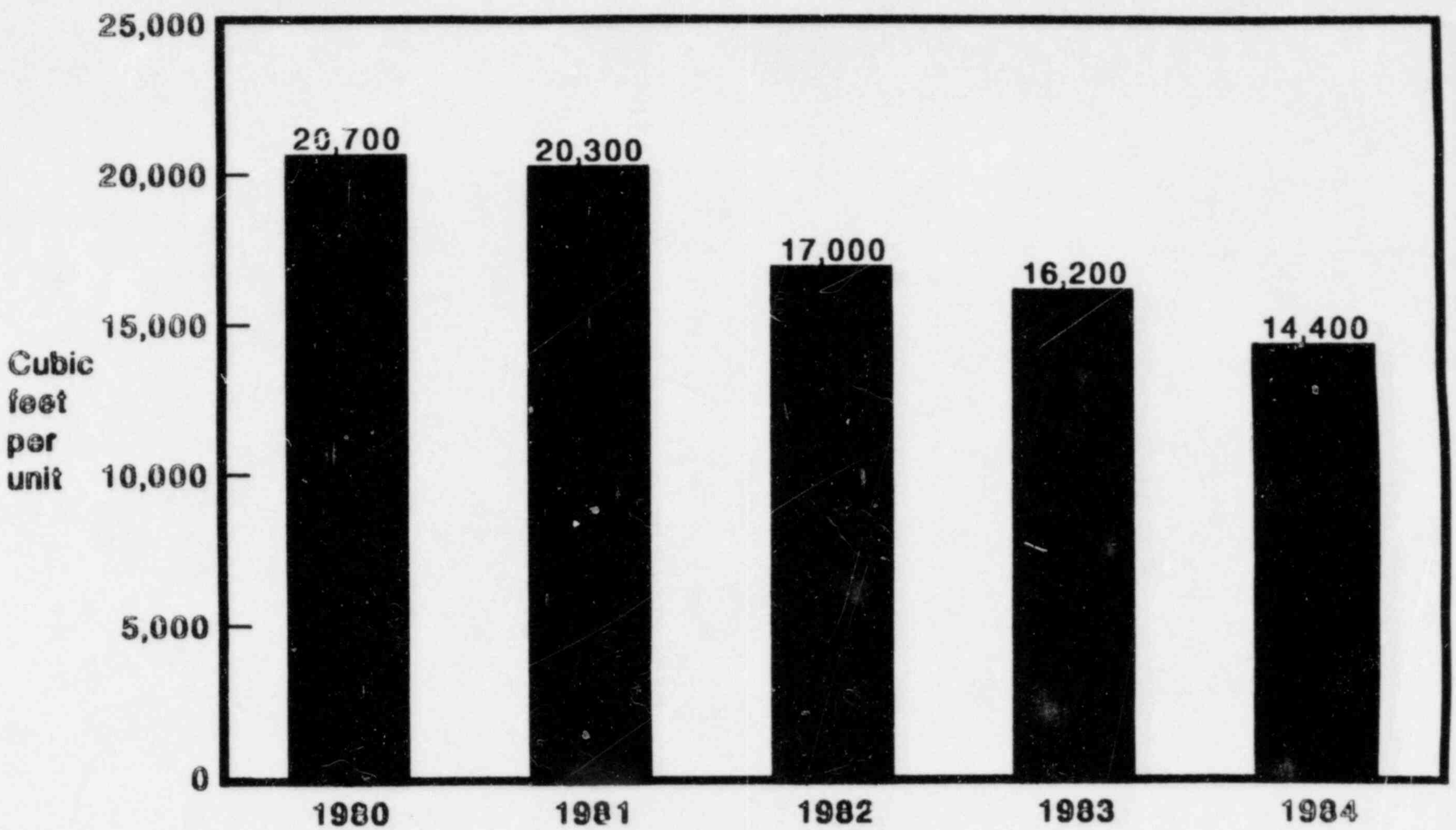
Collective Exposure per PWR Unit



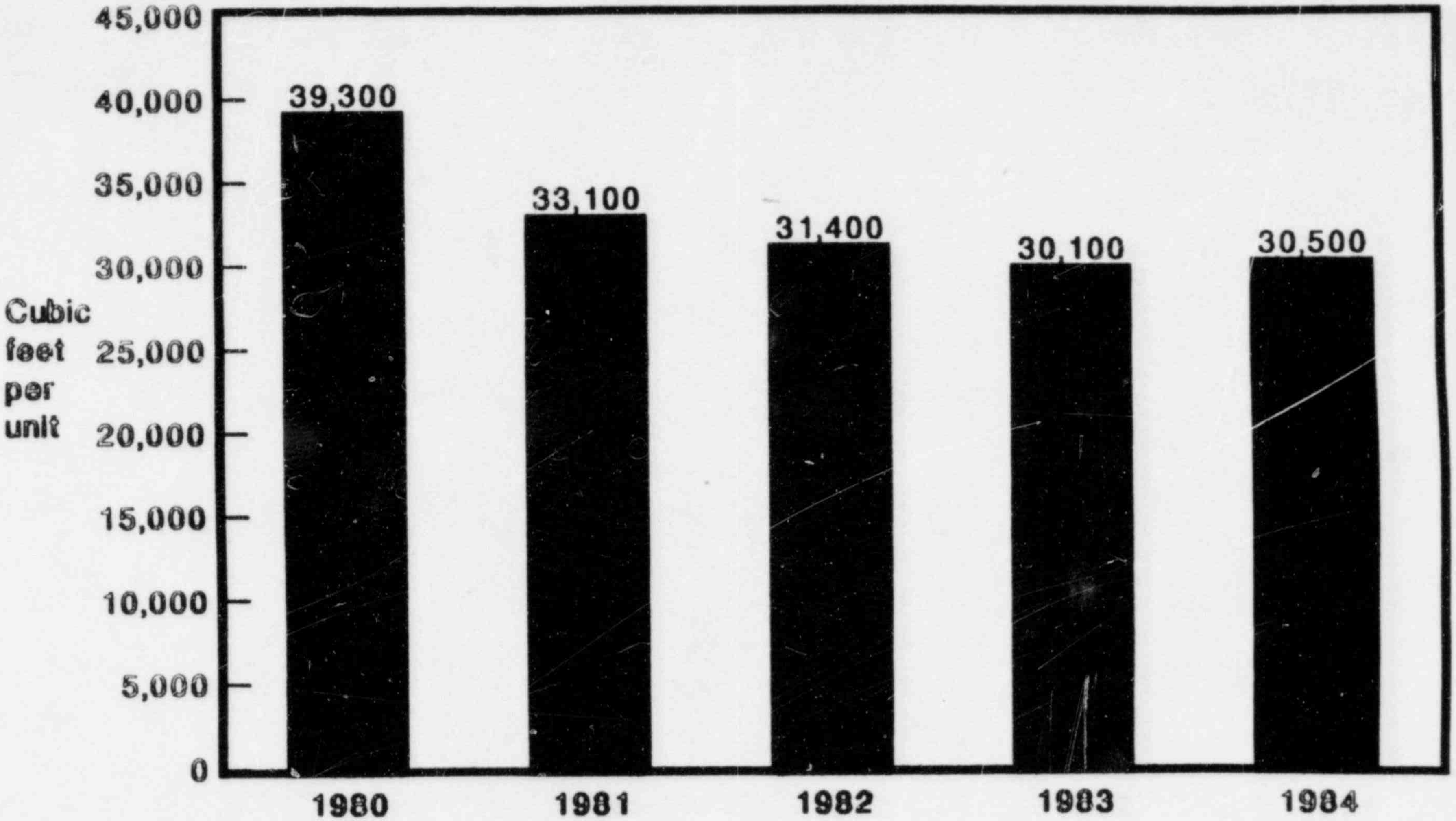
Collective Exposure per BWR Unit



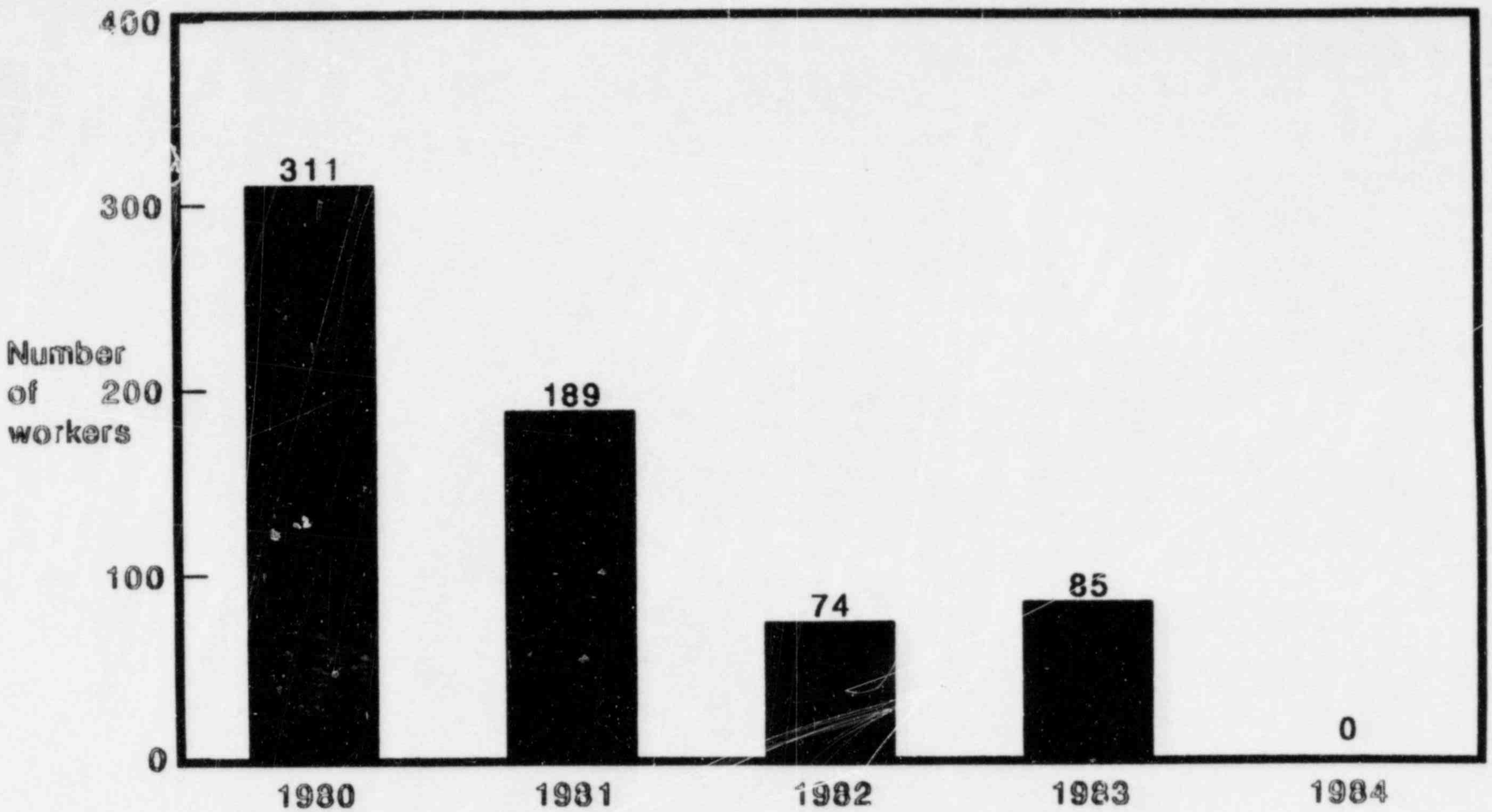
Solid Radioactive Waste per PWR Unit



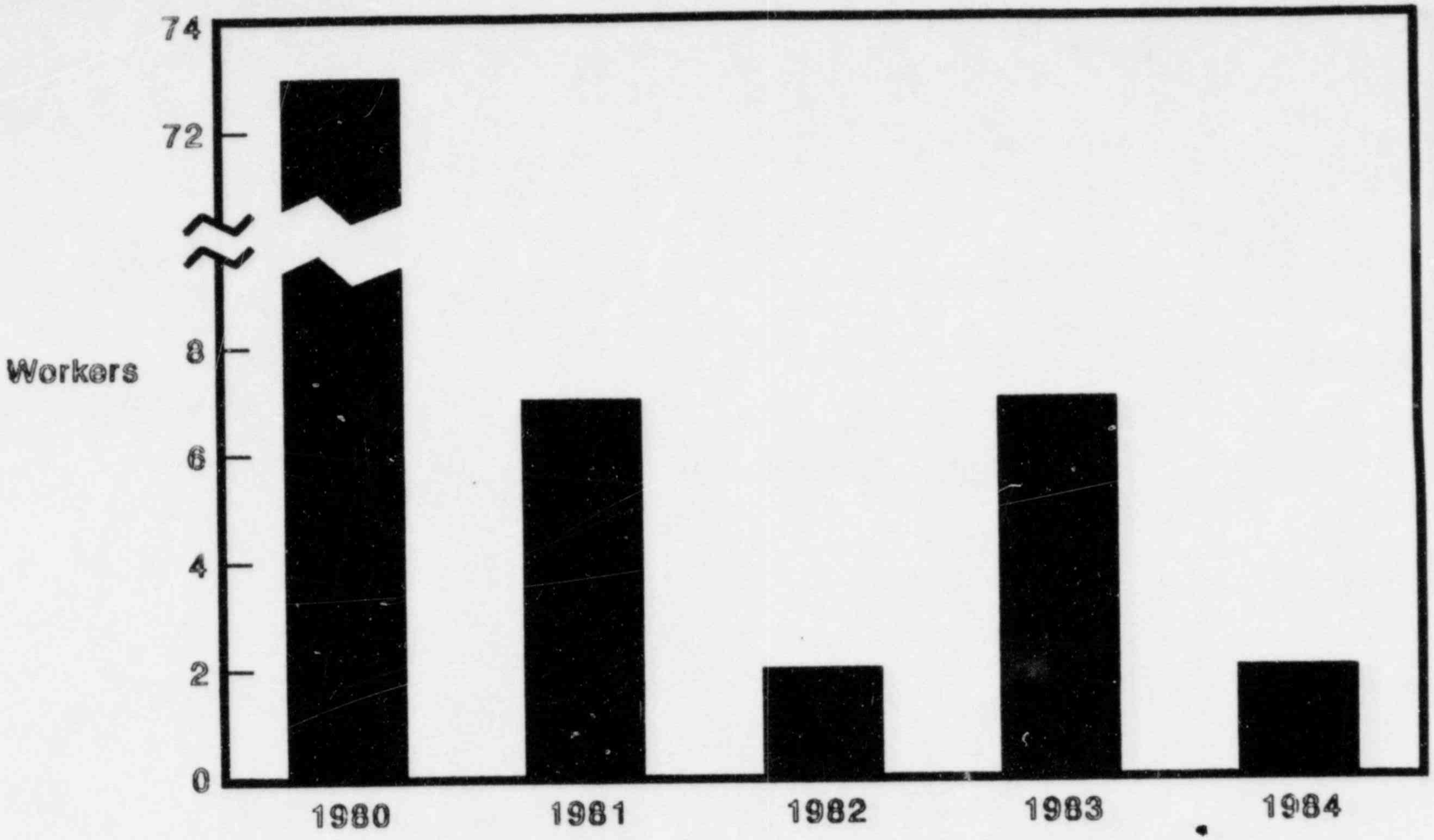
Solid Radioactive Waste per BWR Unit



Personnel Exceeding 5 Rem at 1 Facility



Exposures Exceeding Regulatory Limits



NRC NRC RBE Attach

June 5, 1985

Docket Nos. 50-280/281/334/338/338/423

LICENSEES: Virginia Electric and Power Company (VEPCo), Duquesne Light Co (DLC), and Northeast Utilities (NU)

FACILITIES: Surry Power Station, North Anna Power Station, Be‹‹er Valley and Millstone 3

SUBJECT: SUMMARY OF MEETING HELD ON MAY 6, 1985 TO D'SCUSS RESPIRATORY PROTECTION FOR SUBATMOSPHERIC C NTAINMENTS

The subject meeting was held in Bethesda, Maryland at the request of VEPCo to discuss exemptions to 10 CFR 20. A list of attendees is enclosed.

Those facilities having subatmospheric containments (Surry 1 and 2, Beaver Valley 1 and 2, North Anna 1 and 2 and Millstone 3) present an oxygen deficient atmosphere for those persons entering them. Pressure in these containments has the same percentage of oxygen as normal breathing air, approximately 20%, but the reduced pressure results in reduced oxygen partial pressure equivalent to breathing air at an altitude of 14,000 ft. To compensate for this effort, the licensees enriched the breathing air with oxygen. Because the breathing apparatus was not NIOSH certified with enriched oxygen and different materials are being used, the licensees are seeking exemptions to 10 CFR 20 for these devices. The licensees intend to demonstrate that seven years of experience with these devices prove them to be adequate for interim use until testing (other than NIOSH) of the devices is performed. The need for an exemption derives from 10 CFR 20.103(e), which specifically provides for an exemption where NIOSH approved equipment is not available for use.

The licensees discussed a generic exemption but were told that each licensee must file for an exemption separately. NU stated that they need an exemption by September/October 1985. The short term plan is for VEPCo to submit a testing protocol for NRC's assessment.

/s/JDNeighbors

Joseph D. Neighbors, Project Manager
Operating Reactors Branch #1
Division of Licensing

ORB#1:DL
JDNeighobrs;pws
6/5/85

Attach - ACRS/RRE

POWER REACTOR RADIATION PROTECTION
AND
ALARA EVALUATION PROGRAM
- A PRELIMINARY ANALYSIS -

PREPARED FOR THE
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
SUBCOMMITTEE ON REACTOR RADIOLOGICAL EFFECTS

BY THE
RADIOLOGICAL ASSESSMENT BRANCH

JULY 31, 1985

TASK ACTION PLAN ITEM III.D.3.1
R. J. SERBU, TASK MANAGER

INDUSTRY RADIATION PROTECTION
AND
ALARA EVALUATION PROGRAM

BRIEFING GUIDE CONTENTS

INDUSTRY RADIATION PROTECTION/ALARA
EVALUATION PROGRAM
-PRELIMINARY ANALYSIS-

- OVERALL, DURING THE PERIOD 3/83 - 3/85, POWER REACTORS HAVE SUCCESSFULLY IMPLEMENTED ALARA-INTEGRATED RADIATION PROTECTION PROGRAMS

- BASIS - PRELIMINARY ANALYSIS OF 11 TRENDS IN RADIATION PROTECTION

- INFORMATION SOURCES
  - INDUSTRY INFORMATION ROUTINELY REPORTED TO NRC, E.G. 10CFR20.407, TS (R.G. 1.116), NUREG-0713 (VOL 5)
  - EVALUATIONS PERFORMED AS PART OF ROUTINE INSPECTIONS BY REGIONAL RADIATION PROTECTION STAFF
  - INDUSTRY INFORMATION PROVIDED TO INPO AND SUMMARIZED BY INPO (PROVIDED TO NRC IN BRIEFING FORMAT ONLY, BUT NOT OFFICIALLY TRANSMITTED)

- QUALIFICATION OF DATA
  - NRC DATA NOT YET FULLY COMPILED AND ANALYZED
  - INPO DATA NOT YET OFFICIALLY PROVIDED TO NRC IN OTHER THAN BRIEFING
  - DETAILS OF INPO SUMMARY INFORMATION NOT USEABLE BY NRC
  - SIX CRITERIA OF ELEVEN CAN BE ANALYZED BY NRC FROM AVAILABLE NRC DATA, OTHER FIVE AVAILABLE ONLY FROM INPO DATA AT PRESENT TIME

CRITERIA 1, 5, 7, 8, 9

INFORMATION IS NOT DIRECTLY AVAILABLE TO THE NRC IN THE FOLLOWING AREAS:

- o USE OF DOSE GOALS AND DOSE TRACKING INFORMATION (CRITERIA #1)
- o INSTANCES OF INTERNAL AND EXTERNAL CONTAMINATION (CRITERIA #5)
- o RADIOLOGICAL TRAINING PROGRAM STATISTICS (CRITERIA # 7)
- o RADIOLOGICAL ENGINEERING UTILIZATION (CRITERIA #8)
- o RADIOLOGICAL AUDITING (CRITERIA # 9)

SUCH INFORMATION COULD BE GATHERED AS PART OF FUTURE ALARA MODULE INSPECTIONS BY REGIONAL HEALTH PHYSICS INSPECTORS

CRITERIA AND PRELIMINARY INDICATIONS:

(INPO) 1. DOSE GOALS, DOSE TRACKING IN USE

-AT ABOUT 85% OF PLANTS

--SOME USING AVERAGES AS "GOALS"

2. INDIVIDUAL AND COLLECTIVE DOSES

-GENERALLY DECREASING OR NOT INCREASING WITH # PLANTS

-HIGH OUTLIERS STRONGLY AFFECT PWR/BWR TRENDS

BWR's			PWR's		
PILGRIM	4082	MAN-REM	ROBINSON	2880	MAN-REM
BRUNSWICK	3260	MAN-REM	INDIAN PT 2	2644	MAN-REM
MONTICELLO	2462	MAN-REM	NORTH ANNA	1945	MAN-REM
PEACH BOTT.	2460	MAN-REM	ST LUCIE	1263	MAN-REM
HATCH	2218	MAN-REM			
OYSTER CRK	2054	MAN-REM			

-ALL NRC DOSE DATA NOT IN/ANALYZED

-COLLECTIVE DOSE REMAINING CONSTANT EVEN WITH MORE PLANTS

3. PERSONNEL EXCEEDING DOSE LIMITS

-SHARP DROP IN OVEREXPOSURES '80 -'84

-# WORKERS EXCEEDING 5 REM DOWN TO VERY FEW, ONLY VENDORS OR TRANSIENTS

4. LOW LEVEL RAD WASTE VOLUME

-OVERALL SLIGHT DOWNWARD TREND

-DATA AFFECTED BY OUTLIERS

-NRC DATA NOT CONSISTENT WITH INPO FROM PRELIMINARY SCAN

(INPO) 5. CONTAMINATION INSTANCES

-ABOUT 65% TRACK PERSONNEL CONTAMINATIONS, LIMITS AND CONTROLS DIFFER WIDELY

-ABOUT 68% TRACK POSITIVE WHOLE BODY COUNTS

-DATA NOT TRACKED BY NRC, COULD ADD TO REGIONAL INSPECTION MODULES

6. EXTENT OF CONTAMINATED AREAS (SEE ATTACHED RATINGS)
   - OVERALL RATING BY REGIONS IS SATISFACTORY +
   - SOME PROBLEMS APPARENT, NEED TO REVIEW DATA SHEETS AND DISCUSS WITH REGIONS (VISITS INTENDED TO EACH REGION)

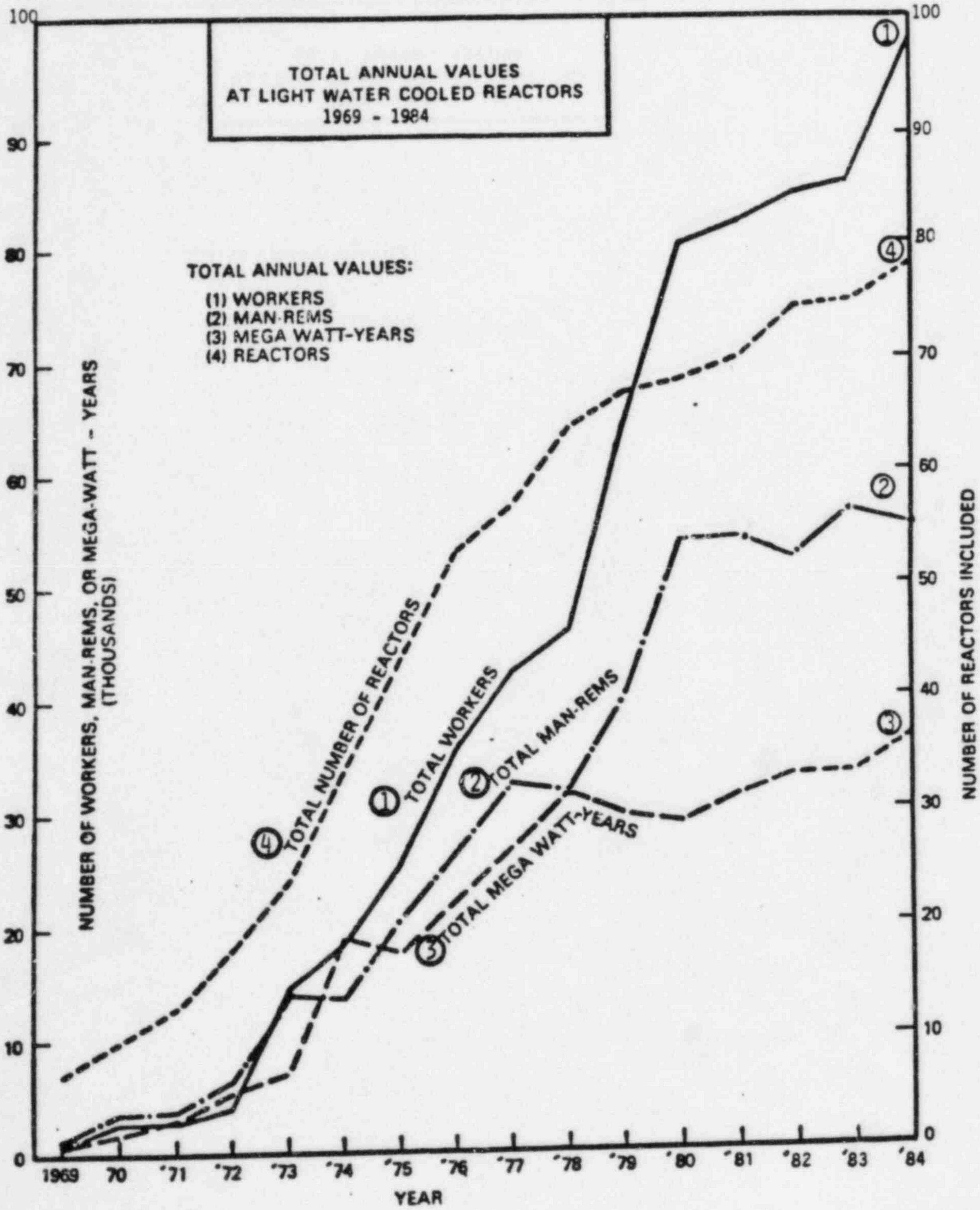
(INPO) 7. RADIOLOGICAL TRAINING
-ABOUT 65% CERTIFIED FOR GET
-ABOUT 95% NOW USE PRACTICAL FACTOR TNG FOR RP
-HP TECH CERT TNG UNDERWAY
-NRC DATA AVAILABLE

(INPO) 8. USE RADIOLOGICAL ENGINEERS (HP IN WORK PLANNING)
-ABOUT 93% HAVE SOME FORM OF RAD ENG., ALARA COORD, ETC
-STAFFING VARIES FROM 1 TO 5

(INPO) 9. INDEPENDENT ASSESSMENT OF HP PROGRAM
-DONE BY ABOUT 95% OF PLANTS

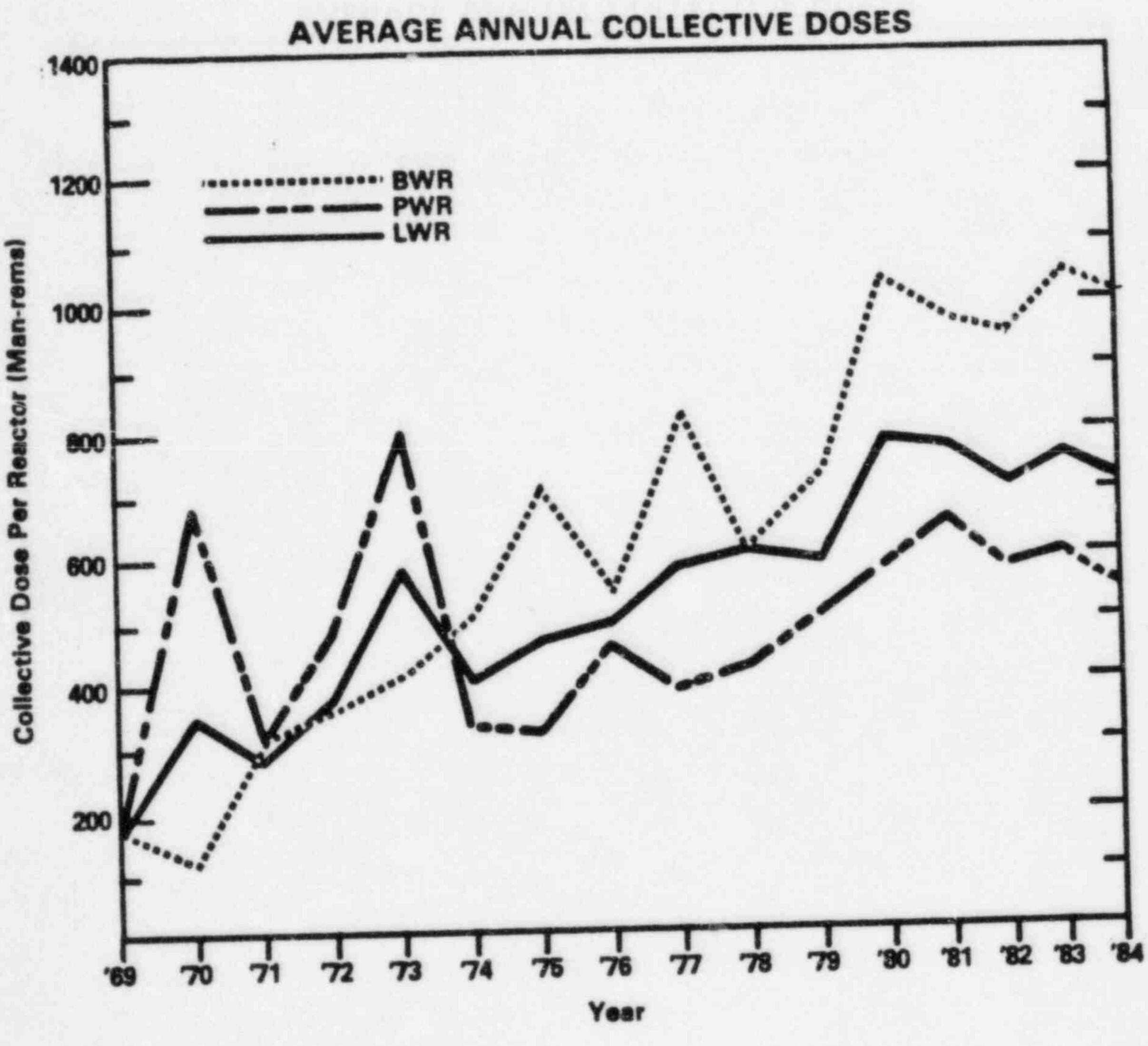
10. RADIATION PROTECTION STAFF STABILITY (SEE ATTACHED RATINGS)
   - OVERALL RATING BY REGIONS IS SATISFACTORY +
   - WILL DISCUSS WITH REGIONAL REPRESENTATIVES DURING VISITS

11. SALP TRENDS IN RADIATION PROTECTION
-DATA AVAILABLE FROM IE
-PRELIMINARY ANALYSIS (J. MINNS) SHOWS OVERALL IMPROVEMENT

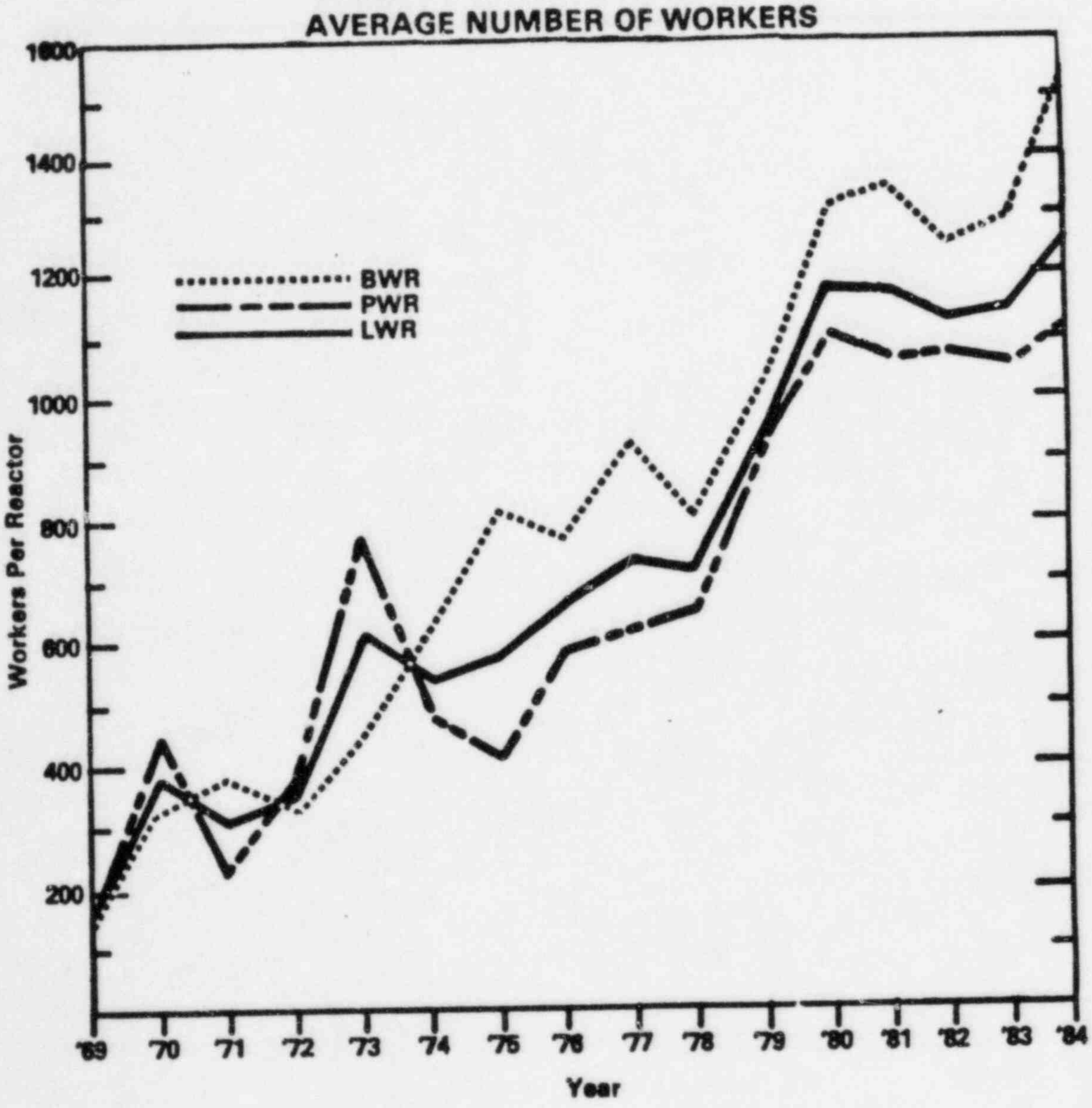


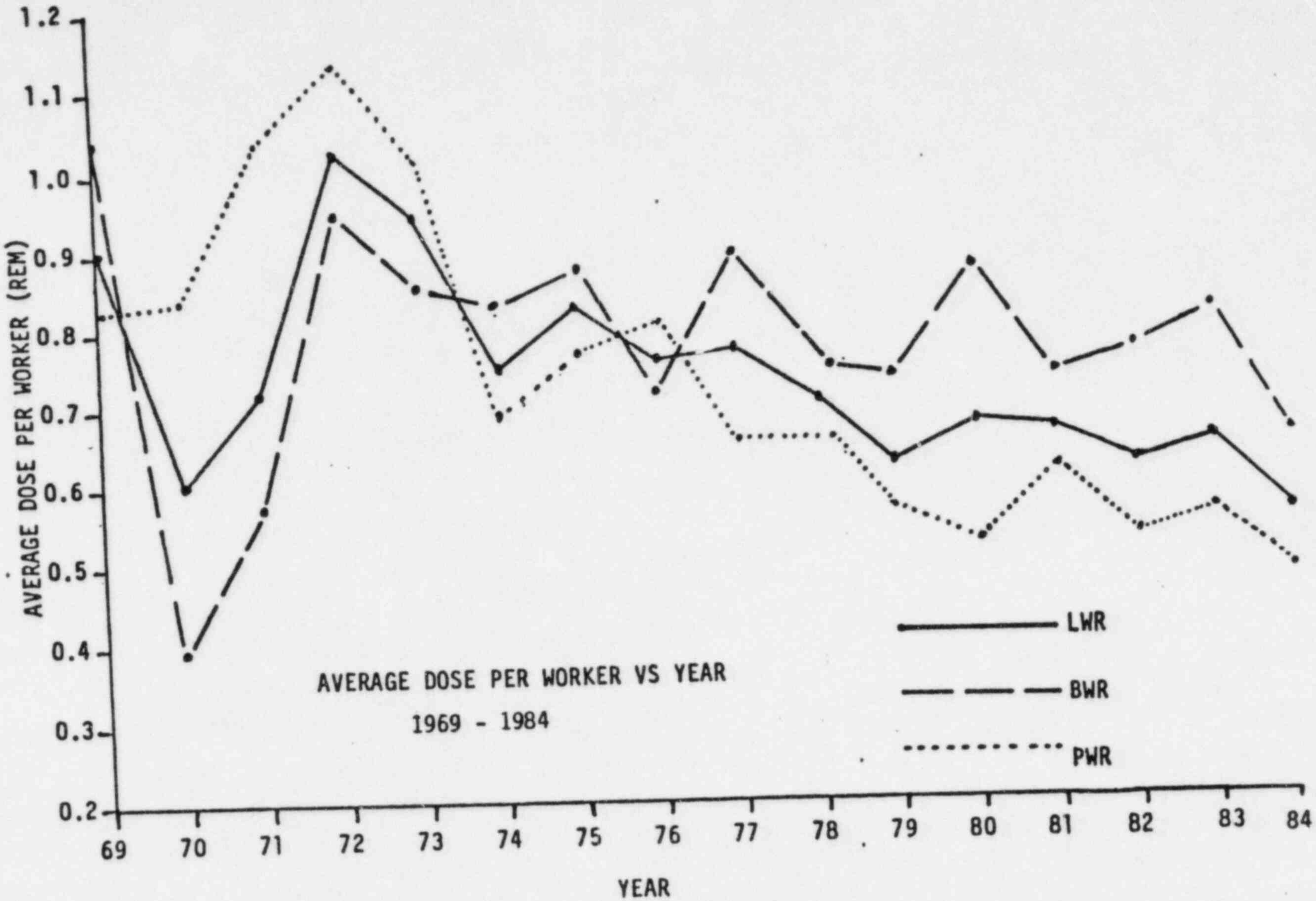
TOTAL ANNUAL VALUES
AT LIGHT WATER COOLED REACTORS
1969 - 1984
TOTAL ANNUAL VALUES:
(1) WORKERS
(2) MAN-REMS
(3) MEGA WATT-YEARS
(4) REACTORS
TOTAL NUMBER OF REACTORS
TOTAL WORKERS
TOTAL MAN-REMS
TOTAL MEGA WATT-YEARS
NUMBER OF WORKERS, MAN-REMS, OR MEGA-WATT - YEARS (THOUSANDS)
NUMBER OF REACTORS INCLUDED
YEAR

COMMERCIAL LIGHT WATER
COOLED REACTORS
1969 - 1984



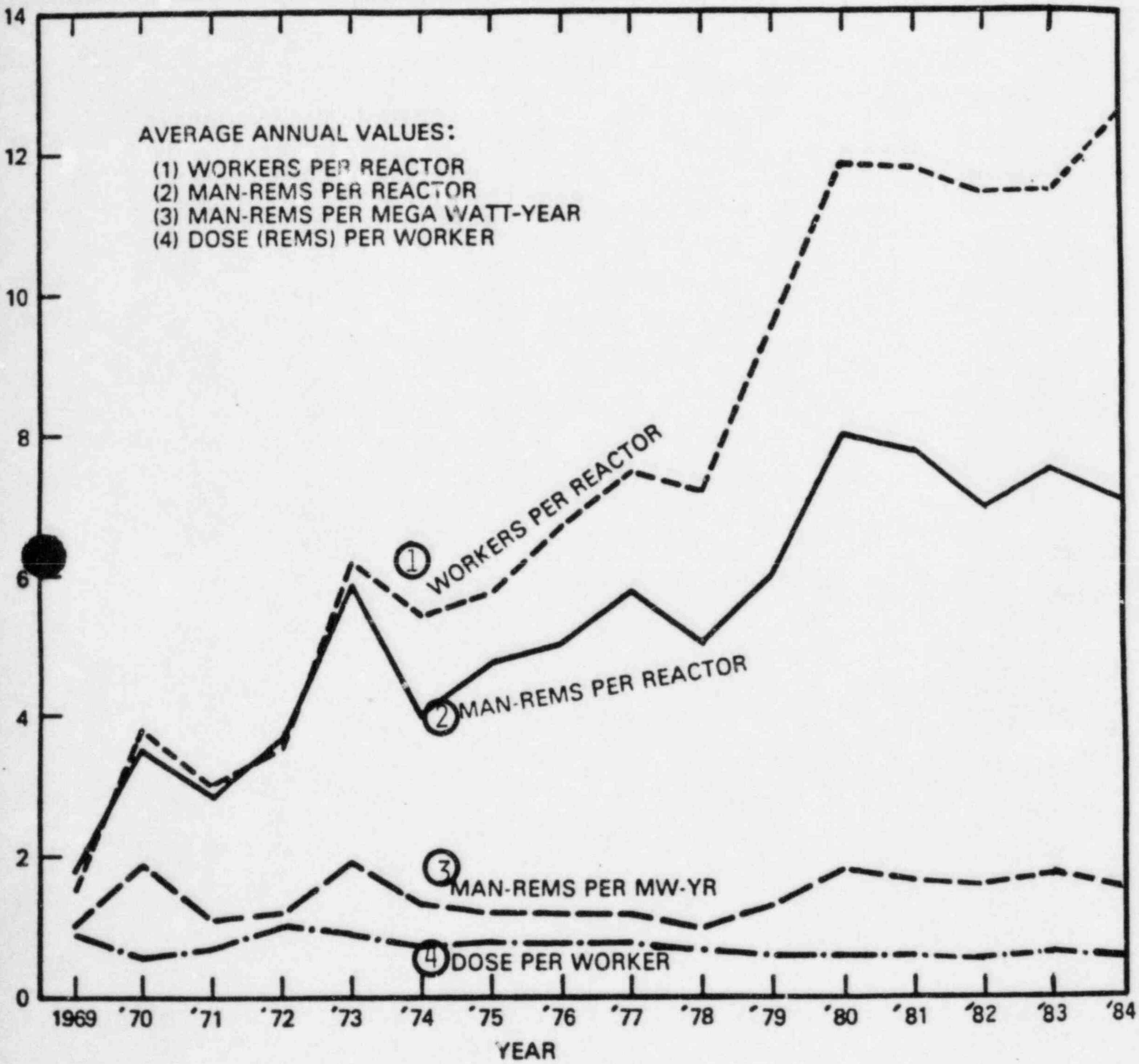
COMMERCIAL LIGHT WATER
COOLED REACTORS
1969 - 1984





1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
AVERAGE DOSE PER WORKER (REM)
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
YEAR
LWR
BWR
PWR
AVERAGE DOSE PER WORKER VS YEAR
1969 - 1984

AVERAGE ANNUAL VALUES
AT LIGHT WATER COOLED REACTORS
1969 - 1984



MAN-REMS PER MW-YR AND DOSE PER WORKER — USE SCALE X 1
WORKERS PER REACTOR AND MAN-REMS PER REACTOR — USE SCALE X 100

CRITERIA 3

OVEREXPOSURES AT POWER REACTORS

YEAR	# OVEREXPOSURES
1980	73
1981	7
1982	2
1983	7
1984	2

WORKERS EXCEEDING FIVE REMS

YEAR	# EXCEEDING (AT ONE FACILITY)
1980	311
1981	189
1982	74
1983	85
1984	0

CRITERIA 4

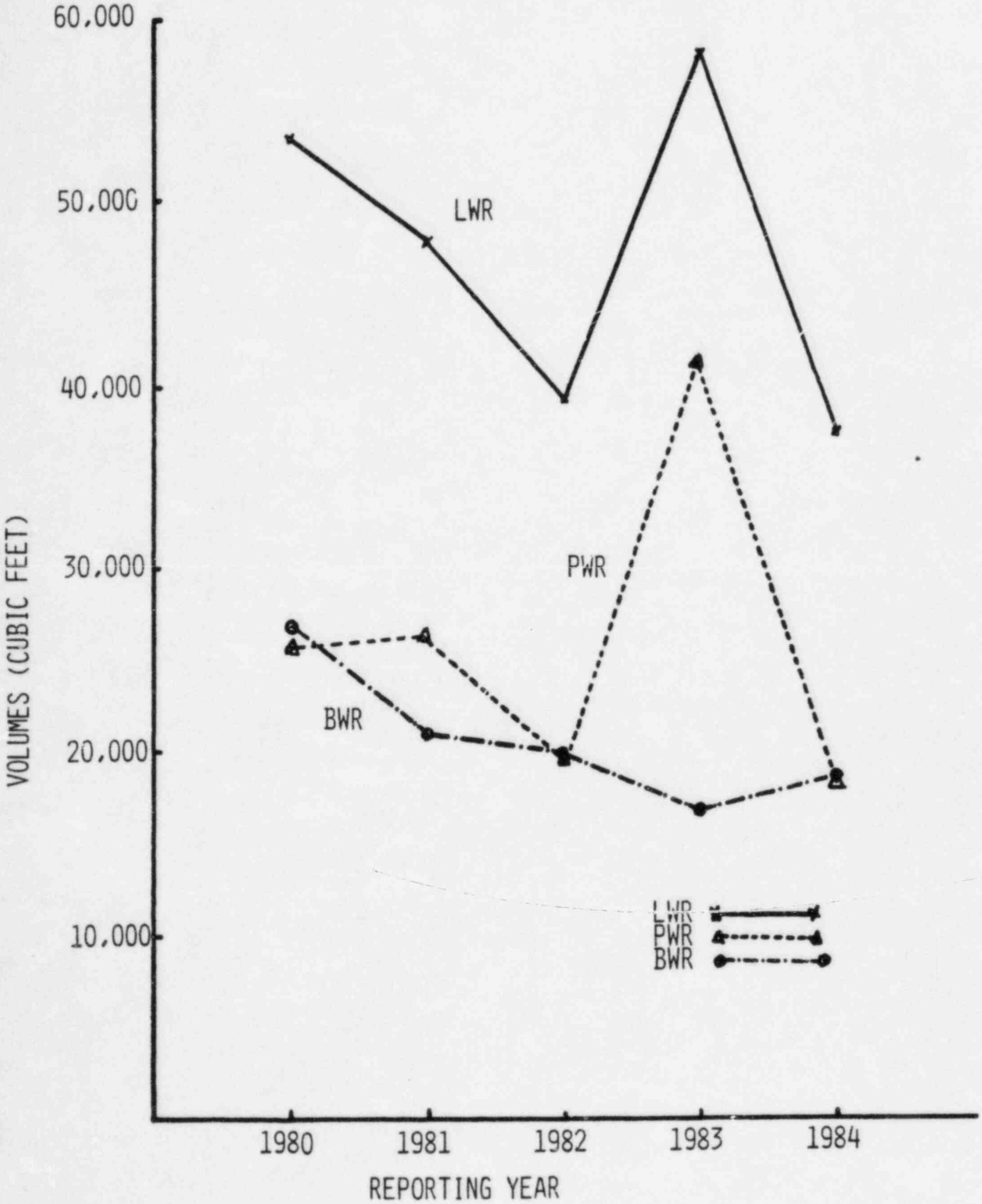
SOLID RADIOACTIVE WASTE VOLUMES FOR LWR'S

VOLUMES IN CUBIC FEET

PWR	1980	1981	1982	1983	1984
# PLANTS	28	30	29	27	28
TOTAL VOL.	26,000	26,800	19,200	40,900	18,000
AVE. VOL.	939	893	662	1,504	671
BWR					
# PLANTS	18	17	18	19	19
TOTAL VOL.	26,900	20,800	19,700	16,900	18,300
AVE. VOL.	1,494	1,224	1,094	889	963
LWR					
# PLANTS	46	47	47	46	47
TOTAL VOL.	53,200	47,600	38,900	57,800	37,100
AVE. VOL.	1,157	1,013	828	1,257	789

SOURCE: NUREG/CR-2907, 10CFR50.36A/R.G. 1.21 REPORTS

SOLID RADIOACTIVE WASTE VOLUMES
FOR LWR'S



CRITERIA 6

CONTROL OF CONTAMINATED AREAS

- 58 FACILITIES RATED BY ALL FIVE REGIONS FOR PERFORMANCE IN CONTROLLING CONTAMINATED AREAS
- EACH REGION RATED FACILITIES LOCATED IN REGION, EXCLUDING RECENTLY LICENSED PLANTS
- RATINGS

RATINGS	# IN CATEGORY
OUTSTANDING	3
EXCELLENT	20
SATISFACTORY	28
IMPROVEMENT NEEDED	6
EXTENSIVE IMPROVEMENT NEEDED	1

- MOST RATINGS BASED ON ON-SITE INSPECTIONS AS PART OF ROUTINE ALARA MODULE INSPECTIONS; SOME DONE IN-OFFICE WHERE ADEQUATE DATA AVAILABLE
- AVERAGE RATING SATISFACTORY +

CRITERIA 10

RADIATION PROTECTION STAFF STABILITY

- o 60 FACILITIES RATED ACROSS FIVE REGIONS FOR RP STAFF STABILITY IMPACT ON PERFORMANCE
- o BASED PRIMARILY ON ON-SITE INSPECTIONS OF FACILITIES LOCATED IN EACH REGION; SOME IN-OFFICE EVALUATION BASED ON PRIOR INSPECTIONS
- o RATINGS

RATINGS	# IN CATEGORY
OUTSTANDING	3
EXCELLENT	23
SATISFACTORY	30
IMPROVEMENT NEEDED	4
EXTENSIVE IMPROVEMENT NEEDED	0

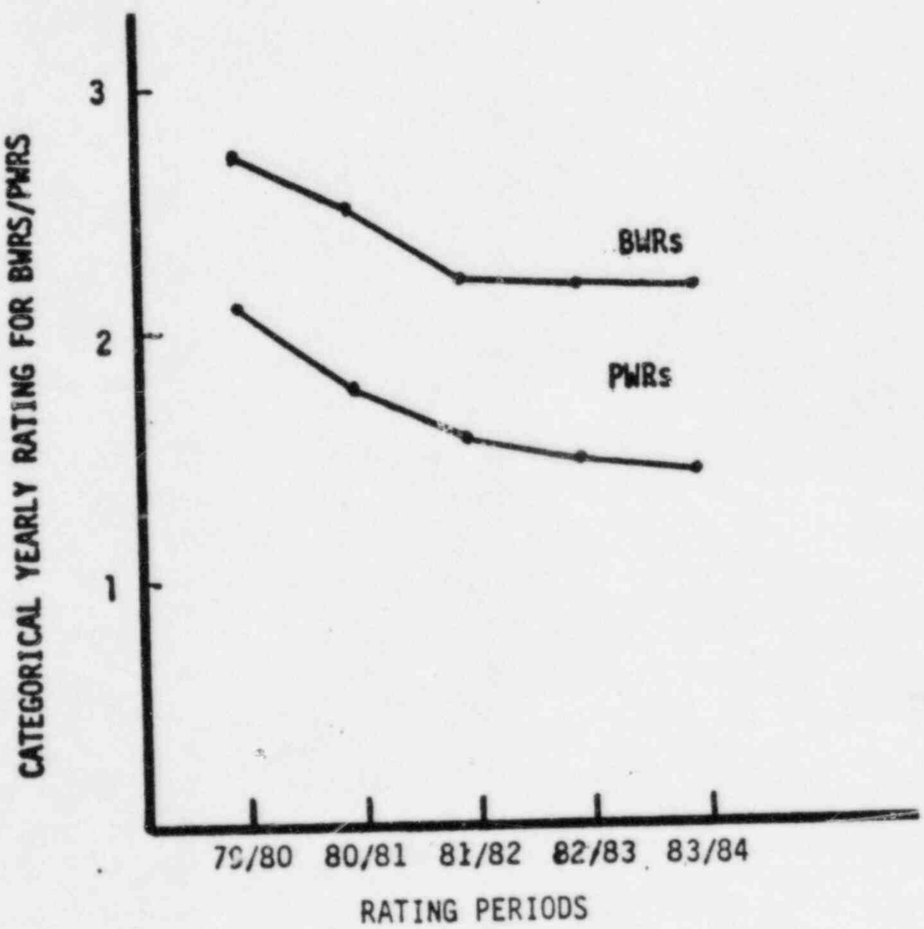
- o AVERAGE RATING SATISFACTORY +

CRITERIA 11

SALP TRENDS
IN
RADIOLOGICAL CONTROLS

YEARLY RATING PERIOD	BWR'S	PWR'S
1979-1980	2.8	2.1
1980-1981	2.4	1.8
1981-1982	2.2	1.7
1982-1983	2.2	1.6
1983-1984	2.2	1.5

AVERAGE YEARLY RATING OF RADIOLOGICAL CONTROL SALPS



CONCLUSIONS:

- o PERFORMANCE IS PROBABLY AT A SATISFACTORY LEVEL, IMPROVING TRENDS
- o THERE ARE CLEARLY POOR PERFORMERS THAT AFFECT OVERALL INDUSTRY TRENDS
- o THE IMPROVEMENT CANNOT BE SPECIFICALLY ATTRIBUTED TO ANY ONE EFFORT OR GROUP, EFFECTORS INCLUDE:
  - -REGIONAL INSPECTION PROGRAM IN ALARA
  - -HEALTH PHYSICS APPRAISAL PROGRAM AND FOLLOW-UP
  - -INPO EVALUATIONS, ASSISTANCE VISITS, GOOD PRACTICES
  - -UTILITY INDEPENDENT EFFORTS
  - -AMERICAN NUCLEAR INSURERS
  - -NRR LICENSING REVIEWS INCORPORATING ALARA
  - -THREAT OF NRC RULEMAKING IN ALARA
  - -INCREASED NRC MANAGEMENT ATTENTION TO RP/ALARA

CONCLUSIONS:

- o AREAS NEEDING GENERAL INDUSTRY IMPROVEMENT
  - -USE OF GOALS (MANAGEMENT TOOL VS ARBITRARY FOR COMPLIANCE)
  - -ALARA/RP IN WORK PLANNING
  - -CONTAMINATION CONTROL
  - -CONTRACTOR RP CONTROL
  - -UPPER LEVEL MGMT. UNDERSTANDING & SUPPORT FOR ALARA
  - -RAD WASTE CONTROL/REDUCTION
  - -DOSE TRACKING, DOSE CONTROL

- o COMMENTS ON INPO EVALUATION PROCESS/COORDINATION PLAN
  - MOST INPO EVALUATIONS ARE CONDUCTED DURING NON-OUTAGE CIRCUMSTANCES, GREATLY REDUCING THE POTENTIAL FOR OBSERVING RADIOLOGICAL CONTROLS/MAINTENANCE UNDER TIGHT SCHEDULES AND OPERATIONAL PRESSURES
  - IMPLEMENTATION/UTILIZATION OF ALARA ENGINEERING CONTROLS/MEASURES NOT STRONGLY EMPHASIZED
  - INPO FOIA CONCERNS AND CONCERNS OVER REGULATORY USE OF INDUSTRY DATA/INFORMATION HAVE GREATLY HAMPERED THE FLOW OF INFORMATION
  - THE NRC CLEARLY NEEDS TO MAINTAIN A SEPARATE (IF REDUNDANT) RADIOLOGICAL DATA SOURCE

FURTHER ACTIONS:

- COMPILE AND ANALYZE NRC DATA IN LIEU OF VALIDATED INPO DATA
- DETERMINE DISPOSITION OF FUNCTIONS/RESPONSIBILITIES IN NRR REORGANIZATION
- PREPARE COMMISSION PAPER SUMMARIZING EVALUATION OF INDUSTRY EFFORT TO ACHIEVE ALARA INTEGRATED RADIATION PROTECTION PROGRAMS
- ESTABLISH BROAD NRC RAD DATA BASE FOR CONTINUED INDEPENDENT NRC TRACKING OF INDUSTRY HP TRENDS
- REVISE COORDINATION PLAN WITH INPO

  DETERMINE HOW TO DEAL WITH NEEDED IMPROVEMENTS AND POOR PERFORMERS (E.G.:)
  - -MULTI PLANT ACTIONS
  - -INCREASED REGULATORY ATTENTION
    - INCREASED REGIONAL INSPECTIONS
    - SPECIAL HP APPRAISALS (E.G. PAT, HPAP)
  - -LETTER TO CEO'S FROM SENIOR NRC MGMT
  - -COORDINATED EFFORT WITH INPO
- DETERMINE STATUS OF ALARA RULEMAKING AND RG 8.XX: ROUTINELY REVIEW REV 4 TO RG 8.8 IN FY-86
- CLOSE OUT GENERIC ISSUE III.D.3.1

GENERIC ISSUE MANAGEMENT CONTROL SYSTEM

Issue Number	Issue Type	Action Level	Office/Div/Br	Task Manager	Tac No
III.D.3.1	Safety/ High	Active-L1	NRR/DSI/RAB	R. J. Serbu	42928

Title ---------------- Radiation Protection Plans

Work Authorization --- NRR FY-84 Operating Plan (Appendix G).

Contract Title ------- None

Contractor Name/ FIN No. ------------ None

Work Scope ----------- Finalize a "Letter of Agreement" which outlines the relationship between INPO and the NRC during the period when INPO will actively assist licensees in implementing ALARA-integrated radiation protection programs. Develop an auditing method whereby the NRC can assess INPO/industry progress and success in achieving ALARA integrated radiation protection programs.

Affected Documents --- Directly Related Documents

1. "Memorandum of Agreement Between INPO and the USNRC" (April 1, 1982), Appendix Number Three, "Coordination Plan for Radiological Protection Activities" (March 3, 1983).

2. NUREG-0761 (draft March 1981) - revised into Regulatory Guide format as R.G.8.XX.

3. R.G. 8.XX - revise and hold for issue pending success of INPO/Industry.

4. "Development of a Program to Evaluate Industry Efforts to Achieve Successful ALARA-Integrated Radiation Protection programs," (R. J. Mattson, June 16, 1983). - Action Plan/Assessment Method - developed to evaluate INPO/industry progress and success in implementing ALARA integrated radiation protection programs.

5. "Evaluation of Industry Efforts to Achieve Successful ALARA Integrated Radiation Protection Programs" (April 23, 1985, D. R. Muller to Division Directors) - criteria, worksheets and examples for Regions to evaluate aspects of industry radiation protection programs.

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6. "Request for the Regions to Assist in the Evaluation of Industry Success in Achieving ALARA-Integrated Radiation Protection Programs at Power Reactors" (H. L. Thompson to DRP Division Directors, May 8, 1985).

7. "Request for Research Assistance in Establishing a Radiological Data Base" (H. R. Denton to R. B. Minogue - at DST for concurrence since 2/14/85)

Status --------------- A "Coordination Plan for Radiological Protection Activities," effective March 3, 1983, has been prepared by NRC/INPO staffs and approved by the NRC EDO and the President, INPO as Appendix 3 to the NRC/INPO Memorandum of Agreement dated April 1, 1982. A Commission Information Paper discussing the Coordination Plan and related staff actions was provided to the Commission by the NRC staff. Following coordination between NRR, RES, IE, and the Regions, a program to evaluate INPO/industry efforts under the Coordination Plan was promulgated (R. J. Mattson letter dated June 16, 1983, "Development of a Program to Evaluate Industry Efforts to Achieve Successful ALARA - Integrated Radiation Protection Programs"). The staff completed a topical review of NRC and INPO radiation protection/ALARA guidance (letter Congel to Muller dated June 30, 1983), and established a schedule with IE and INPO in June 1983 to accompany INPO site visits beginning in September of 1983. NRR Staff members have accompanied INPO personnel, as observers, during their INPO site evaluations during the period October 1983 through March 1985.

Regulatory Guide 8.XX (NUREG-0761) and Revision 4 of Regulatory Guide 8.8 have been held in abeyance, and the NRC staff has proposed delaying any consideration of rulemaking regarding radiation protection plans until the upcoming major revision of Part 20 is promulgated. The NRC staff is continuing its evaluation of industry's radiation protection/ALARA efforts under its evaluation programs as planned. If the staff evaluations find the INPO/industry effort successful, the issue will be considered to be resolved. If the staff evaluations find the INPO/industry effort not to be successful, the staff will resume efforts to promptly issue R.G. 8.XX and pursue related rulemaking.

Based on staff experience with the NRC/INPO Coordination Plan and evaluation program, the staff intends to research, format and analyze existing NRC information sources to establish a radiological data base which will (1) provide an NRC-originated source of radiological data, (2) broaden our overall trending and analysis capability in radiation protection,

(3) support future cooperation with INPO by supplementing our data sharing with INPO, and (4) provide further capability to validate the findings and conclusions of our industry evaluation program.

Problem/Resolution --- Information essential to the evaluation process has been developed by INPO and reviewed with the NRR staff on April 1, 1985 - an earlier date would not have been consistent with existing INPO reporting requirements for utilities. This necessitated adjusting the original 03/85 evaluation of INPO/industry success in achieving ALARA-integrated radiation protection programs (and subsequent milestones) to 09/85 to enable the staff to review and integrate this data, perform an evaluation, and publish the results. The free flow of information from INPO has been hampered by INPO's reluctance to provide proprietary information to the NRC (in summary or detail) which could then be requested under FOIA by intervenor groups, or compiled and analyzed by NRC staff for regulatory purposes.

Either circumstance would result in INPO's efforts being applied against the best interests of the industry INPO represents. While the NRC staff had originally intended to validate and use INPO data in conjunction with NRC-originated data, it is now necessary for NRC staff to generate all data for evaluation criteria, in lieu of sharing the effort with INPO. The staff has made an effort to expedite the capability to compile and analyze NRC-originated data, however, delays in DST and RES policies regarding occupational health research, have offset this effort. Additional time may be necessary to establish a radiological data base, particularly if NRR/RAB must assume this effort.

Technical Resolution - Milestones are as follows:

Milestones	Original	Current	Actual
Draft Proposed Revised NRC/INPO Coordination Plan distributed for review and comment by OIE, RES, and Director, DSI.	-	-	01/19/83
Draft Plan to INPO Staff for review and comment.	-	-	01/26/83
Staff Recommendation to EDO to transmit proposed Coordination Plan to INPO (Follow-up to INPO (Wilkinson) letter dated August 26, 1983).	-	-	02/25/83

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Milestones	Original	Current	Actual
Coordination Plan signed and in effect.	-	-	03/03/83
Draft auditable criteria for ALARA/radiation protection evaluation of INPO Program, including ALARA checklists and evaluation criteria, distribute to IE, RES, and Regions for comment.	04/83	-	04/15/83
Revise evaluation criteria based on comments.	06/83	-	06/15/83
Complete a topical/functional comparison of INPO objectives, criteria and guidelines against NRC criteria.	06/83	-	-
Establish ALARA checklist parameter, SALP/inspection findings, etc., tracking system.	07/83	-	06/15/83
Establish schedule of NRC accompanied INPO Appraisals.	09/83	-	07/06/83
Draft criteria for determination of acceptability/unacceptability of INPO/Industry success.	10/83	-	06/15/83
Establish milestone for criteria approved process.	10/83	-	06/15/83
Finalize criteria for determination of acceptability/unacceptability of INPO/Industry success.	12/83	-	06/15/83
Receive INPO input	-	04/85	04/01/85
Initiate radiological data base	-	08/85	-
Evaluation of INPO/industry success completed.	03/85	09/85	-

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Milestones	Original	Current	Actual
Radiation Protection Plan RG either issued or withdrawn based on determination of success or failure of INPO/ industry program	03/85	09/85	-
Technical Resolution Complete. (If program is acceptable, issue close-out documentation memo to EDO. If program is unacceptable, develop milestones necessary for approval for a Radiation Protection Plan Regulatory Guide.)	03/85	09/85	-

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EVOLUTION OF NRC/INPO COORDINATION PLAN

FOR RADIOLOGICAL PROTECTION ACTIVITIES

1972	10 CFR PART 20.1(c) - RECOMMENDS ALAP
1973	REG GUIDE 8.8 ISSUED, "INFORMATION RELEVANT TO MAINTAINING OCCUPATIONAL RADIATION EXPOSURE AS LOW AS PRACTICABLE"
1977	REG GUIDE 8.8, REV 2 ISSUED -"ALARA"
1978	RESPONSE TO PETITION FOR RULEMAKING RECOMMENDING REDUCTION OF DOSE STANDARDS
1979/80	DISCUSSIONS WITH AIF/INTERNAL STAFF DISCUSSIONS
1981	-DRAFT NUREG-0761 PUBLISHED, "RADIATION PROTECTION PLANS FOR NUCLEAR POWER REACTOR LICENSEES", DRAFT REG GUIDE PREPARED
	-INPO PROPOSED INDUSTRY IMPLEMENTATION
	-NUREG-0761 LINKED TO PROPOSED ALARA RULE
1/82	COMMISSION POLICY AND PLANNING GUIDANCE SUPPORTS INITIAL COOPERATION WITH INPO
4/82	NRC/INPO MEMORANDUM OF AGREEMENT SIGNED
1/83	COMMISSION POLICY AND PLANNING GUIDANCE FOR 1983 SUPPORTS "...ALTERNATIVE REGULATORY CONCEPTS WHICH RECOGNIZE THE CONTRIBUTIONS OF INDUSTRY SELF-POLICING PROGRAMS...CONSISTENT WITH NRC REGULATORY RESPONSIBILITIES."
11/82-2/83	PROPOSED 10 CFR PART 20/50 RULE CHANGE; CRGR REVIEW
3/83	NRC/INPO COORDINATION PLAN FOR RADIOLOGICAL PROTECTION ACTIVITIES, COMMISSION INFORMATION PAPER PREPARED
1983-85	EVALUATION PROGRAM TO ASSESS INPO/INDUSTRY EFFORTS TO ACHIEVE ALARA-INTEGRATED RADIATION PROTECTION PROGRAMS
9/85	SUMMARY EVALUATION OF INPO/INDUSTRY EFFORTS
9/85	DECISION ON FURTHER ACTIONS REGARDING NUREG-0761/RG 8.XX

ACCEPTANCE CRITERIA FOR NRC EVALUATION OF INPO/INDUSTRY SUCCESS IN ACHIEVING ALARA-INTEGRATED RADIATION PROTECTION PROGRAMS

(INDUSTRY PROGRESS/SUCCESS WILL BE INDICATED BY THE FOLLOWING:)

1. DOSE GOALS ARE IN USE AS A MANAGEMENT TOOL FOR RADIATION PROTECTION/ ALARA PROGRAM IMPROVEMENT. DOSE TRACKING FOR STATION DOSES, INDIVIDUAL TASKS, WORK GROUPS, AND INDIVIDUALS, IS IN USE.

OVERALL TRENDS INDICATE A BROAD, GENERAL IMPROVEMENT IN THE INDUSTRY IN THE FOLLOWING AREAS:

2. INDIVIDUAL AND COLLECTIVE DOSES
3. NUMBER OF PERSONNEL EXCEEDING DOSE LIMITS AT POWER REACTORS
4. LOW-LEVEL RADIOACTIVE WASTE VOLUME
5. INTERNAL AND EXTERNAL CONTAMINATION INSTANCES
6. EXTENT OF CONTAMINATED AREAS
7. A TRAINING AND TESTING PROGRAM IS IN PLACE AT ALL FACILITIES TO INCLUDE:
   A. A FORMAL, PROCEDURALIZED RP/ALARA TRAINING PROGRAM IN USE WHICH MEETS INPO'S CRITERIA FOR RADIATION WORKER TRAINING AND HEALTH PHYSICS TECHNICIAN TRAINING FOR BOTH UTILITY AND CONTRACTOR PERSONNEL
   B. PRACTICAL FACTOR TRAINING AND EVALUATION
8. USE OF RADIOLOGICAL ENGINEERS/ALARA COORDINATORS/HEALTH PHYSICISTS IN THE PLANNING AND ASSESSMENT OF RADIOACTIVE WORK
9. INTERNAL AUDITING OF RADIATION PROTECTION PROGRAMS
10. RADIATION PROTECTION STAFF STABILITY:
    A. SENIORITY OF MANAGERS AND TECHNICIANS
    B. NUMBER OF PERMANENT AND CONTRACTOR RP STAFF
11. SALP EVALUATIONS AND TRENDS IN RADIOLOGICAL CONTROLS

PRELIMINARY

TABLE 1

SUMMARY OF ANNUAL INFORMATION REPORTED BY COMMERCIAL BOILING WATER REACTORS

1969 - 1984

Year	Number Of Reactors Included	Annual Collective Doses (Man-rems)	No. of Workers With Measurable Doses	Gross Electricity Generated (MW-yr)	Average Dose Per Worker (Rems)	Average Collective Dose Per Reactor (Man-rems)	Average No. Personnel With Measurable Doses Per Reactor	Average Collective Dose (man-rems per MW-yr)	Average Electricity Generated Per Reactor (MW-yr)	Average Rated Capacity Net (MWe)
1969	3 (2)	586 (300)	290*	192	1.03*	195	145*	3.1	64	112
1970	6 (4)	764 (510)	1,321*	912	0.39*	127	330*	0.8	152	267
1971	7 (5)	1,784 (1,069)	1,873*	1,308	0.57*	255	375*	1.4	187	339
1972	10 (7)	2,858 (2,130)	2,258*	3,058	0.94*	286	323*	0.9	306	434
1973	12	4,564	5,340	3,394	0.85	380	445	1.3	283	459
1974	14	7,095	8,769	4,059	0.81	507	626	1.7	290	513
1975	18	12,611	14,607	5,786	0.86	701	812	2.2	321	611
1976	23	12,626	17,859	8,586	0.71	549	776	1.5	373	647
1977	23**	19,042	21,388	9,098	0.89	828	930	2.1	396	645
1978	25**	15,096	20,278	11,774	0.74	604	811	1.3	471	668
1979	25**	18,322	25,245	11,671	0.73	733	1,010	1.6	467	669
1980	26**	29,530	34,094	10,868	0.87	1,136	1,311	2.7	418	664
1981	26**	25,471	34,832	10,899	0.73	980	1,340	2.3	419	674
1982	26**	24,437	32,235	10,655	0.76	940	1,240	2.3	410	674
1983	26**	27,455	33,473	9,730	0.82	1,056	1,287	2.8	374	675
1984	27***	27,074	41,105	9,963	0.66	1,003	1,522	2.7	369	722

*During the years 1969 through 1972, all plants reported collective doses but a few did not submit the number of personnel that received measurable doses. The number of reactors that did report doses and number of workers is given in parentheses in the second column. The collective doses shown in parentheses in the third column, as well as the asterisked numbers in the remaining columns, are all based on the data submitted by the number of reactors shown in parentheses.

** Two plants have been shut down continuously for a number of years but have been included in the count of reactors used to compute various averages per reactor in this report. One may wish to calculate these averages without counting these reactors each year: Dresden 1 - shut down since 10/78; Humboldt Bay - shut down since 7/76. (See Appendix A.)

***Humboldt Bay was not included in this year's tabulation.

PRELIMINARY

TABLE 2

SUMMARY OF ANNUAL INFORMATION REPORTED BY COMMERCIAL PRESSURIZED WATER REACTORS

1969 - 1984

Year	Number Of Reactors Included	Annual Collective Doses (Man-rems)	No. of Workers With Measurable Doses	Gross Electricity Generated (MW-yr)	Average Dose Per Worker (Rems)	Average Collective Dose Per Reactor (Man-rems)	Average No. Personnel With Measurable Doses Per Reactor	Average Collective Dose (man-rems per MW-yr)	Average Electricity Generated Per Reactor (MW-yr)	Average Rated Capacity Net (MWe)
1969	4 (3)	661 (363)	454*	1,097	0.80*	165	151*	0.6	274	349
1970	4 (3)	2,738 (1,099)	1,340*	979	0.82*	684	447*	2.8	245	349
1971	6 (4)	1,844 (912)	905*	1,912	1.01*	307	226*	1.0	319	399
1972	8 (5)	3,708 (2,083)	1,885*	2,544	1.11*	464	377*	1.5	318	446
1973	12	9,399	9,440	3,770	1.00	783	787	2.5	314	533
1974	20	6,627	9,697	6,824	0.68	331	485	1.0	341	619
1975	26	8,268	10,884	11,983	0.76	318	419	0.7	461	643
1976	30	13,807	17,588	13,325	0.79	460	586	1.0	444	675
1977	34	13,469	20,878	17,346	0.65	396	614	0.8	510	699
1978	39	16,713	25,720	19,840	0.65	429	659	0.8	509	723
1979	42**	21,659	38,877	18,249	0.56	516	924	1.2	434	729
1980	42**	24,266	46,237	18,287	0.52	578	1,101	1.3	435	721
1981	44**	28,671	47,351	20,552	0.61	652	1,076	1.4	467	745
1982	48**	27,753	52,147	22,141	0.53	578	1,086	1.3	461	773
1983	49**	29,016	52,173	23,196	0.56	592	1,065	1.3	473	778
1984	51***	28,185	56,987	26,478	0.49	553	1,117	1.0	519	805

*During the years 1969 through 1972, all plants reported collective doses but a few did not submit the number of personnel that received measurable doses. The number of reactors that did report doses and number of workers is given in parentheses in the second column. The collective doses shown in parentheses in the third column, as well as the asterisked numbers in the remaining columns, are all based on the data submitted by the number of reactors shown in parentheses.

** Three plants have been shut down continuously for a number of years but have been included in the count of reactors used to compute various averages per reactor in this report. One may wish to calculate these averages without counting these reactors each year: Indian Point 1 - shut down since 10/78; Three Mile Island 1 and 2 - shut down since 3/79. (See Appendix A)

***Indian Point I was not included in this year's tabulation.

PRELIMINARY

TABLE 3

SUMMARY OF ANNUAL INFORMATION REPORTED BY COMMERCIAL LIGHT WATER COOLED REACTORS

1969 - 1984

Year	Number Of Reactors Included	Annual Collective Doses (Man-rems)	No. of Workers With Measurable Doses	Gross Electricity Generated (MW-yr)	Average Dose Per Worker (Rems)	Average Collective Dose Per Reactor (Man-rems)	Average No. Personnel With Measurable Doses Per Reactor	Average Collective Dose (man-rems per MW-yr)	Average MW-Yrs Electricity Per Reactor (MW-yr)	Average Rated Capacity Net (MWe)
1969	7 (5)	1,247 (663)	744*	1,289	0.89*	178	149*	1.0	184	247
1970	10 (7)	3,502 (1,609)	2,661*	1,892	0.60*	350	380*	1.9	189	300
1971	13 (9)	3,628 (1,981)	2,778*	3,220	0.71*	280	309*	1.1	248	367
1972	18 (12)	6,566 (4,213)	4,143*	5,602	1.02*	365	345*	1.2	311	408
1973	24	13,963	14,780	7,164	0.94	582	616	1.9	299	496
1974	34	13,722	18,466	10,883	0.74	404	543	1.3	320	575
1975	44	20,879	25,491	17,769	0.82	475	579	1.2	404	630
1976	53	26,433	35,447	21,911	0.75	499	669	1.2	413	663
1977	57**	32,511	42,266	26,444	0.77	570	742	1.2	462	677
1978	64**	31,809	45,998	31,614	0.69	497	719	1.0	494	702
1979	67**	39,981	64,122	29,920	0.62	597	956	1.3	447	705
1980	68**	53,796	80,331	29,155	0.67	791	1,181	1.8	429	699
1981	70**	54,142	82,183	31,451	0.66	773	1,174	1.7	449	719
1982	74**	52,190	84,382	32,795	0.62	705	1,139	1.6	443	738
1983	75**	56,471	85,646	32,926	0.66	753	1,142	1.7	439	742
1984	78***	55,259	98,092	36,441	0.56	708	1,258	1.5	467	776

*During the years 1969 through 1972, all plants reported collective doses but a few did not submit the number of personnel that received measurable doses. The number of reactors that did report doses and number of workers is given in parentheses in the second column. The collective doses shown in parentheses in the third column, as well as the asterisked numbers in the remaining columns, are all based on the data submitted by the number of reactors shown in parentheses.

** Five plants have been shut down continuously for a number of years but have been included in the count of reactors used to compute various averages per reactor in this report. One may wish to calculate these averages without counting these reactors each year: Dresden 1 - shut down since 10/78; Humboldt Bay - shut down since 7/76; Indian Point 1 - shut down since 10/78; Three Mile Island 1 and 2 - shut down since 3/79. (See Appendix A.)

***Humboldt Bay and Indian Point I were not included in this year's tabulation.

Attach
ACRS/RRE

PRESENTATION BY

W. R. KINDLEY
DEPUTY DIRECTOR
RADIOLOGICAL PROTECTION AND EMERGENCY PREPAREDNESS DIVISION
INPO

PRECURSORS TO RADIOLOGICAL INCIDENTS

PRECURSORS TO RADIOLOGICAL INCIDENTS

When INPO was formed by the nuclear utility industry in 1979, one cornerstone of the charter was to identify precursors of potential safety problems. The accident at Three Mile Island as well as previous accidents in transportation, the chemical industry and space programs demonstrated that major accidents are almost always preceded by errors of a recurring nature that contributed to the accident. Hence, it was reasoned that if these errors could be identified and corrected, before an accident, then perhaps the most serious accidents could be avoided or the effects mitigated.

In order to identify precursors of radiological accidents I asked my staff to review six incidents, all of which had the potential of becoming a major radiation accident. In four incidents, workers exceeded Federal radiation exposure limits; in the other two, workers nearly exceeded limits. But let me emphasize, in each case the potential existed for workers to receive exposures that could have affected their health.

I do not plan to identify the initiating events of these incidents, as they are generally not associated with radiological protection. There will always be an equipment malfunction or

personnel error to start an incident. One purpose of radiological protection is to control exposures after the initiating event. Radiological protection programs should be able to protect the worker from high radiation exposures even though there is a system or personnel failure. In other words, if a 1000 Rem/hr source is exposed, a plant's radiological protection program should be good enough to identify this source and prevent uncontrolled personnel exposures.

One of the first points this review of radiological incidents demonstrated was it was never a single error that caused the personnel exposure. After the initiating event, there was a chain of events or errors in each incident. Also, and this is important, the uncontrolled exposure probably would have been avoided if any one of the errors had not occurred. In other words, if one link in the chain of errors had been corrected, there would not have been a radiological incident.

The second point this review demonstrated was that each of the radiological protection errors had existed prior to the exposure incident. The errors occurred routinely, were usually well known and were tolerated by both radiological protection personnel and plant management.

These two points are not unique to radiological protection. The accident at Three Mile Island taught us that accidents are

made up of a chain of errors, any one of which, if avoided, would probably have reduced the consequences of the accident. In addition, any study of major accidents whether they be airplane crashes, ship sinkings, industrial plant fires or explosions draws the same conclusion: major accidents have an initiating event that would have been a small problem had not a chain of follow-on errors permitted it to develop into a major accident.

Our review identified six radiological protection errors that were common to most exposure incidents. As shown on Table 1, four to six of these occurred in each exposure incident.

The first error was inaccurate or incomplete radiation surveys by radiological protection personnel. These surveys failed to identify the source or identify the extent of the source. For example, in some cases radiation levels were known to be high, but the surveys were not taken in the location where the worker was likely to be working. In these areas, radiation levels were generally much higher. In one case, surveys were not performed at all, and in another, previous surveys taken under different conditions were assumed to be still valid.

The second error was the radiological work permits (RWPs) were not adequate for the work to be performed. In some cases RWPs were not required by plant procedures. For example, some plants did not require an RWP, or they permitted use of a general

RWP if personnel radiation exposures were "expected" to be low. For others, it was assumed that an RWP used for another job would be adequate for the job in which the exposure incident occurred. These decisions were made by radiological protection personnel. The key point is that in each of the six exposure incidents the procedural use of RWPs was not properly implemented.

The third error was that the radiological protection technician at the scene did not react to changing or unusual radiological conditions. In some cases the technician at the scene was inexperienced. In none of the cases was a supervisor present. Generally, training courses for technicians did not emphasize diagnosing or responding to unusual conditions.

Let me digress here and ask the question, why do we train radiological protection technicians? Is it solely so that they can perform their daily routines? I believe you will all say no, not solely. Well then, is it to provide knowledge to make up for lack of experience? Is it to provide the technician with the ability to act alone until his supervisor can relieve him? Shouldn't it be to provide the technician the ability to recognize unusual conditions? Shouldn't it be to enable him to anticipate problems, think his way through them, and take the necessary actions to prevent the accident from getting worse?

Returning to our discussion of precursors, one of the key points is that in each of four exposure incidents, radiological technicians were present but did not take action to adequately control exposures.

The fourth error was workers did not follow procedures or exhibited poor radiological protection practices. Examples included the following: entering posted or known high radiation areas without survey instruments, not reading their pocket ion chambers, and ignoring instructions from radiological protection technicians. Remember, I commented earlier that all these errors had occurred routinely prior to the exposure incidents. The performance of these rkers was no exception. At the plants where these inciden. occurred workers did not normally comply with radiological protection requirements nor follow good work practices. Workers who routinely wear their protective clothing unzipped to their waist, wear their hood like an Arabian turban, and act like they are "shooing" flies away with the frisker, are not likely to be rigorous in following rules in high radiation areas.

The radiological protection performance by these workers leads us directly to the fifth error. In five of the six exposure incidents, there was a need for more involvement by the supervisors or foremen of the workers. These supervisors did not

feel responsible for ensuring that their workers followed radiological protection rules; that was considered the job of radiological protection technicians. In addition, supervisors were not present during critical steps in the work in radiological areas. Supervisors did not brief their workers on the task to be performed and did not ensure the workers had been appropriately trained. In short, these supervisors did not feel accountable for the performance of their workers, and they did not feel accountable for their workers' radiological protection practices. This was also demonstrated by the fact that contamination control practices used by the supervisors were no better than those used by the workers. It should not surprise us that if a worker sees his supervisor not frisking properly, then it is unlikely he will frisk properly.

Why didn't supervisors feel accountable for the radiological protection of their workers? I believe it results partly from the sixth error.

In five of the six exposure incidents, the overall management attitude at the plant was neutral or negative toward radiological protection. Basically, management outside of the radiological protection department was not involved in radiological protection. I am referring primarily to Maintenance, Operations and Technical Support Department Managers. Radiological protection was not considered an integral part of their work. Radiological protection aspects of a job were added on at the last minute

by radiological protection technicians, usually by RWP, rather than made an integral part of the work procedure.

While the first three errors are directly under your control, the latter three will be more difficult for you to correct. The last three might be summarized as a need for stronger involvement on the part of plant management in the area of radiological protection. Each of you may need to help the maintenance, operations and technical support manager increase his involvement in radiological protection. For example you may want them to:

- o Approve radiation exposure goals for their department.

- o React to trends of increased solid radioactive waste volumes by assigning their personnel to determine why volumes are increasing.

- o Improve their personnel's compliance with Radiological Protection Requirements.

You will have to develop the facts to support the need for action, and you may have to prepare the paper for their signature, but these types of actions will increase his involvement and leadership in radiological protection.

In summary, these are the six errors which were common to these high exposure incidents:

- o Inaccurate or incomplete surveys
- o Inadequate RWP or non-existent RWP
- o Insufficiently trained radiological protection technicians
- o Workers not complying with rules
- o Supervisors not feeling accountable
- o Station management not involved in radiological protection

As I stated earlier, the high exposures in these incidents probably would not have occurred if any one of these errors had been corrected prior to the incident.

While it is unlikely we will ever stop people from making mistakes, it is possible to break the chain of events that lead to accidents.

Routine recurrence of errors such as these increases the potential for having high exposure accidents at your plant. An active program to correct these errors reduces the chance of forming a chain if an initiating event occurs. I suspect many of you know of a case where a high exposure did not occur because high radiation levels were clearly located, RWPs contained

rigid, specific controls, etc. To say it another way, allowing errors such as these to occur routinely at your plant is the same as playing Russian Roulette. However, working to correct these errors and minimizing the number that exist at any one time, reduces the chance they will complete the chain that causes a major exposure accident.

Although I can't guarantee you will not have a major radiological accident if you correct these six errors, I am willing to say you <u>will</u> significantly reduce its probability.

Radiological Incident Precursors

Event \ Errors	Surveys	RWPs	Training	Practices	Supervision	Attitude
1	X	X		X	X	X
2	X	X	X	X	X	X
3	X	X	X	X	X	X
4	X	X		X		X
5	X	X	X	X	X	
6	X	X	X	X	X	X