Transcript of Proceedings

Before the

NUCLEAR REGULATORY COMMISSION

In the Matter of:
PUBLIC WORKSHOP ON NRC CONVERSION TO THE METRIC SYSTEM

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The above-entitled matter came on conference pursuant to notice before ZOLTAN ROSZTOCZY, Chairman at Holiday Inn Inner Harbor, at Howard & Lombard Streets, Baltimore, Maryland, Tuesday, November 14, 1989, at 8:15 a.m.

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P R O C E E D I N G S

CHAIRMAN ROSZTOCZY: Good morning, ladies and gentlemen. My name is Zoltan Rosztoczy. I am the Deputy Director of the Regulatory Applications Division of NRC, and I will be serving as your Chairman for our workshop for the next two days.

I would like to welcome all of you to NRC's workshop on metrication, and the hope you all will have an opportunity to express your views.

The purpose of the workshop is to gather information on the possible metric conversion of NRC's activities. It's important to emphasize here that we are talking about NRC's activities, any conversion by the industry is voluntary on the industry's part.

Conversion to the metric system appears to be inevitable. Out of the 160 or 170 nations on the Earth there are only three which are not on the metric system: these are Liberia, Burma and the United States.

So sooner or later we all have to learn to speak the same language and be able to communicate with all of the other nations in the common language.

As you probably all know, a new law was passed in summer of 1988 in the United States that declared the metric system as the preferred system of the U.S. Government and direct U.S. government agencies to try to

use the metric system in their activities.

We will go into a lot more detail at the workshop, I am just mentioning it briefly now.

The same law also encourages government agencies to encourage metric conversions by the industry.

But let me stop here on the conversion question and leave that up to our speakers and instead take care of some of the housekeeping activities.

You all received a folder and in the folder there is an agenda for the two days. The first day, today, is basically dedicated to nuclear power plant related issues, after some introductory and policy type of sessions.

Tomorrow will be dedicated to industrial and medical uses of nuclear materials.

In today's session there is one change relative to the printed agenda, the first item is going to be NRC's grant practice and future plans, and then the second will be the national policy which will include the Act, will include government's policy, industry's policy, codes and standards, state government's considerations and also educational policy.

After that we are going to turn to nuclear power plants. We are going to discuss both future power plants and licensing issues for future power plants as

well as existing power plants -- communication and work in connection with the existing plants.

To the extent that it is practical, we are going to follow the agenda. At the same time we intend to give the opportunity to all you to express your views and we certainly we will find a way to do that.

In terms of the conduct of the workshop, it is a public workshop. It is for everyone to express his views, and we will provide an opportunity for that.

Today's program is a rather ambitious program. We intend to keep it on schedule and at the same time, you will still have the opportunity to express your views.

Under each session outlined in the agenda, first we have a few speakers who are going to make introductory remarks and once the introductory remarks are finished in the given area, then we are going to follow with a discussion.

The discussion period, you can express comments, you can ask questions from any of the presentors or from anybody else.

You can also, if you wish, can submit written questions and NRC people are sitting on my right at this end of the table, and if you have any written questions, what you us to pose, then please just drop it off at one

of them, and they will take care of the rest.

Should you find later on that you have some additional thoughts that you didn't have a chance to express here today, then please feel free to send it into us. Send it either to the individuals who were listed on the public announcement, the Federal Register notice or send it directly to me and we will figure it into our overall activities.

We have telephones available outside in the hall so if any of you have to take care of some other business that certainly can be done. We are also answering the phones if any messages come in, they will brought in here and we are going to bring it to your attention.

There is a transcript of the meeting that is being kept for NRC's purposes, just to make it easier for us to recall what went on at the meeting. The young lady at my left is keeping the transcript.

Additional copies of the transcript are available from her, so if anybody would like to have an additional copy, then please see her in the intermissions and you can sign up for a copy.

In order to facilitate the transcribing, before you make a remark or before you ask your questions, please state your name and your affiliation and also

please speak up or use one of the microphones. We have microphones scattered around in the room so there are some available and close to everybody in the room.

I am also reminded that there are some of our speakers who will have to leave at certain times during the day, so they won't be able to stay here for the whole day.

It is important that any questions or comments that you have in a given session, please make it at the end of that session while our speakers are still here and they can respond to your questions.

We will try to accommodate everybody. If anybody would like to make a comment about some of the sessions that come up, let's say tomorrow or later in the afternoon and you are not able to stay that long, we can accommodate that also. Just please let me know and we will find a way to squeeze in your question or comment and we will put it down on the record, even if it's a little bit out of order.

The only change in the agenda is that Dr. Beckjord to talk on NRC's current practice and future plans is going to be the first talk, right after that we will entertain some questions and comments on his talk, and following that we will go to the national policy.

Dr. Beckjord's talk is just about 15 minutes so

this will not make too much of a change in the rest of the agenda.

With that much of an introduction, let me introduce then our first speaker, Eric Beckjord, who is Director of NRC's Office of Research. He personally is responsible for the development of our policy on metrication for the Commission's consideration.

Eric Beckjord?

DR. BECKJORD: Thank you, Zoltan, I just want to check one thing. Good morning, ladies and gentlemen. I want to welcome you to the workshop on metrication, and we look forward to a productive two day meeting.

In recent years, this issue has become much more important to the United States and in particular to the nuclear industry.

As you saw in the Federal Register announcement, the purpose of this workshop is to collect information so that the NRC can develop a metrication policy which will be in compliance with the Omnibus Trade and Competitiveness Act of 1988 which Dr. Rosztoczy already mentioned.

A little bit of background here, as you undoubtedly know, the Nuclear Regulatory Commission is an independent agency. It's mission is the regulation of nuclear power, commercial uses of nuclear power and the

uses of nuclear materials.

Its job is to assure that the civilian uses of nuclear materials in the U.S., whether in medical, industrial or research applications are carried out in the interests of public health and safety, of the environment and of national security.

The main emphasis, of course, is to protect public health and safety. In order to accomplish these goals in a safe manner, the NRC must be receptive to the concerns and the needs of the industry that it regulates and the public at large as well.

Metrication is not a new concept. It's accepted world-wide, taught in all of the engineering schools I believe today, and if the U.S. is to stay competitive, it will have to join the throng.

Therefore, as a federal agency, the NRC will comply with the provisions of the 1988 Act and the legislation and it will establish goals for orderly conversion of its business related activities to metric units in one form or another, preferably by 1992.

For those areas where conversion is impractical, these will be identified in the policy statement, and paralleling these conversion activities, the NRC encourages voluntary conversion on the part of industry's activities.

If I could have the next slide please. I will talk for a minute about issues of concern, we are in sync here. There are a number of complex issues affecting metric usage by the NRC which have various ramifications: political, technical and economic.

These issues have conflicting objectives and needs that preclude a straightforward implementation of full conversion to metric SI units under any scheme that we have thought of.

The foremost political issue is the existence of a legislative mandate and federal guidance to accommodate conversion to SI units.

The U.S. is the last major nation, as Zoltan has already said which is not committed to conversion to SI, although I note, if you do any work on a car which has been built in the last three years, you will find that it's just about all metric, a car built in the U.S. even.

The inevitability of such conversion at some point, as well as the desirability of achieving international uniformity seems to be generally recognized; however it's highly desirable as well as consistent with federal guidance, to assure that NRC policy considers diverse viewpoints; that it does not impose barriers to voluntary use of metric SI units; that

it precludes prejudice against metric goods and services offered competitively to the government; and that it provides for full public involvement in policy development and implementation.

From a practical standpoint there are limitations in the ability of federal agencies to cause conversion to SI unit in the areas outside their jurisdiction. For example, in the area of emergency response, many state and local government entities have economic, educational and safety reasons for resisting change.

The primary technical issues affecting metric conversion are those concerned with nuclear power plant regulation, during design, procurement, construction, training of crews and operators, licensing, operation, inspection and public involvement.

These concerns cover for example the information which identifies specific functions to be performed by an instructor, system or component of the facility and the specific values or ranges of values chosen for controlling parameters, as reference for the design; in other words, essentially the technical specifications.

In addition, during the operation of a facility all emergency plans and procedures would also be

expressed in metric units. These would include reports, communication between the licensee and the NRC.

As to economic implications, they may be positive for some and negative for others, depending on whether the manufacturer has substantial current international sales with customer requirements for SI units.

To further complicate the situation from the point of view of society, there may be additional costs to conversion in terms of reduced public safety, the possibility of reduced public safety arising from the chance of errors of recording and interpreting data and in public understanding.

In developing a policy for NRC, it should be consistent with federal policy and guidance and tailored to the mission of NRC and to interaction with licensees, with other government entities, both federal, state and local and foreign governments as well and the public.

Information and guidance available from various sources will be used in the development of NRC's policy statement. I will get into the schedule on that a little later.

First, the Omnibus Trade and Competitiveness Act of 1988, this Act contains, among other things, a section on metric usage. The Act designates the metric

system as the preferred system of weights and measures for U.S. trade and commerce.

It requires that by the end of 1992 all federal agencies will have converted to the metric system of measurement in procurements, grants, and business related activities, except to the extent that such use is impractical.

Is that what the legislation says? Those very words?

CHAIRMAN ROSZTOCZY: Yes.

DR. BECKJORD: So there is some interpretation there. With respect to the implementation of the 1988 Act each agency of the Federal Government is required to establish guidelines to carry out the policy set forth in the law.

In addition, as part of its annual budget submission, each agency is instructed to report to Congress on actions it has taken during the previous year, as well as future actions to fully implement the metric system in accordance with the policy.

Secondly, guidance provided by the Interagency Committee on Metric Policy which is chaired by the Under Secretary of Commerce for Technology, and the committee's arm is the Metrication Operating Committee. These committees were formed to coordinate federal interagency

activities, and to provide policy guidance to federal agencies. The NRC has a representation on both of these groups.

Third, the Department of Commerce proposed rulemaking which would establish metric conversion policy for federal agencies: the general policy calls for agencies to plan and coordinate for the increase in use of the metric system, consistent with the Metric Conversion Act of 1975, and to support an environment which can accommodate metrication.

Fourth: public comments received on previous rulemakings: a request by the U.S. Council for Energy Awareness in September 1988, asking the NRC to consider the possibility of using rounded whole numbers which have metric equivalents for package sizes. This request was made because there are strong indications that countries in the European economic community will convert from dual units to metric units only.

When this is done it appears that the users of radioactive materials will encourage suppliers to adopt rounded units, since this will be a more convenient measure.

Then a public comment on a proposed rule of 10 CFR 1051, early site permits, design certifications and combined licenses argued that Part 52 should require all

technical information in license applications to be in metric units.

The NRC believes that there was merit in this proposal and drafted a requirement to be placed in the appropriate section of Part 52 which required as follows: an application filed after September 30, 1992 must provide all technical information in the international system of units, as modified for U.S. usage by the Secretary of Commerce.

U.S. customary units should be included parenthetically where it will help clarify.

This requirement was deferred until establishment of a forthcoming NRC policy on metrication.

The next point: the approaches taken by the NRC in developing its policy on metrication will have to take into account the collective interests and concerns not only of the NRC, but those of industry, state governments and the public.

The auto and liquor industries are two examples where metric conversion has already taken place and is functioning very effectively in the marketplace.

The purpose of today's workshop is to solicit your comments. Once the policy statement is formulated, it will be issued then for public comment and you will have a second opportunity to express your views.

In March of 1989 the NRC on its initiative, formed a committee to consider how the provisions of the Omnibus Trade Act might be best implemented, and to what extent it was practical to implement them in the NRC.

The committee considered three areas of review. First was to conduct a review of the NRC activities and identify those which fall into the "procurement grants and other business related activities" category addressed in the Trade Act, and make a recommendation on which activities would be practical to convert to the metric system.

Second: to determine how NRC should implement the conversion; decide what actions are needed for conversion; what the schedule would be and to provide recommendations on the conversion itself.

Thirdly: to develop recommendations on the assignment on responsibilities, including coordinating responsibility for the conversion plan and then to prepare a final report to Congress.

The study, we completed this study in July of this year and the results of the study indicated that sudden conversion, that is saying that on one day we are going to convert to metric units by the NRC is impractical, but rather some gradual form is preferable.

Now we are going to talk about policy scope

here for a minute. The NRC in performing is regulatory role conducts a number of activities which will require familiarity with the metric system of weights and measures, when conversion is finally implemented and a policy statement developed.

The scope of the policy statement will cover the following regulatory activities: first, licensing activities, related to license applications, issuance of licenses, amendments, regulatory review, hearings, test specs, operator examinations, safety evaluation reports, environmental impact statements and environmental assessments.

Secondly: emergency response activities related to emergency planning and to the operation of the Emergency Response Center.

Thirdly: development of regulations with which licensees must comply and regulatory guides which provide some guidance in how licensees can comply with rules.

Fourthly: inspection activities that ensure that the construction and operation of license facilities meets license requirements, to identify conditions that adversely affect public health and safety, provide information used as the basis for issuance or amendment of the permit or license, and to determine if applicants and licensees have an adequate quality assurance program

in place.

Well, as you probably know, today the NRC does not have an official policy on metrication. Nevertheless, as an enforcement agency, such a policy is needed and it must be a practical one so that the safety and efficiency of the licensing process it not compromised.

At this time in all licensing activities the NRC uses English units; however, if a licensee for one reason or another wishes to use metric units, in the past the NRC would have required the applicant to submit its application with both units indicated, English units followed by metric units in parentheses.

Is this requirement a burden on applicants? Well, we don't -- we are not sure about that, but we would like to know your views and also if you could tell us what the reasons are for concluding that a dual system is burdensome.

In the past consideration was given by NRC to issuing new rules in dual units, but no policy on conversion was adopted and the decision to use dual units was determined case by case; as a result, just about all our rules are in English units.

There are a few exceptions. Some of our rules using radiation units are issued in dual units. Using dual units in regulations has benefits and drawbacks.

The main benefit is that each application or licensee will find in the regulations the units he is working with; and one of the drawbacks is a higher potential for error while dual units are used.

We would like to hear your preference and also your reasons on that point.

Well, we are not only a regulatory agency, but our work overlaps with other government agencies like the EPA, Federal Emergency Management Administration, Department of Energy and so forth, and since it appears that the long term movement toward metrication in the U.S. is inevitable, it would be beneficial to publish a metrication policy for the NRC that is coordinated with other agencies of government.

In this connection, plans are underway for the NRC to hold meetings with other agencies of government in order to promote coordination on this point. Implementation of such a policy would define NRC intentions and facilitate the transition for both the regulated industry and others who have an interest.

Brief comments on conversion options: in developing an NRC policy on metrication, there are several options that could be followed.

These are, and in one particular order, first to continue with the use of English units within the NRC

staff and if an applicant elects to use metric units the application would have to include dual units to facilitate staff review.

A second would be consideration to a single step, one step conversion. In this case the NRC would pick a time and convert all selected regulatory activities to the metric system. From that date forward NRC would conduct its regulatory affairs only in metric units.

A third option could be gradual conversion, and in this, the NRC would begin converting its regulatory activities at a certain time; let's say, beginning Fiscal '93.

The agency would then reflect dual units in its business activities for a specific period of time, perhaps several years. At the end of that period, dual units would be discontinued and only the metric units would remain.

The fourth option would be a partial conversion. Under this option existing facilities would be expressed, their tech specs would be expressed in either English or metric units at the option of the licensee.

New applications submitted after a certain date would be expressed only in metric units. What this

option would do it to stretch out the total conversion to the metric to some time well in the future.

Whatever the option that NRC decides on it will consider the views of industry and the public at large in making that decision.

So a few words about future plans: we expect to complete the gathering of information in the next two months. We will prepare a policy statement for the Commission to consider and approve by March of the next year.

During the development of the policy statement, a parallel effort will be undertaken to assess the needs, to issue a rule on metrication or to amend existing regulations.

After the Commission's issuing of its policy statement, the agency will develop an implementation plan giving specific guidance for metric conversion; issue a rule on metrication if that is needed; to revise existing rules and reg guides so that they will read in metric units; and to revise the standard review plans and then to revise the appropriate inspection manuals.

An integral part of the implementation plan could very well include establishing a training program to assure consistency in the use of metric units throughout the NRC.

Let's see, I should say a bit more about the schedule. I think that the -- if the proposed policy statement is issued in March, having been approved for issuance by the Commission, we would then take public comments and we would make the policy statement final in the summer of 1990, after the appropriate time for receiving comments and sifting through them and then making the final decision.

Well, this finishes my remarks on this important subject. I hope over the next -- today and tomorrow that you will give your views and I assure you that we will seriously consider all views expressed at this two day meeting on metrication.

I thank you for your attention.

CHAIRMAN ROSZTOCZY: Thank you, Dr. Beckjord, and now we would like to entertain comments or questions on NRC's plans and NRC's current policy.

Any questions or any comments?

MR. GAT: Yes, I am Uri Gat from Oakridge National Lab. I think it might be very helpful in this area of radiation to very exactly specify the meaning because the metric, many of the non-SI units are metric units so there may be a little confusion when somebody talks about it whether the -- for instance, the rad and the rem are included, even the Curie might be included

and then calling the other units English, is that synonymous to non-SI for the same reasons? So these clarifications might be very helpful.

One other thing, there is one other option that is possible, it's not very different from gradual conversion, but that is phase-out of non-SI units. It is very similar to what one normally means with conversion, but it's much less painful from the point of view of the user and gives a little bit more flexibility. So perhaps that an option that one might wish to consider.

DR. BECKJORD: Yes, I think that's an important comment, and it occurs to me, in thinking about that that is one of the first things that we ought to do, like a definition on the SI units, and about the rad and rem units --

CHAIRMAN ROSZTOCZY: As far as our discussions here today and tomorrow are concerned, frequently we are using the metric units or metric system in a relatively loose sense, but what it really means it the SI units, the way they have been documented in the Bureau of Standards document and in the U.S. Standard document that we have on metrication.

MR. GAT: Even there there is still one difficulty and that is specific to the electron volt which is non-pure SI but permitted for use with SI and

it's very important in NRC, the discussions and documents. So perhaps that one would at least need to clarify that meaning very specifically.

CHAIRMAN ROSZTOCZY: Yes, thank you for the comment.

Any other questions or comments?

Well, if there are no more questions or comments, then we would like to turn to the next session which is national policy and conversion to the metric system.

Our first speaker is Jim Turner from the congressional staff. Jim was briefly involved in the formulation of the 1988 Trade Act and also the enactment of the Trade Act and he is a real expert to tell us what was Congress' intent when they enacted the Trade Act.

Hopefully it will help us to understand how can we implement it. Jim?

MR. TURNER: Good morning. I guess that would be a pretty tall order for anybody to explain what the Trade Act was about, that was properly the thickest bill I ever saw and there were 17 committees of the Congress total that worked on it. So thank God, that's not my assignment this morning.

This is hard enough. What I would say, a couple of introductory remarks about myself and about my role

and how I fit into this and the conditions under which I come and speak in forums such as this.

Necessarily, whenever we pass legislation of this type we are not thinking so much of specific agencies as of overall policies.

Coincidentally, I have a small amount of nuclear background, having worked on our committee staff in that area for four years during the 1970's, but I would be the last one in the world to claim that I understood the difference between SI nuclear units and non-SI nuclear units. That's certainly beyond the pale for me.

Also, I wanted to say at the beginning when I come to a forum like this I try to be as candid as I possibly can; but I do it under one condition: that people consider the remarks unless I say them specifically in another way as being my remarks rather than attributing the views to any particular member.

On the Science Committee we have almost 50 different members, ranging from far right to far left and everything inbetween, and it's pretty hard to say, well, the committee thinks this or the committee thinks that.

If I slip and say that, it's really Jim Turner thinks this or that.

Let's go into the subject at hand. Metric was a

long time in coming, and still is coming, but in a way we are dealing with a Civil War issue. The first U.S. Metric Act was passed in 1866, believe it or not, and Congress I guess has proceeded with all deliberate speed, as we often do.

We waited 100 years after we became an original signatory of the treaty on the meter to pass the Metric Conversion Act and even then we didn't convert to metric. We used that Act more or less as a trial run, in some ways what not to do if you wanted the country to go metric.

Our trade situation became more and more difficult during the 1970's. There was a certain amount of concern building each year and probably the problems that the Metric Conversion Act faced which I, and this is Jim Turner's view, I don't want to hang this on anyone else, but I think as much as anything, we were dealing with what some people called "mass phobia," a certain group of people who were scared by numbers, don't understand numbers, prefer to think in terms of the concepts you learn in English class rather than engineering school.

The idea of going to the metric system, even though it's -- from someone from my background is a much simpler way of thinking, it was truly threatening to a

hard core of conservative congressmen.

Well, they retired one by one and the Trade Bill came along the year after the biggest opponent of metric retired. So both on the House and Senate, the people who had been the major proponents decided the time had come.

Our committee approached the trade bill in a very strange way. We let the thing go by in the House and ended up writing maybe seven to 10 percent of the bill by the end of it.

This was sort of, because of serendipity and because of a change in our committee that this happened. We were given a deadline of, I believe, April 1st to have bills reported out of the committee, this was April 1, 1987, about three months after the Congress convened, to have anything that was going to be in the trade bill reported out of committee.

We had just had a new chairman come in and we were just really getting reacquainted with each other. There was no way we could meet a deadline like that. So we started working with our Senate counterparts on deciding what, from science and technology point of view, should be in the trade bill.

The deadline passed, there was floor consideration on the 28th, 29th and 30th of April of 1987

on what the trade bill should look like from the House point of view, and on the 30th the bill was passed.

In those same three days our committee held hearings on what we might like to have in the trade bill. So we were moving with all deliberate speed. We eventually caught up.

In terms of the contents of our parts of the trade bill, I think that they were perhaps as well thought out or more thought out than other parts because we just had a lot longer time to think about it.

As it happened, we had one of the longer conferences of the 1980's, the trade bill took, oh, I guess from the time we went into conference, it took almost a year to work out the differences.

Well, lo and behold, the first conference agreements to be reached between the HOuse and the Senate was on the technology title and I guess it was because we had worked our differences because the Senate had put the provisions in and we worked them out from the beginning.

So I think that the provisions were worked out with more of a sense of comity and less bitterness than a lot of the other provisions of the trade bill.

The way metric actually came into the trade bill was through Senator Clayborn Pell originally. He had written resolution which had basically called for the

metric system to be the preferred system of measurement within the United States.

It had a whole lot of good words and very few teeth. I don't know -- wouldn't even help that bill.

The other bill that went through, in our package that was moving through, was Congressman George Brown of California wrote what was called the Metric Usage Act and which was what eventually became part of the trade bill.

Senator Pell offered his amendment for the Senate and it was accepted unanimously. That gave metric a position in the trade conference, and Mr. Brown's goal was the one that was conferenced against Mr. Pell's provision and the decision of the House and Senate conferees was if you were going to do something in metric, probably the Brown approach was the one that would be taken.

I think there is a certain significance in really the trade bill being the place where the metric usage act finally became law and in that end, it was a coincidence that we choose the year 1992 for implementation.

I wish I had thought of Europe 1992 at the time we were going through, but I would be liar if I said it was either on Mr. Brown's or my mind at the time that we

were drafting this thing. Certainly, by the end of the conference it clearly was, that there was great concern about whether we had an unfair trade barrier that was going to force us out of the combined Europe market, just as it already is becoming -- the U.S. not using the SI system of metric, is already hurting us in our trade with Japan and that being one of the many excuses from my point of view, that Japan is using for not throwing their markets open to U.S. products in the same way that U.S. products, and the way Japanese products just flood our market.

We also, by the end of the trade conference had seen or had certainly become a lot more aware than we had in the past, that international standards other than Europe 1992 were becoming much more important than they had been in the past; that then the German's standard organization, the French, the Japanese, even the Australians had volunteers around the world working with the various standards writing groups from various countries.

For instance, Saudia Arabia probably had 20 or 30 volunteers from other countries helping them update their standards codes.

Well, update is not a good word from an American point of view because of the U.S. dominance in

the standards area in the 1960's, world standards to a large extent meant U.S. standards.

These volunteers were bringing in new standards, including metric that cut the U.S. out since we had been passed by in terms of international measurement.

So I just wanted to give you a feel for where I think that those members who are concerned about the metric bill were coming from in terms of the provisions that they put forth and they the bill developed the way it did and why there was so little controversy in putting it through this time.

I think at this point I would like to look at this, which I believe is in your package, I think this is off Jerry's word processor, that it is a compilation of the Metric Conversion Act, the 1975 attempt to go metric and the Metric Usage Act, the amendments to that Act which were included in the trade bill.

The provisions which are in lighter type are the ones which survived from the original Act. The ones which are in darker type are the ones that I would like to focus on and those are the ones that we added in our bill.

The first section, Section 2 is what we call findings in writing legislation, pure and simple they are

speech. It's a way for members to get off their chest what they really mean before they get into the fine tuning and the things that actually have to be enforced.

It's a way for people to look back at the legislation, other than digging out a committee report which may be filed somewhere and try to figure out exactly why the provisions were written the way they were.

We didn't add a whole lot of findings. Sometimes findings go on for pages, we added just five, but I think those five really, especially the first four of them say why the Congress did what it did.

As I said before, we saw world trade was increasingly geared towards metric and we saw that the U.S. was becoming at a competitive disadvantage because of our non-standard metric system.

The American National Metric Council has for three or four years been embarrassing us on the hill by pointing out that we are in -- if we would just switch to the Brunay system of measurement there would probably be two of us who are using the same system of measurement that was non-metric.

The whole rest of the world had changed and we were there with Brunay and Borneo I believe as the three countries which had not made a real strong commitment to

going metric.

I think there is a strong feeling of anyone who had looked at the system, that if you -- I can't speak for the metric units in the nuclear field, but in general, metric units are much simpler to use than non-metric units.

The fourth point is that there was a feeling that there had to be a special responsibility exercised towards small business that in terms of conversion, big business is probably already using the metric system in a large number of areas because they are world citizens as much as they are U.S. citizens.

The burden would likely be on the small businessman in terms of conversion and I guess we occasionally we believe that we are from the government here to help you, but we felt we would at least want to be here from the government, not to hurt you in this regard and therefore to ask each agency to look at how small business would be affected, if we had made legislative mistakes, oversights or omissions and we should come back and do something to help small business.

We are certainly willing to do it in terms of the implementation, and we felt the agencies and their regulations and their programs should do the same.

At the bottom of this page there is a simple

declarative sentence that it's the policy of the United States to designate the metric system of measurement as the preferred system of weights and measures for United States trade and commerce.

You would think that if you had an Act that was called the Metric Conversion Act of 1975 that you could read between the lines and figure out that the metric system measurement was the preferred system of measurement.

There was a tremendous amount of debate over the 10 years after the passage of the Act, whether the Act really meant what it meant, whether it meant anything and whether those people who didn't want to convert said, sure, it says metric conversion, but it doesn't say the preferred system of measurement, we will go on doing what we feel like doing.

It is clear now I think that preferred means preferred. It's spelled with the same standard nine letters that it usually is in the law right now and I hope that that part of the debate is over.

At the top of page two is what is really the meat of the Act. There is a requirement that each federal agency by a date certain and to the extent economically feasible, by the end of Fiscal Year 1992, use the metric system of measurement in its procurements,

grants and other business related activities, except to the extent that such use is impractical or is likely to cause significant inefficiencies or loss of markets to U.S. firms, such as when foreign competitors are producing competing products in non-metric units.

I guess we have enough words that are potentially confusing in there, to allow someone to win a national debating championship over this clause; but let me try to at least explain what we were trying to do there.

The first thing that may not be absolutely clear is what a federal agency is. We used the standard definition of a federal agency as anyone independent or not independent in the Executive Branch and as far as I am concerned, if the Library of Congress wants -- we made a mistake, we should have included them. The legislative branch probably should convert as well as well as everyone well. We meant federal agency to include everyone.

By a date certain and to the extent economically feasible, by the end of Fiscal Year 1992, why that is in there is to give a little bit of flexibility in the process. We choose Fiscal Year 1992, the end of 1992, looking at Canada's conversion experience.

It took them approximately five years to complete their conversion. We were optimistic at the time this bill was written in February 1977 that we would have it signed into law by the end of the year. The trade bill at that point was a top priority, it was on the fastest tracks. It got on to some sidings along the way, and it was signed into law probably nine months to a year after it was expected to be signed into law.

So the period from date passage until the end of 1992 was compressed to four-and-a-half years, but that's really what the ball park is, that we are hoping that for the most part the Federal Government conversion could happen by the end of 1992.

However, we realized that there are over 40 agencies that will be going through conversion and everyone of them is different and there may be special circumstances, and we did not want to absolutely nail into concrete that 1992, if there was a good reason to finish it earlier or finish it later, that 1992 absolutely had to be the date for every agency.

However, we felt that nothing would happen if there was not a goal toward which people were moving from the beginning. So the word "date certain" is there, to give the alternative to agencies to set 1991 as the first day or June 1993 as the first date, but to set your

milestones and move towards that date.

The next clause is use of the metric system of measurement in procurements, grants and other business related activities. The question is what is a business related activity?

I think that it in our mind it is whatever is not -- it is sort of a double negative, it's not a non-business related activity.

The reason that we used that word is that we wanted to differentiate between things like B60 column running or 100 yard dash and something that really makes a difference in terms of world trade.

I think that probably the 1975 Act ran into a tremendous number of red herrings, by first having the first conversions being road signs on the road and people worrying about things they could be 60 column or that somehow their God given right to run 100 dash was being taken away from them. But that really was not the concern of this legislation.

The concern was to get the government on an even business footing with the rest of the world, and so I think business should be interpreted broadly but not ridiculously.

The clause, "except to the extent that such use is impractical and is likely to cause significant

inefficiencies or loss of markets to U.S. firms, such as when foreign competitors are producing competitive products in non-metric units," was thrown in there as the price for certain Republican members who come from states who are heavy in the aerospace industry. That was their price for participation.

I think that's going to be much less of a problem because the first agency to go metric turned out to be the Department of Defense and since they are so heavily linked to aerospace, I think that we will find that the aerospace industry will be converting, but that clause was put in there because the aerospace industry was saying, looking, your goal is to aid U.S. business overseas, in terms of at least of sales of commercial airplanes we are very, very dominant and this is one area where the U.S. standard is still the defacto world standard, please don't burst our bubble for us prematurely.

So we certainly weren't in the business of hurting U.S. business, so that's why that clause went in. It's not solely located to aerospace, we don't want it to be such a big loophole that you could drive Mack trucks through it. It is our attempt to put some flexibility into it and realize there may be some situations where even though an agency may be converting in 1992, that a

particular part of its constituency may need a little bit longer to convert or there may be some areas where eventually the system is not metric, but that was the purpose for that.

The number three, from the beginning we felt that education had to go hand and hand with metric conversion. This is just a repetition of a goal from the beginning. I would not be comfortable with metric, as would some others in this room, had I not had a very heavy dose of it when I went through the public schools. In fact, my son is getting a much heavier dose than I did and in certain classes he is not allowed to use English units.

I think through education, that's how we get people to the point where they really feel comfortable in going metric.

I have already talked number four.

That takes over to, I think the very end of the document on page seven, are the last things, and these are the requirements that we placed on agencies.

We expected each agency to establish guidelines, except for Section 3, which is the section we just went through, and with each annual budget submission, to report to the Congress on the actions that they took during the previous as well as any actions that

they plan to take in the coming year.

The reason for this is very simple, this is our second crack at going metric. It really didn't happen by passing a law saying we have converted to metric, and it would take -- it took more than that and we felt that there really should be a congressional oversight and that the process required a partnership of the Executive Branch and the Legislative Branch and the members who pushed for the change clearly intended to be in it for the long haul until the conversion actually occurred.

I think that's probably evidenced by the Interagency Committee on Metric Policy, the senior level committee in the Executive branch, having their kick off meeting not that long ago in metric and Congressman George Brown going to that meeting, taking time off, luckily he didn't miss any votes, taking time off from his legislative schedule, going downtown and explaining the Act to them as I am explaining it to you and giving his pledge to do whatever is necessary for the Act to go forward.

So that is one of two ways that we expect that Congress will be involved. The second half is one of the legislative branch agencies, the General Accounting Office, we have asked them to be a partner in the conversion as well.

Because of the lateness in the passage of the Act, close to the end of the fiscal year, there was great ambiguity as to when the first of the annual budget, the first of the report coming out with an annual budget submission should be, and a total of three out of 42 relevant agencies actually submitted a plan last year, a couple of them were place holders.

We didn't want to lose another whole year or 1992 would become a crazy deadline to try to meet. So we asked the General Accounting Office to survey agencies and find out basically what would have been the contents of the report if we had gotten one. What they were doing? What they planned to do through the next year?

We felt -- we did this for two years, the one that I just mentioned, and the second, to increase the quality of the first report that comes to Congress, to get the people in the new administration thinking about what their responsibilities would be since you had new assistant secretaries and above throughout the government, at least the ones that have been appointed and confirmed -- I guess ironically, the undersecretary who would be the head of the metric program has not even been named at this point, along with certain agencies; but that was our intent in that as well.

The last thing here is more or less a wrap up

report from the Controller General of the General Accounting Office, at the end of Fiscal Year 1992, to see where we are and where we go from here.

So that's basically where we stand at this point.

I guess I could mention one other thing, with the General Accounting has been working very hard the last two or three months on this issue, and they are coming back to us informally next week and at this point, just about every agency has compiled and has done serious thinking, so there are meetings like this one that will be happening all over town, all over the country, as the various agencies grapple with what the Act means.

So you are certainly not alone and I look forward to hearing if there are legislative problems because I think there is already some thought being given as to what might be the next legislative steps in this process and in our attempt to look for ways to make sure that people 100 years from now aren't coming up with another metric bill, having metric finally go in as the bicentennial metric instead of the centennial metric.

Thank you very much.

CHAIRMAN ROSZTOCZY: Thank you very much. Jim, our plans are to have all seven of our speakers in this session to complete their talk and then we will have a

discussion session which probably will be between 11:00 and 12:00. Will you be able to stay with us to be here for that discussion session?

MR. TURNER: Maybe for part of it, I have to go back to a late meeting.

CHAIRMAN ROSZTOCZY: In that case, then why don't we entertain now some questions just on Jim's part and we will then group the next six speakers together for the following session.

Any questions? Yes, Dr. Ruby?

DR. RUBY: I have two questions for you, the first concerns what happened during hearing on the Omnibus Trade bill, the metric boosters of this country all know that at hearings on the metric conversion act there was considerable labor union opposition to that bill and I was wondering whether on hearings here there was any metric opposition and if so, from what category?

MR. TURNER: I would lie if I said we publicized it as widely as we might have publicized the 1975 hearings. We did have, I guess one day of hearings in -- on the 29th of April 1977 and we had a panel that represented small business, the government and various people who had been involved in the metric movement.

We had no requests from the unions to testify. I can only remember one letter that we received during

the whole process and it was probably from one of your favorite characters from 1975 expressing concern over the bill, but that person never requested any meetings and never requested to testify or get involved in any way.

I think there was a change in opinion in 10 years, talking to people who had been talk shows for instance, dealing with metric, they could expect maybe six, eight, 10 years ago to be torn apart by a handful of callers. It's common knowledge to go through a talk show appearance, having no negative comments whatsoever.

So I think there has been a change in attitude to a certain extent, and I think it's partially that anyone my age or younger understands metric because they have learned it in school, so we have a majority of people in the country who have grown up with metric, although not using it in every measurement.

CHAIRMAN ROSZTOCZY: Yes.

MR. NELSON: Bob Nelson, University of Maryland. You pointed out the possibility of continuing legislation on this issue and I would like to bring to everyone's attention and to you in particular that in Title 15, Section 205 of the U.S. Code which deals with metric issues, there is an authorized table of metric equivalents and this table goes back to the original 1866 law which made the metric system legal in this country.

However, I would like to point out that these equivalents are no longer correct, and further, there are many terms in the table that are obsolete. I would like to quote from the legislation. It says:

"The tables and the schedule annexed shall be recognized in the construction of contracts and in all legal proceedings as establishing, in terms of the weights and measures on June, 22, 1874, and use in the United States, the equivalents of the weights and measures expressed therein in terms of the metric system. The tables may lawfully be used for computing, determining and expressing in customary weights and measures the weights and measures of the metric system."

The table then goes on to give an incorrect set of metric equivalents which have been superseded by international agreements. I would like to recommend to you to bring to the legislators' attention the need to correct this table in light of these more modern equivalents.

MR. TURNER: We will be glad to work with you on that.

CHAIRMAN ROSZTOCZY: Yes, sir?

MR. DeGRANGE: My name is DeGrange from Maryland Weights and Measures. I am wondering if you folks at the congressional level are contemplating doing anything with

the Fair Packaging and Labeling Act where your labeling requirements are basically in the customary system, although it does permit metric equivalents in parentheses, rather than requiring metric as the basic label, was possibly the customary measurement and the parenthetical statement?

MR. TURNER: I have gotten a copy of the Act and the legislative history on it. We are taking a look at it, and it will depend on whether the problem is more regulatory or regulations from the executive branch implementing that or the Act itself, about what we will do.

But we will take a look and see if there is something that should be done there.

MR. DeGRANGE: I am sure you recognize that if a packer labels strictly in the metric system, and he goes into interstate commerce he is going to run into a problem because it would be contrary to the requirements of FPLA in some instances.

MR. TURNER: Yes, we will take a look at that.

CHAIRMAN ROSZTOCZY: Yes?

DR. BECKJORD: I just wanted to thank Jim for his very enlightening discussion of the history of the legislation and the considerations. I learned a lot from that.

There was just one point I wanted to mention, which is that I don't think there is any question about the greater merit of the metric system, and if you visualize it's use from the beginning, I mean, training people to work for example in a nuclear power plant control room, if they start out with metric there is going to be no problem.

There is one unit that I think I would always have to think about and that's pressure. I can relate to every metric unit except Pascal's. That happens to be a rather important one and that perhaps is an example why we in regulation, we have some difficulties over the transition period because pressure is a variable you certainly wouldn't want anybody to make a mistake about.

MR. TURNER: I think that's also one reason why we didn't press in areas like highway signs this time. I think safety is of paramount concern.

CHAIRMAN ROSZTOCZY: Any other questions? Yes, Mr. Colvin?

MR. COLVIN: Joe Colvin with NUMARC. I was wondering if you might clarify the aspect of business related activities a little bit, at least as it regards the Nuclear Regulatory Commission.

I think from the industry's view, there is no question that the NRC's business is regulating the

industry, and yet when you look at the intent of the bill which is to promote trade and commerce, I am not sure how that relates to the generation of power at least from the commercial utility industry and whether there was intent from Congress that NRC conduct its business of regulation in metric units and that be pushed on the industry from the standpoint of converting operations and the methods of operations to the metric system.

MR. TURNER: I think there was a clear hope on the part of the members who pushed this bill that the country will go metric and the easiest way to get the government -- the country going metric is get the government going metric first.

It's two things, one if you are sort of putting your money where your mouth is on the part of the government and secondly, it's the government business related activities are in so many aspects of our life that once that happens I think the rest of the conversion is likely to happen.

I think -- I would followup on what Eric was saying a minute ago, that there was some thought in terms of regulatory, most of it was in terms of trade, there was some thought in terms of regulatory.

We choose not to be greatly specific there and we realized there were some competing values like public

health and safety and if those become paramount then the exceptions in the Act should be used, all things being equal, metric should be used, that would be our attitude.

CHAIRMAN ROSZTOCZY: Any other questions or comments?

Thank you very much, we certainly appreciate your time.

As we heard by now, the various agencies of the government are supposed to be working on metrication and they are all equal within the government except there is always one that has a little bit more responsibility than the rest.

Within the U.S. Government, the agency that has the increased responsibility is the Commerce Department. The Commerce Department has a metrication office which is dedicated to the metric conversion and also the Commerce Department has a leading role on the interagency committees, on the ICMP, the Interagency Council for Metric Policy and on the MOP, the Metric Operating Committee.

Our next speaker is Gerry Underwood from the Commerce Department who is the Director of the Metrication Office and he is also the Chairman of the MOC. Gerry?

MR. UNDERWOOD: Thank you, Zoltan. Good

morning. It's always a pleasure to be on the program with Jim Turner, who you have heard from the legislative side and now we have the executive side.

But I just want to comment to you that we are fortunate to have somebody on the hill who has the background and the knowledge and the perseverance that Jim has had on this issue.

I personally believe that had it not been for him we wouldn't be nearly as far along as we are.

I do have the pleasure of meeting with a lot of diverse groups and talking about the metric issue, and most recently I think I found the strongest reception to my comments when I emphasized the point that I think Jim made earlier that in Monday "Quarterbacking" on the 1970's one could say that the failure to differentiate between social metrication and industrial metrication did us in.

When I look at the files of letters that came to the government in that period of time, and incidentally anybody who writes to the government about the metric change, probably the letter winds up ultimately in our office in Commerce; that is they write the executive branch, and many of the letters to congressmen come to us as well.

But those letters in the 1970's opposed and

were concerned with the invasion of one's personal comfort zone, the social metrication was what made everyone disinclined toward the change. Had we differentiated between social metrication and industrial metrication at that time, I think we might be much farther along today.

The reception publicly that I get from advancing industrial metrication separately from social metrication is positive on all fronts. I think it has a lot of to do with the reception that the issue has had.

Secondly, the wisdom of incorporating this legislation in the Trade Act was subtle but extremely valuable.

The argument that I go forward with now that this is a trade issue makes it acceptable in quarters that it would not have been acceptable in before, including a community you all know a lot about, the technical standards community.

All too often I think people have failed to recognize that the metric system is a standard. It's a standard and that standards are the vehicles by which science and education and technology gets advanced, that's the pathway, those are the highways.

They are terribly important and as the world shrinks they are becoming increasingly important.

Let me make just a quick comment on that, just to give you some insight, in 1970 the United States had approximately 15 percent of the world's manufacturing trade, our share of world manufacturing trade was about 15 percent in 1970.

At that time the Japanese had nine percent. Today the United States has just a little over 10 percent of the world's manufacturing trade, from 15 to 10 percent and your mathematics will tell you what a drop that, and Japan at the same time has gone from a little over nine to over 13 percent.

More startling the east Asian tigers, you know them, have gone from 2.3 percent in 1970 to 9.2 percent in 1987, and of course, those trends are continuing and that's a sign that we as a country are stepping back out of our role of dominance in manufacturing and that has a lot to do with our participation in the international standards.

I wanted to open my remarks with that because I think those are the compelling arguments that make it necessary for us to be here and to have meetings like this one.

Let me start quickly and reiterate what Jim said about the driving factors on the law. I am not going to repeat them, but those are the commentaries in the Act

which of course drove the Congress to accept the legislation.

The obstacles to metrication in the United States, as I mentioned, were essentially concerns about social disorientation. There was a strong feeling of nationalism, the United States was extremely dominant in world trade and other areas, our competitors, other nations didn't own our banks and didn't buy up our factories like they are today.

We were in a much dominant position. We were able to take a nationalistic approach and say, well it's our system and we are the king of the mountain and therefore we are going to stay with it.

That evidence was clear, there was a concern about industrial disorientation. My background incidentally, I worked 20 years with the John Deere organization, working with them around the world, and I can tell you that in switching to the metric system there is a lot of industrial disorientation involved and it takes effort to go out and do it right.

On the other hand, introducing inch products into Europe was a tough job for me as well as Latin America and other parts of the world, and in fact there is a much serious disorientation because it was a minority when we were trying to do that.

So one has to see that in the perspective of disorientation. Obviously, the laws and the regulations, just take the building codes for example, the things that you are all going to grapple with, I incidently don't diminish in any way the enormity of the task that faces your industry and the specialties that you represent. I think it's an enormously difficult task.

It's one thing to say let's not do it because it's difficult, and it's another thing to say, let's not do it because it's wrong.

I think everyone tends to agree that it's a good thing to do, it's just how do we get there and that's the task at hand.

Laws and regulations, I mentioned building codes, but there are many others. Somebody mentioned FPLA, the Fair Packaging and Labeling Act, that's a complex issue, and invaded by both -- I say invaded in a nice way, I think they are managed in one way or another by the Food and Drug Administration and the Federal Trade Commerce, but there are differences even among those agencies to resolve the problems of packaging and labeling.

To make U.S. goods acceptable in the world markets, they are certainly not only going to have to be labeled in metric, but as we heard earlier, very wisely I

think, they are going to be packaged in metric sets or modules that are logical in other countries, not simply translated, and of course, logical in our own country as well.

I would like to mention in that regard also, when you come to costs, time and again we hear enormously overstated estimates of the costs of converting. I will go back to the Chirpick report, the report on SI metric radiation units that some of you may have seen, but there are some cost estimates in there that echo those that I have said seem for the last 15 years, orders of magnitude, sometimes two orders of magnitude larger than ultimate expenses that are involved.

So it's very popular to discard the notion of going to metric simply because of the cost is overwhelming.

Incidentally, I think unfortunately very seldom do I hear the question, what are the costs going to be if we don't? Perhaps that is the concern that needs to be put in the same equation, very often it's ignored.

The options of course to the country and were to evolve on a national basis. We have in the '75 Act what I call "federal lip service" to metric. We could be mounting a modest federal effort, let the government stand by and let private industry push the whole thing.

The government might get very aggressive and become very demanding on industry, or we could have, as Jim alluded to, new legislation that is far more compelling.

It is our own view that somewhere between three and four is where the logic will be accepted by the American public and that's the kind of program we have mounted into what modest effort we give this matter in the Department of Commerce.

Let me show you what we are doing. We said there is a need for federal metric leadership. There is a difference between leadership and mandate. We are not mandating anything to the industry, but there is a need for a partnership between government and industry, to get together and say -- just as you are doing in a meeting such as this, how can we work together to get this done and what's the best schedule for us to do it and let's get over the question of "whether" and start talking about how.

That's the reason that we think that there is this clear need for federal metric leadership because we have heard for years, people would say, well, I would go to metric if the law said we should do it, we would do it, but as long as the law is flexible I am not going to do it. So people sat there and watch each other while we

lose our share of the worlds' markets.

First of all, we are reorganizing the Interagency Committee on Metric Policy which was mentioned earlier, and reenergized the Metrication Operating Committee, which is a member of that committee, and it's meeting quarterly and its executive committee which I also chair is meeting monthly.

We also have, and I will show you later, a series of task forces established within that structural group.

Now it's not the point of the ICMP or the MOC to direct federal metrication. It's a body through which the activities of the Federal Government can be coordinated, so that, particularly to the public perception, the government appears to be working in concert and not in disarray as they approach the metric issue.

We have set a series of tasks up for each of the task force within the Metrication Operating Committee, we have been examining and we have asked for input from all of the members for any regulations, any laws that are on the books that are not in keeping with the current new legislation, they certainly have to be resolved.

This is an excellent body through which that

can be achieved, and we have got to look at any federal legal barriers. There are such things as in the weights and measures area, there are things with regard to building codes and other, EPA regulations, and certainly those within your own organization, where there is going to be conflict between local and national regulation and law that have to be resolved.

This body hopes to be and tries to be a clearinghouse for that kind of conflict.

I will just so you have quickly the make up of the agency, this picture at least gives you some idea of the diversity of concerns and problems and interests that are expressed in an MOC meeting. It's almost difficult to set an agenda for that meeting because each of these people has a very, very different perspective and a whole different set of problems to deal with.

We certainly don't try to understand all of those in the committee, but to the areas in which they overlap and which they have to interact, we hope that having a committee such as this makes such interaction more successful.

We made a very strong effort to get the Office of Management and Budget participation. It may be interesting for you to know that in its earlier life, the Interagency Committee on Metric Policy didn't have a

member from the OMB.

The OMB sort of stood aside. We have been very pleased to see them now come into the committee aggressively and I have in my hand two documents which have just been issued on the 30th of October to the procurement community throughout the Federal Government from Allen Berga, the Deputy Administrator and Acting Administrator for the Office of Federal Procurement Policy in the OMB.

These are the first two solidly pro-metric, supportive documents coming out of the OMB that I have ever seen and I think it comes from the fact that they recognize the inertia that's building on the issue and have come forward and taken a very positive and supportive stand on perhaps modifying the Federal Acquisition Register and certainly with a letter of encouragement to support the legislation.

We are very pleased to see that we have a very active member from the OFPP on our executive committee of the MOC and I think that will help the agencies to know that the OMB is giving them support.

I have mentioned the other points, the update of measurement sensitive laws such as the FPLA, promote state and local accommodation and we have also got to take a view, I think some of you who are active in the

standards community recognize that the United States' participation in the international setting process is not as strong as it could be.

Jim Turner mentioned it. It is a very serious concern that we do not carry the united voice in Geneva, to the ISO, to the EC and also in Brussels to the EC where the new standards are being drawn and should there be a unification of East and Western Europe and should that body of people be drawn into the SEN and SEN elect body of standards, U.S. votes on international standards would be enormously reduced in power and we might be forced into metric in areas we hadn't thought about, such as ICAO, the control of flight regulations.

The rest of the world very nice flies in feet and altitude and one of these days they might insist on flying in meters and I think when they have all the votes they could do that. It's a good illustration of how our own position in the world marketplace could be influencing our ability to sustain the system as we might like.

Certainly, it was mentioned, The American National Metric Council, there is another organization, U.S. Metric Association in California that focuses on the social side of metrication more and on the educational side, but the American National Metrication Council

represents U.S. Industry, it's membership is growing.

Their annual conference this year had the largest attendance in seven years and it was very well attended by government people as well.

We certainly try to work with the state and local governments. The Secretary of Commerce has written to all the governors and we have had very fine feedback from them, indicating that the states and the Federal Government should be working in concert as they implement the trade act.

We don't have any problem recruiting the technical community. When I meet with the technical people, they all say, I understand the metric system, it's great, it's marvelous and I am all for it, but not too many of them are anxious to get out on the beat and take the flack of getting involved in the change itself, and there is an obligation on the science and engineers in this country, and certainly I feel one as an engineer, I ought to be out helping those who don't understand the importance of this, to move it along a little faster.

The educational community has come back in droves now that they see that the Federal Government is serious about this and they see a much faster trend of movement toward metric in the U.S. industry, educators I think will respond quickly. They have always favored

metric, but they came strong and had to back off as others did in the 1970's.

Of course, I mentioned the National Metric Conference, first held this year and it was very successful.

I have meeting regularly with SAE, ASTM, with ASME and the other principal standards writing bodies as well as NAFC, trying to get them to revise their own internal metric policies. I just did an article in the October issue of SAE's aerospace industries magazine and as I said, three years ago they wouldn't even have talked to me on the phone about.

So the standards community, the technical standards community is changing their attitude toward metric and they are becoming much more supportive and much more proactive than they were.

Principal companies have always been active if they were involved internationally. When you have principal companies that are not involved internationally, they have not been as supportive, but now they are seeing the competition is not whether they sell overseas, but who is taking their market here.

It is interesting, most of those products that are taking their market here are selling metric products and the American don't seem to mind them at all, so there

are some strategies occurring with major manufacturers, even those who do not export.

We are trying to establish an industry advisory function within the Commerce Department to keep an ear to the ground and sort of an organized way and certainly, I mentioned the concern about influencing the international standards, as some of you know, a body of people organized by the Secretary of Commerce just went to Brussels and Paris recently to review our participation in their standards activities and to see if we can't have a larger voice in some of the formative stages of the standards that are being generated in Europe now.

I won't dwell on this one, but obviously we do have to get to the people who write texts and tests. Teachers understandably are guided by those two documents and tests and texts are critical. If the tests contain no metric questions, there is not a great deal of incentive for educators to make sure that the students are totally competent.

They get in the work place and they are not competent in metric, they are going to find themselves disadvantaged increasingly.

So we have been trying to work with the tests and text community and not just talk about it in science and math and physics, but in geography and the social

sciences, in shop and in home economics, courses like that, to introduce metric.

Incidently, we don't argue for converting those documents to metric only. We argue that we are going to be a dual society for a long time and that we should -- people should come out of our school system totally comfortable in both languages.

There is no reason why they can't, other countries do a very good job of that in foreign language, much better than we do and it doesn't seem to cause any great confusion.

Small business is extremely important. The SBA is represented on our committees very actively, but we are also seeking other means of having small business representation. It's very easy for a bigger company once they get their chiller turned to start moving, but we have to find ways to help the smaller people along, and I think the larger companies are very important to that.

Many, many small companies make their living selling to larger companies, so we hope to induce the larger companies in the country to encourage and support conversion of their smaller vendors and the small companies on whom they impose their contracts. That's also true of the government.

I might just mention quickly, the GSA has

published their own plan. It's a terribly important area for all of us to recognize in terms of procurement. The GSA has put forward a very progressive plan of their own introduction of metric into federal procurement and they are specifically putting provisions in to deal with smaller businesses so that they don't get locked out of government contracts.

I think the DOD's policy will have to be strengthened in this area as well.

If special financing is going to be needed, then I think there may be the possibility of some very special legislation. Chairman Lafalse of the House Committee on Small Business has already raised that issue with us in terms of metric conversion costs for small businesses.

Public awareness is something that we are not doing very much of because that was one of the major activities carried on by the U.S. Metric Board, incidentally, that board still exists in the law you will note, but it doesn't exist in fact. It has no budget.

The responsibilities of the U.S. Metric Board were moved to the Commerce Department by President Reagan and we have a small office in commerce that is doing everything that that board tried to do. This is one of the areas they worked in on a very large scale, we have

virtually nothing going on.

So the private sector and the individual agencies are going to have to pick up this as a part of their program to improve whatever public awareness is necessary, they are going to have to do it, because the Commerce Department is not budgeted, as was the U.S. Metric Board, to deal with some broad scale general public awareness programs.

Of course these are the kinds of things that we would focus on as best we can. I deal a great deal with the media and we think -- the media I am talking about there is funding for printing and publishing and that sort of thing, but I deal with the press to answer questions and I would echo Jim's comments that interviews I have on radio, newspapers, have all been on the plus side in the last year where they used to be very, very negative.

The subcommittees, just so you know what they are, we will leave a handout with Zoltan in which we can put in the minutes of this meeting which shows you what the -- we have chosen as the principal overlapping of common concern areas within the Metrication Operating Committee. These are concerns that would tend to affect many agencies. So we have established a subcommittee with its own charter for each of these agencies with a

chairman coming from an area that's principally concerned with that particular activity.

We have talked about making some additions and changes to these in our meetings, but basically this is it.

There is a document again which can be made available to the federal community, it's available through NTIS, it's the Metrication Handbook for Federal Officials, it's in one document you do have all of the necessary reference materials including federal standards from the GSA and the various historical documents that I think probably would be helpful to anyone in an agency who is responsible for coordinating the metric program within that agency.

I put this here as sort of a stimulating question mark. The question really is what is going to happen in this country with regard to metrication? This is a projection. It represents a consensus that we have made in talking with a lot of people and it's interesting to see that we have shown the Federal Government metrication as being the leader and I think you can see that the industry and the general public will follow government leadership.

I think -- to presume that the private industry is going to lead the government in this thing was an

assumption made earlier which has not been successful and I think that was made very clear in Jim Turner's comments to you with regard to the need for federal leadership.

I just want to take one more minute to talk quickly about this document. I don't know, Zoltan, how many people in this audience will have seen this report. It is the report of the committee established in 1985, the wrote the report in 1986 recommending the practice with regard to SI units in the area of nuclear radiation and nuclear science and I think -- I would just commend it to anyone studying the issue to reread this report.

It cites the issues of safety, the issues of problems of transportation of nuclear materials, the problems that have been discussed with regard to costs. But it does summarize in the end that the subject should be revisited in five years.

It was written in 1985, I do recommend highly that this group do something to promote the revisiting of this report and updating of it in terms of current law.

CHAIRMAN ROSZTOCZY: Gerry, since you mentioned that report, would you please read into the record the exact title.

MR. UNDERWOOD: Yes, it is the Report of the Committee on Interagency Radiation Research and Policy

Coordination on SI Metric Radiation Units, published in December of 1986, and it was issued by the Office of Science and Technology Policy, Bill Graham who was the science advisor to the president at that time on December 31, 1986.

CHAIRMAN ROSZTOCZY: Thank you very much. Up to now you heard from Federal Government representatives and now we are going to turn the microphone over to the industry.

The next two speakers represent various sections or various segments of the U.S. industry. The first speaker, Mr. Baker, is from Amersham Corporation who represents basically the manufacturer in the industrial uses of nuclear materials and that will be followed by Joe Colvin who will be talking about the nuclear power industry.

MR. BAKER: Thank you. Good morning. As you heard, I am with Amersham and Amersham is an international supplier of products used in life science research, medicine and industry, and many of these products are radioactive or the components of the products are radioactive.

Our company is a member of the U.S. Council for Energy Awareness (USCEA) specifically the radionuclides and radiopharmaceuticals committee and this was formally

a committee of the Atomic Industrial Forum.

This is an industry committee and includes the following companies: Amersham, Dupont, Mallinckrodt, Medi+physics, Squibb and Syncor.

Most of these member companies are international. I have been chairing a subcommittee of this group looking at conversion to SI units, the subcommittee has been in existence about two years.

For background information. I am a chemist by training and have worked in the labs at Amersham making radioactive chemicals before going into technical work and then at the present time, regulatory affairs.

As you have already heard several times this morning, most countries in the world have adopted the SI as the primary system of measurement, including measurement of radioactivity. Some countries, including those of the European economic community had established a certain date beyond which time only SI units could be used.

The EEC, the European Economic Community had originally established 1990 as the date when SI units only would be permitted and then a couple of years ago, they extended that date to 1992 but earlier this year, they have proposed that dual labelling, the use of both conventional and SI units would be permitted until the

end of the century.

That particular proposal has yet to be ratified by the EEC but it does seem that this proposal is likely to be adopted.

If some countries are going to require SI units only and others are going to require conventional units or both units, this will present a real problem for international suppliers of radioactive materials.

It means having two sets of labelling for every product and really preparing two batches for each product. This is particularly a problem for the research radiochemicals and organic compounds containing Carbon-14 or Tritium because batches of these materials can be stored for a long period of time. Relabelling is not really a viable option, particularly some more energetic images because of the radiation dose that would be received by the operators and it's difficult to forecast for a market like this the actual number of packages that would be supplied in say SI units and those that would be required in conventional units.

This problem can be solved for international suppliers if in fact the United States does adopt SI units.

I turn now to awareness of SI units in the markets that the companies are serving. There certainly

is an increasing awareness of SI units in the U.S. scientific community. A number of scientific journals now require the use of SI units in articles submitted to them for publication. The companies in the USCEA group that I had mentioned are using dual labelling, that is, SI units and conventional units in the labelling of the products, in the literature that accompanies the products and in all aspects of labelling.

Our company, Amersham has been doing that for 12 years, but we still get questions from user of these products. They want to know what is a Bq and what is a becquerel.

So we do feel that there does need to be a greater awareness of SI units in the United States before a switch to SI units only is made, and the members of that group, we do propose to continue using dual units until the end of the century when they would not longer be permitted in Europe.

The USCEA had developed an educational program designed to be used over a three year period, prior to that date, when SI units only would be used.

The core of that educational program is a brochure and we may well proceed with the development of that brochure, but we wouldn't plan to implement the educational program itself until the late 1990's. We

still envisage a three year program at that time, that would consist of mailings to editors of journals, to users, people who would be ordering these materials, and having information booths are scientific meetings.

To answer one of the questions in the Federal Register publication, Amersham and the other member committees of the USCEA committee on radionuclides and radiopharmaceuticals are in favor to conversion to SI units if you haven't already picked that from what I have said, but as we already indicate, we feel that there needs to be a greater awareness of these units before they are used exclusively.

We had written to the NRC and agreement states in September of 1988, requesting the use of dual units on licenses and amendments. We had noted that dual units were used in some places in the regulations and our first request that these dual units then be used in the issuance of licenses and amendments to help familiarize users with these units.

At the time that letter was written we were expecting to have to convert to SI only units internationally in 1992 and we were proposing to go with a straight conversion, in other words, a one mCi package would be labelled and supplied as 37 megabecquerels.

However, we think it's quite likely that users,

particularly those in the life science area would favor rounded units, but which we meaning increasing the one mCi package, 37 megabecquerels up to 40 megabecquerels, an eight percent increase.

Our company, Amersham has in fact used an eight percent rounding in the radioactive standardized solutions that we supply and these are used principally for instrument calibration in the nuclear power industry.

We have been doing that for several years, although these are admittedly nominal values, for example, instead of supplying a 50 microCurie package, we have been supplying a 2 megabecquerel package, instead of 5 microcurie, saying 200 kilobecquerels.

The microcurie equivalents are also provided on the labelling and the accompanying literature.

We feel that the advantages rounding, it would be easier to reference a multiple of 10, there would less likely to be errors in working with a multiple of 10 and it would certainly be easier for people requisitioning material.

Our second request - I am going to discuss industry perspective on SI conversion for medical and industrial products in my talk tomorrow.

Our second request to the NRC and the agreement states, was that when the licenses were issued or

renewed, that the licensed possession limits be increased by eight percent in anticipation of the rounding up package sizes. Thus, if a licensee was requesting to possess and use five millicurie, that is 185 megabecquerels of a radionuclides, then we were asking that that license be issued for 5.4 millicurie, 200 megabecquerels, with the eight percent rounding.

We envisage that these changes would help familiarize licensees with SI units and facilities the transition to SI units only.

Certainly one of the benefits in using SI units in the life research area is the fact that a direct conversion of count rate to becquerels when a correction is made for efficiency of counting. So that's certainly a benefit.

To summarize then, we do favor a conversion to SI units. We do favor the use of the dual units until the end of the century, and we feel that it would facilitate the transition to have an eight percent increase in licensed amounts to cover the rounding up of package sizes.

CHAIRMAN ROSZTOCZY: Thank you very much, Mr. Baker. Our next speaker represents the Nuclear Nuclide Industry and Nuclear Manufacturers, basically in the power industry, Joe Colvin from NUMARC.

MR. COLVIN: Thank you and good morning, ladies and gentlemen.

I am Joe Colvin, Executive Vice-President and Chief Operating Officer of NUMARC; and I am particularly pleased to be here with you to talk a little bit about the industry perspective on the conversion to metric units.

I think it's appropriate for NUMARC to be involved in this, and for those that don't know NUMARC, let me take just a moment.

NUMARC, the Nuclear Management and Resources Council is the organization, association for the industry that coordinates the industry's resources to resolve generic, operational and technical regulatory issues, and to do so with the Nuclear Regulatory Commission and the other government agencies.

So we are here trying to work for the utilities primarily. We have 54 utility companies, that's 100 percent of the operating nuclear utilities in the United States, along with the major architecture engineer firms and nuclear steam system suppliers.

Before I make my comments however to give you the disclaimer that Jim Turner gave you, it's interesting the analogy between the industry and Congress, and I am not sure I want to point that out too often, but like the

congressional committees, we have differing views from the industry that go from the right to the left, between the 54 utility companies and also from the manufacturers and suppliers.

So for the most part, these views are my views, or the views that people that we have talked to, and I think we will present, if I can say, that the coordinated industry viewpoint and the public, tying our comments to the policy statement when that arises.

You are going to hear today for the most part the recommendations for future plants and recommendations for existing, and what I would like to do is just talk on what I consider the overall industry perspective on conversion, and you are going to hear from speakers that know a lot more about this subject than I.

Tom Price is here with me from NUMARC and asked me to speak, and it came down to the fact that everybody else in the office that knew anything about this already had a better excuse than I did, so I got the job.

Let me -- if we talk about the move to metric, fundamentally, I think that at some time in the future and it looks like we are moving in that direction, that the world is going to function under one system of measurement.

I was interested to find out that there are

only three basic countries, the U.S. being one, that hasn't moved in that direction and it's clear that that system is going to be the metric system and with the SI units of measurement.

Most of the world already uses it, it's too bad, most of the world has already used it for a lot of years, longer than we have, so they had an easier choice.

Clearly, the United States Government has indicated its belief that we should go metric to be competitive and to encourage international trade and I think that's the right way to go.

I also believe that the utility industry for the most part agrees. Where there is a need and a corresponding benefit, we are already moving in that direction.

You have heard a little bit from Mr. Baker. We also, in the area of international comparisons between utilities, through the Institute of Nuclear Power Operations, established a lot of overall industry performance objectives.

We have been using international units in a few areas already and that has caused some confusion in radioactive waste when people tried to compare what they thought were cubic feet of volume, of radioactive waste disposed of or sent to the radioactive landfills when

actually the units were cubic meters and it caused inordinate confusion among a number of utilities until we pointed out that in fact we had already converted to cubic meters so we could compare internationally.

There has been a lot more work in that area done and I don't want to dwell on that, but we are working with, the U.S. industry is working through the Electric Power and Research Institute, INFO in Atlanta, with the international utility organizations worldwide through UNIPED and so on to establish some comparisons of measurement utilizing international units, using the SI units.

So I think we are clearly moving in that direction, and I think it is only a matter of time. I think the timing, as was said many times, is really everything.

So when you look at going to the metric system, I think we need to look at first of all, several questions: Why should we convert? What's the driving force for conversion? When should we do that and then probably the most important is how do we get there from here?

Perhaps an overview from the industry's perspective on our national nuclear power program: we developed that technology in the United States over the

past 30 years: the concepts, the designs, the infrastructure, we have got computer codes, equipment and everything was designed, constructed and operated under U.S. standards under the English system of measurements.

We currently have 112 plants that licensed to operate and we have a couple of more that are real close. Today's article indicated that Seabrook Nuclear Power Plant has been given the go ahead to commence full power operations in January, so that will bring us up to 113 units.

We have got a huge infrastructure today, not only to design and build, but to operate, maintain and refuel the plants we have.

I want to underscore this by the fact that we have a major multi-billion dollar industry out there and we need to really consider seriously how we go about the conversion to metric so that we don't impact that in any negative way.

We have already heard about the driving force from Congress. I think it's pretty clear. I still wish Jim Turner was here, I still would like to understand the issue a little bit more about business related and non-business related. I think that's going to be an interesting viewpoint as we proceed.

It's clear that the NRC is moving in that

direction and we are here for this workshop and I think the NRC will be a driving force in the conversion of the industry in many ways, but I think we want to help the NRC how best to proceed in that area to minimize the impact.

I think also the driving, like everybody has mentioned, the driving force in this realistically is going to be the international market, the competitive market, and we have seen that even within the industry from the supplier's side and we will hear more about that later.

Let me take a second and get into existing plants and the question of should we convert existing nuclear power plants to metric or maybe when should we convert.

I guess it's my point of view that we should not move to convert existing power plants to metric. I think that's one, inadvisable; and two, I don't think we should consider it.

Let me make a couple of points as to why I believe that. First of all, I don't think it's going to enhance the safety or efficiency of the plants and in fact, may have some negative potential in fact on safety.

Dr. Beckjord's comments about thinking in Pascals is difficult. You know, from being an operator I

have the same concern. When we move in to try to get our control room personnel and those that are actually operating the units to think inherently in a different way.

We have been working for many years on trying to get the people that operate the plants to have this understanding, this innate feeling, this engineering judgment when they operate the plants and I think that would be much complicated when all of a sudden the man would look at his units and see liters per second and say, gee whiz, how that does that convert to gallons per minute or Pascals to pounds per square inch.

So when we look at that, just from an operator's standpoint and the people that are operating our existing plants, I think we need to carefully consider the impact on them, on their training, that was on the chart that Dr. Beckjord put up.

So I think that when we look at that, if we could see a clear benefit to that conversion of both the training, the labeling in the plant, the meters, the system, then perhaps there would be some advantage.

I don't see that there is an economic advantage to the U.S. utilities either, those that already have the existing plants, and I think we need to look at the question of backfit.

Do we really want to consider or should we consider, when we are talking about existing plants, backfitting the actual plants, the instrumentation, the procedures, the training programs, the labeling, et cetera and so on and so on.

Perhaps if we are talking about simply taking the units or the reports that go into the Nuclear Regulatory Commission, the mandatory report, need to be converting those to metric, then obviously that's a different thing.

I think it is much analogous to the examples of the automobile. We have many automobiles that are built with English units still on the road and we are not going back and converting all the bolts and nuts in those systems in those cars to metric; to do so is not reasonable and it doesn't make good common sense.

So I think we have to perhaps view the existing operating plants in the same way, and where there is a benefit then we ought to convert.

I think in the areas of radiation protection, radiation units, it's probably much easier to look towards converting and many of our people are already using international SI units in those areas as was pointed out earlier.

In the area of future plants, you are going to

hear more about that from people who know more, I just want to make a couple of points. The industry, through the Electric Power and Research Institute is developing the design criteria, the actual specifications for future reactors, and in a set of guidance documents, the U.S. utility industry working through EPRI is specifying to the vendors and to the suppliers for the future exactly what its needs are in many areas.

So that work is in progress. We have got a number of new reactor designs being proposed by the various vendors and you will hear more about that later.

In fact, the U.S. vendors that are marketing U.S. plants overseas, my understanding is they have already been doing this dual conversion units, but they do the design in English units, do the computer codes in English and they do all of that work in-house because there is no benefit to go back and try to change the codes for example, and to try to reverify and do all of that, and yet, we are still coming out and the end product is a design that is equivalent in metric units.

So again, I think the drive for conversion must be balanced against what is the benefit versus the impact.

I think from the -- I was really pleased to listen to Dr. Beckjord's comments this morning about the

approach the NRC would use. Clearly, the NRC has at its options, options from one end of the spectrum to the other of mandating these requirements all the way to encouraging their use and I think that if the NRC can provide an open regulatory structure, as I think they are intending to do, that's going to provide a lot of benefits for the industry and the nation.

I think we are going to see the conversion develop as the market dictates. We are going to see domestic vendors change as they see the need. We are going to see domestic utilities considering shifting where that need gives them -- where that results in a benefit, and I think we are going to see the safety and efficiency of the operating plants continue with a minimum of negative impact.

So I guess in conclusion, let me say I think our existing plants ought to remain as far as the operation and as far as the design and the backfitting sides of our operating plants ought to remain in the English units and perhaps our reporting could go to the other -- to the new SI units.

I think that we will see how that approach works in the future plants and I will leave that discussion to others.

I thank you for the opportunity to talk to you

today, thank you.

CHAIRMAN ROSZTOCZY: Thank you, Joe. I think I would like to propose now a coffee break, so we could break for about 15 minutes and reconvene at 10:40, and then we will finish up the remaining three speakers and we will have our discussion on this session.

(Whereupon, a short recess was taken.)

CHAIRMAN ROSZTOCZY: Independently, what we represent, the industry or government, we are all working with codes and standards.

Fortunately, there are a number of organizations who are very active in developing this code and standards and updating them for our use.

We have one of these gentleman with us today, Mr. Fisher from the ASME who is going to talk about codes and standards.

MR. FISHER: Thank you, Zoltan. Good morning, ladies and gentleman. It is indeed a pleasure to be here.

It would be a pleasure even if I weren't to talk about metrication and codes and standards; but since I am going to talk about subjects I have a long time interest in, it gives me double the pleasure as the chewing gum advertisement says.

Metrication and codes and standards are

inextricably related since so many codes and standards are measurement sensitive. It is great that the NRC has seen first to conduct this workshop.

For too long this country has had an isolationist view about metrication. I have heard people say that we should say with our inch system and let the rest of the world change to our way.

That view could never had validity, but now in view of the rise of other country's expertise, it causes it to be a ridiculous statement.

Generally, the world will accept the measurement system of a country in a particular field if that country initiates and dominates in the technology of that field.

The United States is not in that position in sufficient fields to have our products continue to be accepted if they are built by what the rest of the world considers an odd ball measurement system.

The argument has been that it is too difficult to change. Well, I have news for those putting forth that argument: the news that it will soon become too difficult not to change and further, the longer we wait the more difficult it will become.

The conversion of the U.S. to the metric system is merely a continuation of a process which started in

medieval times. At one time, each fiefdom had its own measurement system; however, when it became expedient to trade with each other, they found it necessary to adopt a common measurement system.

We now have the same reasons, plus others, such as communication and travel. As the world shrinks due to better transportation and communications, and as world trade increases, it becomes essential that we all use one measurement system.

When trading consisted mostly of bulk products differences in measurement systems were not as troublesome. Bulk products can much more easily be converted than complex machinery in which dimensions are important in every part.

EC '92, the European Common Market plan, to eliminate all the trade barriers by the end of 1992 is giving new impetus for the U.S. to go metric.

There is concern that when trade barriers are taken down the Europeans will be able to trade with each other so easily that U.S. goods will not be in as much demand.

Their trading will be further facilitated by the completion of the English Channel tunnel. Along with this tunnel will be a high speed rail network with trains running at speeds up to 185 miles per hour.

Therefore, we need to find ways to make our products more desirable to the Europeans.

Twenty-three of our exports now go to Europe and that could change, one of these is for our products to be designed and manufactured in metric units.

U.S. codes and standards writers have generally been in advance of industry with regard to metrication. This is because is it easier to metricate a code or standard than to metricate an industry.

There are various levels of metrication to make coder or standard. So when you hear it said that a code or standard has been metricated, that's not enough. You have to ask questions to learn just what the speaker means.

The simplest, which really can't be called metrication, is to merely put conversion tables in an appendix and let the user do the conversion. The next step is to put the metric value in parentheses following the customary value.

This can work but it usually leaves the user with an odd metric value. Also, it's usually necessary to include the proviso that in case of doubt or conflict, the customary value controls.

Sometimes people will show both customary and metric units in the hopes it would cause the user to

become familiar with the metric units.

This doesn't work since the user will merely ignore the metric value unless he has a compelling reason not to learn it.

The next step is to put the metric value first and the customary value in parentheses. This is often used when the code or standard was written originally in metric.

Most U.S. standards now show English units with metric in parentheses. Some merely have metric conversion tables in an appendix, but others have been hard converted.

ASME has been a leader in the conversion of its codes and standards to the SI metric system. The major effort was when a separate interfacing SI edition to the boiler and pressure code was published in October 1983; but unfortunately it was discontinued after September 30, 1986.

All sections, with the exception of parts of Section 2 were issued in the SI addition. The SI edition to the boiler and pressure vessel code was published -- excuse me, I have to talk some of this. This is really cough medicine.

All sections, with the exception of parts of SI Section 2 were issued in the SI edition. The SI edition

of the boiler and pressure vessel code was published, it was a request from the Canadian Boiler and Pressure Vessel Committee.

To accomplish this conversion, the ASME set up an organization of 23 staff engineers and numerous main committee members to prepare and review the conversion of text, figures and tables over a three year period.

The review process by the committee of volunteers was essential to verify the technical accuracy of the final product. The SI version was discontinued because the Canadian federal law that was intended to implement SI regulation was not enacted.

Further, there was insufficient demand for SI version from others, to warrant maintaining this version. It could be revived, by ASME would need assurances that a sufficient demand exists because this is a very expensive process.

Some examples of what has been done by standards writers are the National Fire Protection Association, who show in the fire codes inch units followed by metric, but state the inch units are the required value, and the metric units are approximate.

The American Welding Society and the structural welding code for steel, shows customary followed by metric.

ASEM publishes some standards with no mention of metric and other standards with customary first and metric in parentheses.

Presently, the boiler codes show customary units with conversion tables in the appendices.

This is also true of the Uniform Building Codes. You may hear discussions concerning the old metric versus SI. The codes and standards in the U.S. that have been converted to metric, to our knowledge, have been converted using SI.

Also, most foreign codes are in SI; however, in commercial transactions, the old metric often persists. The bar for pressure is often used, and it is not truly SI, but since it represents 100,000 Pascals, the use of the bar doesn't create a serious problem.

A conclusion one needs to draw is that the modern day professional must be bilingual with regard to measurement systems just as professionals in other countries find that it is necessary to include English as one of their languages.

Thank you for your attention.

CHAIRMAN ROSZTOCZY: Thank you very much, Mr. Fisher.

Our next speaker was scheduled to Mr. Quillan, who was unable to make it and instead of him we will have

Roland Fletcher from the state of Maryland, to make a few remarks about states involvement in the metric conversion and the difficulties that they have.

MR. FLETCHER: Well, many of the speakers have been able to point out organizations that they represented and then promptly disclaimed that any comments that they made were a part of that organization, I am here to represent at least three organizations. I am not sure which one I am going to disclaim yet.

(Laughter.)

But the comments that I am making apply in part to the Conference of Radiation Control Program Directors which represents the 50 state radiation programs.

The agreement states, which represent about 29 states which have an agreement with the Nuclear Regulatory Commission to issue our licenses to radioactive materials users and the state of Maryland.

Maybe I should explain that one, but since I am the program administrator, they will have to live with what I say.

One of the things that I have heard this morning, and I think maybe in approaching the states you may want to modify the approach that you are taking, it would appear to a novice who might be sitting in here for

the first time that we all currently operating on a total English system and we have a big conversion ahead of us that is going to be monumental and we don't know how we are going to do it.

Quite frankly, if we look at many of the things that we are doing and looking at the base metric units, we are already well into the metric system, and what we are talking about now is a further conversion from where we are to where we are going and I think that would sell better with the states than to give the impression that they have got this big mountain to climb and very little tools with which to climb it.

I saw a slide that was used earlier today and I am going to use that to kind of point out the areas of state concern from my understanding that will have to addressed.

One deals with licensing activities. As I pointed out, Maryland is one of 29 agreement states. So if the NRC made a rule to convert all activities, to further convert or complete the conversion of all activities including the use of becquerels, Sieverts and Grays over rem, rad, renkin and curie, which everybody of course has become very familiar with, 21 states have no choice because they are a part of the Nuclear Regulatory Commission and the Nuclear Regulatory Commission would

issue licenses in those 21 states, they would automatically be on the same system.

But 29 other agreement states, as a part of the agreement, would normally have a three year period within which to implement the regulations that the NRC would adopt. So you are talking about from the time the regulation is issued by the NRC to the time that all 50 states should be onboard, a period of three years.

This would normally be considered an item of compatibility with the Nuclear Regulatory Commission. We get inspected of course or reviewed and if our programs are in keeping with NRC programs, then we are considered compatible with the NRC.

I am sure that any regulations for the total conversion into the metric system would incorporate this kind of compatibility.

So that's one aspect that the states would be looking at in having to develop their own regulations to meet those of the Nuclear Regulatory Commission.

As far as emergency response is concerned, I see one area that I haven't heard yet, I hope someone is perhaps going to address it, and that's the area of instrument conversion.

We have got instruments of various kinds all over the country and of various ages that reading renkins

and rems and rads and docimenters that do the same thing and if you say suddenly, okay, those units are no longer acceptable, you have got state programs with some money problems and you have got emergency response activities who either have to come up with some way of taping something over the dials so they get the units right, or coming up with some quantities of funds to make those conversions. So that's another consideration.

Regulations, once again, as I said before, regulation development would follow any rule adopted by the Nuclear Regulatory Commission.

Inspection activities, I don't think there would be any difficulty in adjusting any inspection requirements. Once again, you are talking about instrument conversion more than anything else, particularly for surveys. It's education, education and training of the staff. The NRC would adopting for themselves, I don't know if they recognize this yet, but they would be adopting for themselves a need to broaden their own training base.

Right now we receive considerable training as an agreement state through NRC sponsored courses. This would require almost an reeducation of the most of the agreement state staffs in order to conform to any regulations you develop. So that's another consideration

that should be looked upon.

Now there is one thing that I haven't heard too much of and I am concerned. I said I am representing the Conference of Radiation Control Program Directors which represents all 50 states, and when you think about all 50 states, think about the problems of interstate commerce now.

Think about the impact of putting another requirement and then not -- you know, if you say, each state do it the way they see fit, you maybe be complicating an already difficult interstate commerce problem.

I am just saying this for consideration in how this whole process might be implemented.

Quite frankly, that was all I wanted to say this morning. Thank you very much.

CHAIRMAN ROSZTOCZY: Thank you very much, Mr. Fletcher.

Our next speaker represents the education part of the community. He is a Professor at Maryland University and he is also a member of the American Physics Teachers Association. He has been very active in the metrication area and I understand he is writing a book or has written a book on the subject. Mr. Nelson?

DR. NELSON: Thank you very much. It's a

pleasure to have the opportunity to participate at this NRC conference.

In other to better understand how we go to where we are today, I would like to first very briefly review the history of the metric system; the legal basis of standards of weights and measures in the United States; and the evolution of the metric system to the modern version that is known as the International System of Units, abbreviated as simply SI.

Then I would like to mention my perception of the need for metric education and conversion and discuss units other than the meter and the kilogram that ought be made familiar to the public.

The metric system was created by the French Government during the French Revolution in 1795. This reform was in response to public demand during the 18th Century to simplify and standardize the system of weights and measures then in use.

The values of units used measuring cloth, produce and the like were so diverse and complicated that fraud was prevalent and the specialized skills needed in converting from one measure to another might be compared to those of a tax lawyer today.

As defined in 1795, the new unit of length, the meter, was a fraction of the circumference of the Earth

and new unit of mass, the kilogram, was the mass of a specified volume of water.

The standards for the units were therefore taken from nature. Also, the subdivisions and multiples of the units were based on the decimal system.

Why was the metric system not immediately recognized by the founding fathers of the United States as a major scientific advance and adopted for use here at that time?

First, unlike in France, the systems of weights and measures inherited from the British was fairly uniform if not completely logical.

Second, I imagine that the world viewed the French Revolution and it's reign of terror with alarm, much as we have witnessed the Iranian revolution in our own generation.

Also, the allegiance to French or British policies was a volatile contemporary issue.

Third, it was not clear that the metric system would last even in France. It was not until 1840 that the system was made permanent.

Nevertheless, an official review of the issue was made by John Quincey Adams as Secretary of State in 1821. In an exhaustive study entitled, "Report Upon Weights and Measures," Adams found that the measures in

use among the states were uniform and fair and there was no compelling need to conversion.

He appreciated the metric system as an abstract concept, but objected to the definition of the meter in terms of the circumference of the Earth which required a major scientific operation to reproduce it.

He also believed that the metric system had not reached sufficient maturity in France to recommend its adoption in the United States.

Domestic politics and the issue of states rights also played a role.

Once made permanent in France, the metric system proliferated through Europe in the middle 19th Century. The metric system was made legal in the United States in 1866.

A major advance in international cooperation took place with the Treaty of the Meter in 1875. Seventeen nations participated, including the United States.

The treaty established a general conference on weights and measures, the International Committee on Weights and Measures and the International Bureau of Weights and Measures.

At the first general conference in 1889, the meter was defined by the length of a new meter bar made

of platinum iridium and the kilogram was defined by the mass of a specific platinum iridium cylinder. These standards were copied from the original French prototypes representing the definitions. Secondary standards were also distributed to the participating countries.

In 1893 the superintendents of the U.S. Coast and Geodetic Survey in its Office of Weights and Measures, the forerunner of the National Bureau of Standards, Thomas C. Mendenholl authorized the adoption of the meter and the kilogram standards in the possession of the United States to be the fundamental standards of the nation.

The yard was defined as 36 hundred over 3937 parts of a meter and the pound mass was defined as one over 2.20462234 kilograms.

In 1959, the conversion factors in use among the English speaking countries were unified by international agreement. The new relations became one yard equals .9144 meter and one pound mass equals .45359237 kilograms exactly.

These definitions became legal by publication in a Federal Register notice on July 1, 1959. A more comprehensive list of equivalents was published on July 27, 1968.

It is paradoxical that our own customary units

are literally defined in terms of the metric units.

At this point I would like to remind you of my observation before, that the Title 15, Chapter 6 of the U.S. Code has not been updated to reflect these new definitions and that should be corrected by future legislation.

By 1948 the International Bureau of Weights and Measures was responsible for the units and standards of electricity, photometry and temperature, besides those of length and mass.

Various scientific organizations recommended the adoption of a comprehensive set of units to cover all scientific measurements.

A revision of the definitions to reflect advances in technology, the elimination of redundant units and the simplification of terminology was also recommended.

This modern revision of the metric system was given the name International System of Units, SI, or Systeme Internationale in the internationally agreed upon French version, and was formally adopted by the 11th General Conference on Weights and Measures in 1960.

In 1960 the meter was redefined as a certain fraction of a particular wave length of light emitted by the isotope Krypton-86. Measurements of wave lengths

eventually were capable of greater precision that the reproduction of the Krypton standard itself.

So in 1983, the meter was given its present definition in terms of the speed of light. The definition of the meter implies that the speed of light is 299792458 meters per second exactly by definition. The standard of mass however has remained unchanged.

The United States, Burma and Liberia are the only countries in the world that haven't converted to the metric system as was pointed out earlier.

Progress toward metrication is slowly being made. We heard before about the provisions of the Omnibus Trade Act, Public Law 100-418. I would just like to add that is poetic, that this important piece of legislation was passed by the 100th Congress.

I would like to consider now issues concerning metric literacy in this country. First, it should be recognized that every child who studies science in the public schools is exposed to the metric system.

Those who go on to study earth science, biology, chemistry or physics obtain a detailed understanding. Most people graduating from high school today therefore have some recognition of metric units.

Understanding however is more than simple recognition or familiarity and so therefore, we should

encourage our school systems to continue to do what they have and to do even more and teach out students to use the metric units with confidence.

Second, metric units are already used widely in commerce. Soda comes in two liters bottles. The mass of cereal boxes is given in grams. Automobiles have speedometers calibrated in kilometers per hour besides miles per hour and tools for automobile repair come in metric sizes.

I think the analogy of what has been done in the automobile industry is a good one and it has been mentioned several times, and should serve as a model for how conversion to the use of the International System of Units might take place in other industries.

Science is down entirely with metric units. The use of SI in particular is becoming universal and older metric terminology is phased out.

All new physics textbooks are written entirely in SI.

I would like to depart from my prepared words here for a minute and talk about something about the fact that textbooks today are using SI almost exclusively within the science fields and that our educational systems are doing a good job in testing students in the context of the metric system.

However, the same cannot be said for engineering. I think it is particularly unfortunate that NASA and the National Institute of Standards and Technology as the National Bureau of Standards is now known, have not used their public positions to enhance metric education.

Whenever we watch a launch of the space shuttle on television, it is absurd to hear its altitude described in nautical miles as though it were a ship at sea.

The NIST has also refused to distinguish mass and weight in its literature. Mass is the amount of substance and is measured in kilograms. Weight is the downward force of gravity due to the Earth.

You know, the way we think about things is influenced by the language we use. The more precise our language is, the more precisely we can think about things, and I think not to be able to use the proper terminology in the scientifically correct way in our everyday literature tends to sell the public short, and certainly NASA does have an opportunity to extend the proper usage of terms to the public by using mass and weight correctly along with the National Bureau of Standards, NIST.

Let me just add also a possible definition of

weight that is an alternative to the statement of the downward force of gravity due to the Earth. Namely, the force required to support an object, this definition would be consistent with the terminology as used in a -- would be consistent with the term "weightlessness" as we use it in space environments and it would also be consistent with subtle distinctions between various definitions that do or do not take into account the effect of the rotation of the Earth.

Now I would like to emphasize an aspect of metric education usually overlooked in metric policy discussions. The International System of Units goes well beyond simply the meter and the kilogram.

There are other base units and a complete set of derived units. The Newton is the unit of force and weight. The Joule is the unit of energy. The Pascal is the unit of pressure. These derived units have simple, coherent relationships to one another.

The Newton is a kilogram meter per second squared. The Joule is a Newton meter. The Pascal is a Newton per square meter.

Units such as the calorie for heat energy and the millimeter or mercury for pressure, although metric in origin are obsolete.

These units are not only redundant but they are

imprecisely defined. For example, there are at least five different definitions for the calorie and in connection with units of pressure for example, the millimeter of mercury and the tor which are often used interchangeably in the literature are not in fact exactly the same as one another if you follow through the way in which they are defined in terms of other quantities.

These are examples of how the use of SI makes language more precise.

Earlier it was mentioned that there are some other units that are permitted for use with SI and I would like to just mention them very briefly.

We have the units of the minute, hour and day for time; the degree celsius for temperature; the degree, minute and second of plane angle. Liter is not truly an SI unit, but it is regarded as a unit to be accepted for use with SI and the metric ton is also accepted for use with SI.

There are two other units: the unified atomic mass unit and the electron volt which are in the category of units used with SI whose values are obtained experimentally.

During the break I had a very brief conversation in which it was pointed out that the pound force is not properly defined legally anywhere. I think

in the revision to the table of metric equivalents this issue might also be defined explicitly.

But the pound force is to be distinguished from the pound mass. The pound mass is, as I said, defined as a specified fraction of the kilogram. The pound force is pound mass times the acceleration of gravity which assumes for this purpose a conventional value of 9.80665 meters per second squared exactly and doesn't necessarily correspond to any particular location on the surface of the Earth, and therefore, using the fact that force is mass times acceleration, the pound force happens to be 4.4482216152605 Newtons exactly.

This points out another example of how going to SI units where we have the Newton, a very precisely defined term; the Joule for energy, a very precisely defined term, you get away from either the imprecision of conversion factors or the lack of knowledge in the general literature as to how these conversion factors occur.

Now the entire set of electrical units with which most people are familiar is part of SI. These units include the ampheres, the volt, the ohm and the watt. The lumen used to measure illuminous flux of light is part of SI. For example, a typical 100 watt lightbulb is rated as 1700 lumens.

The unit of time, the second is also part of SI. Historically, time was measured in terms of the rotation of the Earth on its axis and later in terms of the revolution of the Earth around the Sun. However, in 1967 the 13th General Conference on Weights and Measured defined the second in terms of the transition of the Cesium 133 atom as maintained by an atomic clock.

This year's Nobel Prize in physics was awarded to Norman Ramsey for the development of this technique.

I would like to mention in passing an issue of specific interest to the NRC. In SI there are two units used in the field of radiation protection, the unit of absorbed dose is the Gray and the unit of dose equivalent is the Sievert.

Now as we have said earlier in this meeting, these units are analogous to the older units rad and rem. Does equivalent is obtained by multiplying absorbed dose by a physiologically quality factor which is dimensionless.

Therefore, the units, Gray and Sievert are dimensionally equivalent and they are dimensionally equivalent and the turn to the Joule per kilogram; however, to avoid safety hazards, it is imperative that everyone involved in radiation safety understand the distinction between these two units even though in the

literature they are defined both as equal to the Joule per kilogram.

One of the nice features about SI is that there is a fairly extensive list of prefixes, and by the proper use of prefixes one can go from an older type of unit to the SI units in a fairly straightforward way.

For example, the rem is equal is .01 Sieverts or 10 milliseiverts. Therefore, a millirem would be equal to 10 microseiverts.

In an analogous way in the field of spectroscaphy we have the unit of the angstrom which is an obsolete unit; but since the angstrom is 10 to the -10 meters or .1 nanometers, it is very convenient to go, to specify a wave length say of 7,000 angstroms into an equilvant value of 700 nanometers. The proper use of a prefix can make things, make the transition fairly acceptable.

Several times we have had the example of the unit of pressure, Pascal mentioned today. One atmosphere of pressure, 14.7 pounds per square inch approximatley is exactly by definition equal to 101325 Pascals, or in other words, 101.325 kilopascals.

Now if you wanted to round that off to get an order of magnitude bigger you could say tha 15 pounds per square inch or one atmosphere is approximately equal to

100 kilopascals. That is a simple way of thinking about it.

People who used to favor the older CGS form of the metric system, based on the centimeter, gram and second used to refer to the fact that the gram represented the mass of one cubic centimeter of water and that made it seem like a very simple way of defining the relationships of the units there.

But similarly, in SI you can observe that the density of air is just slightly more than one kilogram per cubic meter.

So when we use the right prefixes and when we make the right comparisons, I think that there are advantages to SI that sometimes have not been pointed out.

I would like to conclude with the following observation: there is nothing instrincly difficult about metric units. On the contrary, their decimal structure and coherent relationships are designed to simplify calculations.

The issue is merely one of familiarity and acceptability. In the past 20 years we have witnessed tremendous technological progress. The computer revolution for example has enabled everyone of all ages to have access to his or her own computer, for everything

to playing games to performing sophisticated calculates and accessing vast data banks.

People are becoming computer literate. Should it not also be possible for everyone to become metric literate? This understanding would allow America to better participate in the worlds' commerce and enable our citizens to acquire a part of the language of science.

Thank you.

CHAIRMAN ROSZTOCZY: Thank you, Dr. Nelson. This brings us to the end of the session and our discussion period.

Taking the perogative of the Chairman, I would like to ask the first question myself, and this question is directed to Joe Colvin.

You have expressed interest earlier in the definition of business related activities, and I would like to turn the table and ask the same question from you.

In order to make it a little bit easier, let me throw in for the sake of discussion a potential definition. For example, if NRC would say that after a certain date in the future, NRC's everday activities should be done in metric with the exception of emergency activities, which would stay in the language of the licensee whom we are interfacing with, would that cause

any difficulty looking at it from your viewpoint?

MR. COLVIN: Well, Zoltan, I guess you put me on the spot. I am not sure how to answer the question; but let me give it a try.

I think that the real question is how that is going to be interpreted and utilized in the regulatory and licensing activities.

If I take for a second and consider an NRC inspection that goes into review, some of the work that's going on like the safety system functional inspections, there are technical inspection modules that the region and headquarters based staff use to go in and review the design calculations and the parameters.

I guess I am not sure how, even though you might have that changed over to metric, in order to actually review the work that has been done historically, you would have to go back and convert that back to the equivalency and utilize that within the plan.

I think the same thing is true if you go into the control room and observe licensee activities within the control room. Unless we backfitted the requirements in instrumentation as was pointed out and into the operating procedures, emergency operating procedures, then the inspector himself would have to do the conversion. I think there is a chance for error.

So if we are talking about, on the other hand, if we are talking about reporting requirements to the Nuclear Regulatory Commission and radiation exposures or volume of radioactive waste, or things of that nature, where the conversion can be done by the individual licensee and provided to the NRC so that then your business from that point is conducted in SI units, then I think the impact on the industry is much less than might otherwise be.

CHAIRMAN ROSZTOCZY: Anybody else would like to add to this subject? In that case, then the floor is open for any questions or any comments on all the subjects you heard about this morning.

MR. HALL: I have a question, I don't know whether to address it to Oscar Fisher or Gerry Underwood: in the field of codes and standards, I guess I will address this to Oscar first: to what extent are U.S. codes and standards now in metric or SI units, and if we look forward -- I guess the second part of my question, Gerry and you, Oscar can be thinking about it -- as we look forward to the future to conversion to SI units, in your perspective would this make existing codes and standards go away and we will go into a more international system or will we continue with the existence or the conversion of our existing codes and

standards?

I guess that's a philosophical perspective I don't appreciate.

CHAIRMAN ROSZTOCZY: Excuse me for a minute, would you please state your name and affiliation?

MR. HALL: Excuse me, I am Robert Hall, Duke Power Company.

MR. FISHER: I guess to answer the first one, a very large portion of our codes and standards have been, would be mostly what we would call "soft metricated," put in parentheses the equivalent values, and probably not everybody has done the same kind of work, done the same thing with regard to how accurate it is and how many decimal places they carry it out because you know, it isn't exact, some will round more than others.

But a very large portion have been and especially the ASME codes. The ASME has been a real leader in metrication. In the early 1970's we did a lot in metrication.

As I mentioned when I was talking about the boiler and pressure vessel code, that was a -- it ran into the millions to convert that, to write that new SI version and yet it had to be laid aside. It was very discouraging.

But nevertheless, the ASME has continued with

that and I would say, just about all ASME codes and standards have been, would I could say here, soft metrication, that term isn't always defined too well.

As far as -- I looked through and I mentioned some of those that I looked at, but most have been in this country, and how much good does that do? That's a little questionable there because you really could do it yourself as you are looking at a code, if you know the conversion factors and most calculators now have them already in and if they don't, if the one you want to use isn't it in there you should put in the memory and just keep in your memory in your calculator.

But as far as whether our codes and standards are going to be obsolete, I don't believe that it would be obsolete in the sense that you just can't use them, that won't be. There may be some difficulties there, but to say that we can't use this code now because this country is metric, I don't think that can be. There is just too much knowledge put into these codes and standards.

If you ever stop and think about the tremendous amount of knowledge of human kind that is put into the body, to all the codes and standards, the thousands of codes and standards that we have just in this country, it's tremendous and it's a tremendous source of knowledge

and experience, and to say those are just obsolete, we can't use them, I just can't picture that happening.

I think the rule of reason is going to be a working all the time in this matter of metrication.

I was asked to the metric coordinator in my company way back in '72 and I always did what I thought was best for the company. We had zealous people in the company who wanted me to push metrication. They say, you are the metrication coordinator, why don't you push it? I said, I am going to do what's best for Babcock and Wilcock, that's who I was with.

You know, nothing brings a smile more to you boss's lips than to do what's best for the company. He wants to hear that and that's what I always did and that's how I kept my job so long.

(Laughter.)

This is in an industry where keeping your job is difficult as you know --

MR. UNDERWOOD: I would like to echo pretty much what he said, I have worked in standards for many, many years and I think standards are kind of like people and companies, they have quality, they have reputation, they have essential integrity or they don't.

I have argued pretty loudly at ANSI and ASTM and other organizations that the United States with its

enormous technological base, with its extremely strong research and educational institutions, has developed some of the finest standards in the world.

Those standards are used around the world, many, many of them, particularly testing standards. I think it's ironic that we haven't as a country, because we have a very unique standards development mechanism compared to any other major nation of the world, Switzerland is the only country which has a similar system, where we have so many varied standard organizations with a very weak focal point to present those standards in the international community, it has put us at a disadvantage.

But in the long term, the integrity and value of the standards will tend to prevail, depending on the technology and the quality of the standard itself.

One of the ways that can be done is to soft convert those standards and present them as international standards, with the computational methods we have, with sensible rounding where you can do that, you can move to a metric value, an SI value that's totally acceptable to the standard. If it's not you bring it to the point where it is acceptable to the community.

Let me just illustrate my point. There are probably more hours of experience on blind rivets in

aircraft than any other single hardware component I can think of in terms of total hours of experience, and no one else in the world has any experience that even compares with that.

Why should we adopt a hard metric, blind rivet, SI standard and present that to the world as the new wise metric rivet standard for aircraft? Why not soft convert the U.S. design, present it as a metric design. If any of you are designers, you know that you wind up with all kinds of peculiar numbers when you design odd shapes anyway.

So I think that we are going to see international standards in the future, the question is, selecting the best ones and not worrying so much about the logic of the numbers, especially with computing systems that we have today. I don't think that's as important as the integrity of the basic science behind the standard and the experience that's behind the standard.

But if the United States doesn't mount a stronger effort in the international standards community than it now has, we are going to see ourselves with less quality standards being adopted in other countries, and then ultimately forced on us.

CHAIRMAN ROSZTOCZY: Yes?

MR. TASCHER: May I ask on the same subject?

CHAIRMAN ROSZTOCZY: Would it be the same subject?

MR. TASCHER: Yes. My name is John Tascher from the Defense Department and your question from the man from Duke Power Company, I would like to say a few words about the DOD approach in the standards area.

I guess we feel that there are two reasons for developing metric standards. One is put the document in metric language so people who may not be familiar with the inch and pound system can use these standards.

The other reason for metric standards is international interoperability or obtaining metric modules which can be used for international -- and so what -- building on that, we have looked at -- we are now looking at our 50,000 standards and specs that the DOD has and what we are trying to do is find out how much work or what kind of work we have to do in the DOD to bring the DOD into a metric mode of operation.

One of the reasons for this is there has been a long time perception among, not only in the DOD but in industry and other areas as well, that the lack of metric standards is the thing that is us holding back, that is preventing the country or the DOD from going metric.

So we have -- one of the approaches we have

taken is we have gone out to ten top contractors and asked them to identify all the respectives that they would need to support a metric system, a typical weapons system for example and we have gotten back something like 6,000 references of documents that they think we should change, and we are now entering this all into a database, and just from sort of a spot check of all of these documents, I think there is a great many of these documents that are already metric, at least for the DOD purposes, they are already workable, will do the trick for us.

But I think there is going to be something like 1,500 documents, just as a test, we have a work a lot work to do on this, but maybe a 1,000 or 1,500 where we need to come up with these, what we call hard conversion, to achieve these metric modules for international harmonization.

The rest of them I think, as long as they are in metric language, soft conversion, are pretty much useable the way they are right now.

I just might add that we have done sort of a quick and dirty survey of the 50,000 documents, and we find that approximately five percent of the documents for DOD users are what we call hard metric, and my own personal feeling, just to sort of wrap up, is that this

whole perception of standards being the thing that is preventing us from doing metric has been exaggerated. I think we are narrowing this thing down -- we are identifying what really has to be done, and I think what really has to be done is considerably less than what a lot of people originally thought.

Thank you.

CHAIRMAN ROSZTOCZY: Thank you, John. Yes, please.

MR. GAT: Uri Gat, I just would like to emphasize with a couple of examples, a lot of standards are metric. All pollution standards or pollution standards in general are going by gram per cubic meter and gram per liter and they don't need any conversions or any changes.

There are some others, labeling for examples, food labelings go by grams of protein and fat and so on and they don't need conversion. They are in a little bit of a ridiculous situation where you have grams per ounce, which would require a little change.

To emphasize a point that Gerry made, not all of them require changes. There are BIEN standards which are the standards of Germany, Deutsche Industrie, which have pipe sizes which they call, normally they call them sole, and they have an odd dimension of 25.4 millimeters

and multiples of that, and they have lived with that for the last 200 years or I don't know how long this particular standard has been on.

So, it's not that extreme, we are not talking really about the total changeover of everything. There are a lot of things that will change and a few things, and that's why I like, as I said before, a phase out of the non-SI things as something to be considered very carefully.

CHAIRMAN ROSZTOCZY: Thank you. Any other comments or questions on any of the subjects this morning?

MR. UNDERWOOD: Just one comment, I did mention this federal handbook. One of the things that the handbook has in it is a guide to regulators on what you might call the sensible approach to selecting the values for a given standard or regulation, and I commend that and maybe we can extract that and provide it for the minutes.

It talks about, for example, if you are going to take soil samples and the regulation says, take a soil sample every 10 feet for some particular reason. There is no reason under the sun to soft convert that regulation.

It would seem to me, that unless I don't know the whole scientific background for it, that you would

probably take the soil sample at three meters.

So it's this question of soft conversion, hard conversion, going to an absolute this matter, and this is a matter of a rational value selection.

So someone has said this morning, this thing is more a matter of common sense than it is a matter of technological stress, and I think that's certainly true. All of this has to be taken in the context of common sense.

The other thing I want to mention, Zoltan, I have to leave also this noon. Our office is available to you. We will make that our phone number and so is in your minutes.

Jim McCracken who assisted me in my presentation this morning is going to be staying here if you have any communication to our office and what us to do something for you, please let Jim know. Thank you very much.

CHAIRMAN ROSZTOCZY: Let me mention here something that I have forgotten to mention earlier, we have received the copies of some of the speeches or some of the slides which were presented this morning and if you are specifically interested in one of those, then please leave your name and address and also the subject you are interested in with one of our NRC representatives

here, Joe Brien or Tony and then we will see to that that we will send you a copy.

From some of them we have more than one copies, so for a few of you we can give a copy right now, but probably for most of you we would have to reproduce it and then send it to you. But feel free to ask for it in any specific areas if you are interested.

The same exists also if there are any names or addresses, telephone numbers you are interested in and you don't know it, we probably can help you out with that.

Yes, Mr. Nelson?

DR. NELSON: I just want to point out the existence of this document which I didn't mention during my presentation.

This is the definitive description of the International System of Units, which is a publication of the International Bureau of Weights and Measures and was translated from the original French by members of the Department of Commerce and the title is "NBS Special Publication 330," the latest edition is the 1986 edition. It's called the "International System of Units, SI."

This contains all the tables of the basic units, the derived units, prefixes, units to be used with SI and the like, and also an appendix containing the

pertinent decisions made by the General Conference on Weights and Measures since its inception, relating to the exact definitions of the -- and I would recommend it highly to anyone who wants a definitive statement of SI.

CHAIRMAN ROSZTOCZY: Any other questions or comments?

MR. DeGRANGE: DeGrange from Maryland again. I guess I would like to address my comments to Mr. Underwood.

I am wondering what if any contact has been made with the National Conference on Weights and Measures? As you know, that's a body that's very active in the weights and measures community and it consists of state and local weights and measures officials and members of industry, groups, on which weights and measures activities impacts. So it would seem that that would be a good forum in which to explore this metrication issue, and in addition, I am wondering if there is any thought being given at any level to reactivating the National Metric Board which was in existence I believe back in 1970's and I think was set up to make an orderly transition from our system into the metric system and consisted of members of government, industry and other people with interest in metrication.

MR. UNDERWOOD: I will try to be very brief. The

National Conference on Weights and Measures is terribly important, you are absolutely right.

In their annual meeting in Seattle this year, I don't know if you attended that meeting, but we did provide a substantial amount of literature to the group.

The director, the acting director of the National Institute of Standards and Technology, the old Bureau of Standards, Ray Camra was a principal speaker.

We provided Ray with some metric ammunition and I don't know how much of it he used. I do know there were several sessions on metrication there.

It certainly is an important body. We try to keep them informed. We are a very small office in the Commerce Department and we replaced the U.S. Metric Board when it was defunded. Their budget was in the order of magnitude of three million dollars a year, you couldn't find -- we don't even represent a very, very minor fraction of that budget.

But, I don't believe there is any intention of reinstigating the Board, although it is still a law, it still legally exists. The Conversion Act that Jim Turner mentioned this morning did not disband that body, and should it be necessary to reestablish it, I think the government could. I don't believe they will do that.

We do have a metrication officer appointed in

every state of the union, appointed by the governor at our request. So that's the body through which we deal with the states; however, in many, many cases they are the weights and measure officer for that state, in most cases, and so that's the avenue with which we are working, and I agree, it's a body that we should -- as time goes on we are going to have to be working more closely with them, and particularly as the local building codes problems and the interstate transportation problems surface.

CHAIRMAN ROSZTOCZY: Yes, please.

MR. GAT: Uri Gat, since SPC 30 was mentioned, I think it's necessary to mention that there is standard in the U.S.A., CM E380, the latest edition is 89A, it's called, "The Standard Practice for Use of the International System of Units, the Modernized Metric System," which is the standard generally in use, the only standard existing here.

That SPC30 is not a standard, it is the description of the system. In that association, I would like to make one more comment and that is just about everybody has his favorite and disfavorite units, and we heard, particularly the Pascal, some people don't like it for some reason.

Mr. Nelson mentioned that one of the advantages

of SI is it coherency. If we give up on some of these units as convenient as they may be, we give up on the coherency and then we give up on one of the major advantages and perhaps the most important reason to go SI, so I urge not to give in on those units and this is particularly sensitive in the radiation field because the rad and the rem are related by a factor of 100, which is just as convenient as a factor to 100,000 from the bow to the Pascal, from the rad and rem to the Gray and Sievert.

So I urge not to give in to those, and not to deviate from either one of these two.

CHAIRMAN ROSZTOCZY: Yes, Dr. Rubin?

DR. RUBIN: As a professor, I can't resist saying something about what seems to be a controversy a that is, whose publication on SI is really authoritative here and I will have to agree with Bob Nelson about what he says because the law passed by Congress in 1975, the Metric Conversion Act, is unmistakable about fixing the responsibility for saying what is SI in the United States.

Here I am referring to Section 4, paragraph four, it says, "Metric system measurement means the International System of Units as established by the General Conference of Weights and Measures in 1960 and as

interpreted or modified for the United States by the Secretary of Commerce."

So that is our metric czar, it is Mr. Underwood's boss and speaking of Mr. Underwood, I can't resist mentioning two facts, one of which is my admiration for him along with Senator Pell and Congressman Brown as being one of the most important and influential metric boosters in the government, and as having survived two presidents who did anything but help the metric cause. One of whom sabotaged the U.S. Metric Board by appointing anti-metric people to it and the second one who just clearly axed it completely.

I worry a little too about our new president, but I take a little comfort in the fact that in controversial matters, he likes to be out of the loop and so hopefully, we don't have too much to worry about there.

(Laughter.)

But anyway, I would like to make one suggestion to Mr. Underwood and that is that he extend the idea of a metric coordinator in each state, to suggest a metric interagency committee such as the Federal Government has established, in order to make sure that at least nuclear regulatory people get the message, because if we have to live with a different set of regulatory standards state

wise, and then from the Federal Government, this would make life very difficult for us and maybe that can be anticipated at this time and we should look at it.

CHAIRMAN ROSZTOCZY: Any other comments? Yes, sir?

MR. SOLANDER: Lars Solander, NRC, we heard from at least two speakers, and from other talks also, that there is a need to education or reeducation in regard to the SI system.

We know, it's not easy to reeducate people who are adults, so what would be the opinion of the industry and the industrial organizations regarding that, if we don't have time, Zoltan, we can leave this for maybe tomorrow afternoon.

CHAIRMAN ROSZTOCZY: No, go ahead.

MR. SOLANDER: We would like to hear some inputs regarding this metric, the need for metric reeducation.

CHAIRMAN ROSZTOCZY: Anybody would like to comment on it? Mr. Baker?

MR. BAKER: I had mentioned in my talk that we were anticipating an educational, that we had developed an educational program and that the core of that was a brochure which describe what we were trying to do in the conversion, listing the various units of radiation and

radioactivity and providing conversion factors and conversion tables for becquerels to curies and vice and versa.

That this brochure could be sent out to users and we were also going to be writing letters to editors of journals, to users of the materials, radiation safety officers and people who would be ordering radioactive material.

Not perhaps a very extensive program, but we certainly saw that it would be necessary and would facilitate the conversion to the SI units for radioactivity.

CHAIRMAN ROSZTOCZY: While we are on the subject of education, let me pose a question to Dr. Nelson and anybody else who is interested to comment on it.

Dr. Nelson talked about the metric literacy. One area where literacy might not have been achieved yet, especially in terms of the public, public literacy are the radiation units.

The public by now has heard the radiation units, but most of them when they hear certain numbers they really don't have a feeling for it, how big or how small that number is.

Looking at it from the educational viewpoint, would it be confusing for the public to educate them in

the conventional units or rads and curie and then after that, in a second step, try to convert them into the metric units, or would there be a greater advantage if this public education would be done in the units which eventually we will use.

DR. NELSON: Well, my perception would that the general public is not familiar with the curie or the roentgen in the first place.

Therefore, there is no need to go through that transitional step. Just for the record, I am sure more of the people here probably know this, but you mention the conversion factors, between the roentgen and the -- per kilogram -- now as Dr. Gat mentioned before and as I also pointed out, one of the great advantages of SI is its coherency.

For example, all the derived units are defined in terms of the base units without the need for any numerical factors.

Now to extend the point I made before, how many people here can define the pound force? How many people here can define the poundal? How many people here can define the slug? These are all units used in the inch, pound customary system of units.

However, there is only one unit of mass in SI, namely the kilogram. There is only one unit of force,

namely the Newton and the Newton is defined is simply a kilogram meter per second squared.

Now, to address the specific question that you had, a curie is 3.7 times 10 to the 10th becquerels. A roentgen is 2.58 times 10 to the -4 coulombs per kilogram. Now clearly, these quantiti[illegible] these units involve numerical factors which detract from their use and I really think that an effort should be made to first of all acquaint the people who are involved in radiation and in appreciating exposures, to go right to the units of the Gray and Sievert but to extrapolate a point I made before, they must be made aware of the distinction between these two, because the fact that a dose equivalent is obtained from absorbed dose by multiplicative factors and if one went simply to a table and found a Gray is a Joule per kilogram and a Sievert is a Joule per kilogram, they may think that it really represents the same thing.

Dr. Ruby has in particular stressed this point for many years and I can only endorse that point.

CHAIRMAN ROSZTOCZY: Yes?

MR. COLVIN: Just one point on that that I think we should not overlook and that's, while I agree with Dr. Nelson 100 percent, the thing that we have to look at is the public perception of radiation dose and of

radiation waste issues.

You know, it's one thing when we kept talking about total Curie content buried at a low level waste repository or a Curie or a millicurie or so many millicuries, but when we now start talking in megabecquerel, the public -- I know what the anti-nuclear is going to do with that, they are going to say, one millicurie, well, they have been lying to us all along, look how much of a problem this is because now we are talking about millions of these things where before the industry used the term, one-one-thousandth of this is not equivalent.

So I know that this is one of the things that the U.S. Council for Energy Awareness which handles our public education from the nuclear power industry is very concerned about is the public perception of units and the public perception of risk.

So I think we do have to keep that in consideration as we go forward. I am not saying anything negative about the SI units, it's just something we need to deal with and deal with properly in the public view.

CHAIRMAN ROSZTOCZY: We have time for one or two more comments. Yes, Mr. Tascher?

MR. TASCHER: John Tascher, defense department again. Just to follow up on what Dr. Ruby said, as far as

the Secretary of Commerce being responsible for interpretation and modification of the SI in this country. I don't think there has been a Federal Register to that effect, to do that, it seems like 1982.

I wonder if I missed something. It seems like that thing should be updated, just as a comment.

CHAIRMAN ROSZTOCZY: I am not sure, I would have to search my memory, but I am recalling that the recent proposed rule that the Commerce Department put out for public comment and the public comment I think expired yesterday that does refer to this.

MR. TASCHER: Well, the main reason for -- in case it might be helpful to you, why don't I submit for the record a copy of the DOD metric policy, dated September 16, 1987 and the DOD Metric Transition Plan which was signed off by the Secretary of Defense back in January of [illegible]9. That might --

CHAIRMAN ROSZTOCZY: Thank you very much, we certainly appreciate that. If anybody wishes copies of that, then please come and contact us.

Originally we were supposed to have one more session this morning, and then go to our lunch break. It turns out that that session will last approximately an hour or so, so right now we are about an half hour behind schedule.

I kind of feel confident that we will be able to pick it up in the afternoon and I would like to suggest that we take our lunch break now and start that session after lunch.

That would mean -- the weather is supposed to be pretty nice outside, it will probably give you an hour-and-a-half lunchtime, so you can stretch your legs. That would mean that we would reconvene at 1:30.

Is there anyone who would be inconvenienced by this? Is there any objection to this? No, then let's adjourn for the morning and we will reconvene at 1:30 in the afternoon. Please keep in mind 1:30, your agenda shows a different time.

(Whereupon, at 12:00 p.m., the conference was recessed for luncheon, to reconvene this same day, November 14, 1989, at 1:30 p.m.)

AFTERNOON SESSION

(1:30 p.m.)

CHAIRMAN ROSZTOCZY: We are ready to start our next session. This is the session on metric system relative to new applications or future nuclear power plants.

I would like to introduce Jerry Wilson who is going to give a few introductory remarks on NRC's behalf and then he is going to introduce the speakers, the other speakers for the session.

Jerry has been deeply involved in the review of future reactor design, what we call, advanced designs during the past few years and he was also involved in the review of the advanced light water reactors and he played an important role in our new rule on what we call the Par 52 Rule on design certification, site approvals and one step licensing.

Jerry Wilson.

MR. WILSON: Thank you, Zoltan. The purpose of this portion of the meeting is to discuss the possible impacts of using the metric system and the regulation of future plants.

For this meeting I will define future plants as any plant for which an operating license application has not been filed so that puts plants like Seabrook into

the existing plant category which will be our next session.

Now it's my job to facilitate the exchange of information on this subject and I have three other participants who have been invited to assist me: Brian McIntyre from Westinghouse who will give the perspective of the reactor vendors; Jack Berga from EPRI who will provide the utility perspective and Professor Ruby who will provide university perspective and he is also a member of the U.S. Metric Association.

Now as a lead in to this discussion, I want to point out that NRC has issued a new regulation as Zoltan has said, this regulation was part of our licensing reform effort at the NRC and it has turned out to be a very broad regulation in terms of ways you can seek applications from the Nuclear Regulatory Commission, and because of that I anticipate that all future nuclear power plant applications are going to come under this rule, so I thought I would point to that as a kick off of our discussion.

Now one part of the rule is early site permits and this is a way for a utility to bank a site, get approval of the site prior to its decision on purchasing the building or reactor.

I would presume that utilities probably aren't

interested in the international implications of metric and may not be inclined to file their application in metric, but if they do get an early site permit it's going to last for 10 to 20 years and they will have to focus on what that's going to mean 20 years from now when the rest of us have gone metric.

You see I have an arrow there, design certifications, and give me the next slide, Brian, I will explain that; I think that for the foreseeable future, most of the action under the Part 52 is going to be in the area of design certifications and this is the reason why: a lot of the reactor vendors around the world are designing new plants. This is a list of the ones that I know of and I anticipate that most of these plants are going to seek design certification in the 1990's.

What you see here is 10 designs that represent six different reactor vendors.

Now if we could back, Brian, to the previous slide -- all of these reactor vendors are competing in the international marketplace and so I am presuming that they are going to be very interested in the issue of metrication.

As you see, when the reactor vendor gets the design certification it's good for 15 years, plus he has the opportunity to seek renewal which is another 15 years

and then if a plant is built to that design, that plant could be operating for 40 to 60 years. So we are talking a very long period of time and what they do today is going to have a big impact in the next century.

Now under combined licenses, this is where the two parts can come together. This is where the utility or the site aspects of the design are matched with the reactor design and you seek a license to build and operate the plant.

As I said, that license could last 40 to 60 years and while the utility may already have reactors that are designed and are operating in English units, they may be concerned with what that means in the future for a plant that is going to be operating for 60 years.

Now, why don't you give me the slide, Proposed Requirements. As Dr. Beckjord said, in the time that we were developing Part 52, we considered an additional requirement and this it the requirement and I would encourage the participants to speak to this requirement and let me know what impact they see that this would have.

I am presuming that it may not be a problem in the area of design certification if reactor vendors are competing in the international marketplace, I understand that some designers are converting their applications for

the benefit of the NRC and maybe it's time that we said you no longer need to do that, but I would like to hear about that.

Now to start us off I am going to put up some questions that are a little bit different than the Federal Register, but issues that I think would be good that we could talk to in this session.

I think it would be nice to find out what type of units the designers are using for these future plants, as I showed on that earlier slide, what units the utilities plan to use in the future for operation, what's the view of the industry? Should the applications be in metric for future plants and should NRC evaluations be in metric?

Also, if we go to metric, are we going to see a problem in the area of reactor safety? A potential problem would be utilities that are operating plants under English units and NRC issuing orders and directions in metric, is that going to cause us a problem? Is there going to be a problem in the public's understanding if the NRC starts talking in metric when we have our licensing proceedings before the public?

Is that going to affect their understanding of nuclear safety?

Now I think that's all I want to say to start

off and what I would like to do now is turn it over to Brian McIntyre and let him say a few words about the vendors' perspective.

MR. McINTYRE: You can just jump right into the right on. I am a reactor vendor and I work in English units. I guess we do that because we always have, and we are set up to deal like that. We support all the present day operating plants certainly in the United States and even in the foreign countries, and all the computer codes, the safety codes are set up to work in English units, the structural codes are all set up to work in English units and so that's the way we work, that's the way we have always worked and that's the way we are working right now.

We have two designs, the SP90 and AP600 that were on the slide that Jerry just had up and the SP90 is what's considered to be an evolutionary design and in terms of the NRC, we sort of took what we had and grew it into something that still looks a lot like it did but it has some enhancements to safety and to enhancements to operation.

We started this program in 1979 and it's a joint United States/Japanese project and if you look at it, Westinghouse is the NSSS supplier, we designed the reactor, we designed the steam generators, we designed

the stuff that's involved really in the true nuclear side of it.

Mitshubishi Heavy Industries, they are the BOP people. We are working in English and they are working metric. Now when we supply something to them we are supplying it with dual units and basically we are not even sophisticated enough right now that we have a computerized way of doing this.

We have a guy sitting down and next to every dimension on the drawing, take a pen and pen in what the metric equivalent of it is.

On the AP600, that's kind of a little more interesting. It's an advanced design. It has passive features, but we still use a lot of proven technology and as a matter of fact, we are going to be using -- I will use direct coolant pumps, they are the same ones that our people at Cheswick makes, that's why we are very interested in what DOD is doing because they are the same pumps we put on aircraft carriers, with a slightly heavier glide wheel so they have better coast down performance.

We have been working on this program since 1986, it's DOE funded, so how this law or rule is implemented, if it's everything after 1992, gee, that's kind of in the middle of what we think our contract is,

and so it certainly has some implications for us.

Jerry just had up on his schedule that anything after September 1992 should come in in metric units and how do we feel about that. Fortunately, we are scheduled to submit this thing in June of 1992 and it might be, if the decision is not to convert, work in either metric or dual units, it might be one of those -- you know, slide it under your door, right there at the end of September in 1992.

An issue here I think is that this is totally a U.S. project. Westinghouse is designing the NSSS and Bechtel and Avondale Shipyard and some other people are working to do the balance of the plant, and we are also all working totally in English units on this.

A third plant which is not up there is one we are doing right now for Britain. Britain has converted, they are no longer using English units, they use the SI units.

We are the NSSS designer, CEGB is the BOP, the designer and builder and again, we are supplying information to them in dual units.

As Jerry pointed out, if you look at how long a design certification is good for and how long you expect the life of these plants to be, we are talking like these things could still be running in 2070, if you sort of

think about it in those terms, we are all going to dead.

It's inevitable that we will be working in SI units in that time period. I think it's a question-- we certainly are going to get there and I think the question before us today is how we are going to do it.

Two of the questions in the Federal Register notice sort of dealt with documentation and I lump them both together.

For licensing documentation, we looked and spend some time and decided that it should really be consistent with the way the plant is operating. It doesn't make sense to try to convert McGuire over to using SI units and how many megapascals does the HRH system add before you do the conversion over to do recirculation, and certainly avoid the use of dual units.

I couldn't image an operator dealing with a set of dual unit tech specs when things are really not going well with the plant and his adrenalin level is up a little bit and you get something that could look like it could be reasonable and it's not going to be megapascals and PSI, but it's going to be something else that he could get tangled up in, just avoiding -- that's not human factors engineering.

NRC communications, I think you guys could have a little tougher problem. You send out a lot of

bulletins, a lot of notices, lot generic letters and you have a surprising number of numbers in those things.

I think it's sort of a question of the same thing, that you should try to regulate these guys in the same way that they are operating the plant, don't send SI units to, the guy from Duke is here, to Duke Power to try to have them to convert it to SI if they are compliance, out of compliance or something that should be dealt with so if a thing is floating around out there that people can't understand and it doesn't match up with the way the plant is, has been designed and is being operated.

If you look at the transition, you know, it's great to be the NSSS designer. You are sort of at the top of the chain on this, you make up the drawings and everybody builds the stuff to fit and it wasn't clear to us sitting back in the Monroeville that there is enough infrastructure right now to support this.

Like I don't know what the steel industry is doing. I don't know if they are converting from 10 gauge steel to something that is an equivalent. I have a little story about steel in a few minutes, but you need an awful lot of stuff to support this thing if Westinghouse or Bechtel is going to set up there and say, by gosh, we are going to do it like this.

You have to have places where you can get the

things that we are going to be calling out for. So we think back on that, that there will be a time which is not right now and we think it's probably going to be after 1992, the way we see the progressions going because we can't get things set up in time; that we will have the infrastructure available.

It also sort of gets back to how do we do it? Do we do it by conversion? I like the soft conversion idea. That's kind of a neat way to put it. We have gone back and looked at what our licensees have done and it turns out they have done both things. Frameton, our French licensee takes our design and they totally, they said, reengineered it. We asked them the question, and they said, oh, yes, the inside of our steam generator tubes happen to be 19.05 millimeters, it's not a very unusual numbers, you do the calculation, it's three-quarters of an inch.

Now you sort of think that somewhere they could either round it up or round it down or do something and given that that is a custom made piece of equipment, 600, 692, there is not a lot of call for that, so you make what you need to make.

But it's sort of a case of where they didn't go back and back engineer it.

The question came up with training and what we

have found, certainly as a manager, that the people we have hired out of college they know metric stuff. They know the metric stuff when they come in out of engineering school better than they know the English stuff, and for want of a better term, we kind of "whip" it out of them.

There is a tremendous amount of inertia. All of our records are set up in English units, all of the corporate records, all of our policies, all of our procedures, all of our computer codes.

You could work, I think at any of the reactor vendors, and I have talked to the other people, the same thing there, you could work in SI units, but it would really be a bit difficult.

So I don't think there is really a question of education. I know I got out of school 17 years ago and I would say half of my homework problems, half of my texts dealt with SI units. It wasn't just the physics. It was the engineering problems and things besides Btu's and kilowatts and things like that.

So I don't see that education is being so much of an issue. I think that most of us could certainly pick it up without a significant amount of retraining.

Another question was, what would this mean to us commercially and we haven't found the units that we

work in, whether it be working in English units, really to be a major effect in us making a sale or not making a sale. It gets down to who has the financing, who has the features and how much of it can we have done local, local content is extremely important.

Local content which will be the story here on subtier suppliers sometimes has its advantages because more often than not the local outfit is in metric units.

What we find it is a bit of a disincentive. You go out and you say, well, you are going to get a three loop Westinghouse PRW and it's going to make 750 megawatts and it's going to all be in inches and feet and pounds and those sorts of things.

The utility just kind of sighs, recognizing that they are going to have keep two sets of tools, two sets of tooling, two sets of books and they are going to have with it like that. It's more of a disincentive.

It hasn't really been, we have never been told we told the sale because of the units we work in.

You go back to being at the top of the boot chain, if we were to suddenly decide and we certainly can't for the operating plants obviously, but to go back and respecify all the piping sizes, all the tubing sizes, all the thread taps and things like that in metric units, to be quite honest, I think that there would be a number

of people who just would not bother in 1989 here in November to bother to supply us because the nuclear is such a small part of their business and they will be gosh darned if they are going to go out and invest in the tooling just to supply me with 17 pressure transducers a year to plug into the AP600.

If the business was there they would probably do it and what we would have to most likely do if we wanted to do that, we would end, at least, we were sitting around thinking about it, have to get those things offshore, bring them in from Italy or France or goodness knows where.

One of the advantages that we did see, because I talked about the steel and I talked about subtier suppliers is we went back -- I think it was Korea and we went over, and we said, here is the list of materials you need, and it had nine different sheet metals sizes on it, and the guy kind of looked at it and said, gee, I don't have all of those.

He went back and thought about it and he came and talked to us, and he said, I can't do it like that, how about if I use these four sizes, they are the metric equivalents more or less?

So he couldn't do it exactly, but I guess on the good side is that he had gone back and really freshly

thought about it. He had taken what was call "plan simplification" and obviously made his life a little easier, by taking a truly fresh look he was able to find something a little simpler that still did the job out of it.

That concludes what I had to say, I think basically, right now we are working in the English units and we intend to, certainly in the short term, continue; we are in the middle of two projects. For a totally new project, unless we got some direction or dictate or certainly a push from a customer we probably would continue to work in English units, purely because there is no real incentive for us at this point to change.

MR. LARKINS: Brian, given what you said in your slide that you are going to design AP600 in English units and you want to have your application in English units and you feel the operation should be in the same units that the application is in -- you are talking well into the next century, how do we ever get there from here then?

MR. McINTRYE: At some point and I don't know where that is going to be, we will -- I didn't say that it should be in the same units that it was applied in because at some point you are going to have to say, hold a time out and I don't know what year that is going to be

in, but do those conversions over.

MR. LARKINS: Do we have any other questions for Brian?

DR. NELSON: Which specific units are you referring to that would be involved in this enterprise? Repeating, what units would be involved in the specifications that you are talking about?

MR. McINTRYE: In the ones that we could convert over?

DR. NELSON: Well, in other words, units of what types of quantities are involved?

MR. McINTYRE: Anything dealing with dimensions, links, the physical operational type of parameters, not so much relating to radiation.

DR. NELSON: Would it deal with energy also for example?

MR. McINTYRE: Right.

DR. NELSON: What types of energy units do you use, Btu's?

MR. McINTYRE: Yes, we work in Btu's.

DR. NELSON: What units of pressure do you use?

MR. McINTYRE: We use PSI.

DR. NELSON: Pounds per square inch?

MR. McINTYRE: Right.

DR. NELSON: Absolute or gauge?

MR. MCINTYRE: Both.

DR. NELSON: Is that clear in your specifications?

MR. MCINTYRE: Yes.

DR. NELSON: So it's basically mechanical units we are talking about?

MR. MCINTYRE: Right. It's pretty simple to convert it operationally, you just magically convert the entire control room and then change the tech specs, but the plant itself, the thing that is sitting out there, is occupying a couple of square units is still going to be in English units and that could be reengineered if you would and you could, for future designs, you could take a pipe tap to be from a three-eighth inch pipe thread to a whatever the equivalent is in metric units.

But the market at this point is not driving us to do that and it would cost us a substantial amount of money to make that change. I think we would also run into -- I look at the human factors even back home, if you were going to do a safety analysis right now, what we would do, we work for EPRI because EPRI wants things and they either want it in SI units or they want an English scale here and an SI scale over there and we just have a little thing that takes all those numbers and goes through the conversion factors that we have selected and

it spits them back out.

DR. NELSON: If I might be permitted one more question, how many significant figures do you usually use in your specifications? Would you quote for example heat in Btu's to say six significant figures?

MR. MCINTYRE: The answer is yes.

DR. NELSON: Then you would have to specify --

MR. MCINTYRE: You may.

DR. NELSON: You would have to specify then what you definition of what the Btu is, there are at least six different definitions.

MR. MCINTYRE: We probably should. I would have to get something out of a back of a textbook.

MR. GAT: Uri Gat, how would the usage of metric units differ from what you are doing now when you use inches and feet? Isn't that conversion just the same, or you just said you are using Btu's, but you quoted the power plant in megawatts, that's a conversion and in megawatts already and you don't need to convert that one anymore, that's fine.

Why is it different to convert from inches to feet and I don't know if you use yards, but you definitely use cubic yards when you use the concrete that goes in there, from converting to -- and you probably do that. Don't you have some units in there that are

already metric?

MR. MCINTYRE: I think very few.

MR. GAT: But you have some.

MR. MCINTYRE: I am sure there are.

MR. GAT: Some of the electronic equipment that goes in is definitely in metric standards.

MR. MCINTYRE: I am sure there is. When you do the conversion, the difficulty is, it's just as simple as going through and doing all of the multiplications, but when you start looking at tolerance stack ups and you round it up, and you got to round it down and traditionally if it is going to be plus or minus .001 inches, you convert it to a metric number and then you round it down a little bit because you say, okay, a little tighter has to better and also to make sure that you are not stacking six of these things up and that it's all going to work.

We ran into this problem on the more complicated mechanisms, but we were told by the manufacturing people, anytime that we had gone through the exercise like that, as opposed to totally reengineering it, and just doing the basic soft conversion that it gets more expensive because you are building basically a more exacting piece of equipment.

I am not a lathe operator or machine operator,

but that's what I was told by the manufacturer.

MR. GAT: May I add a comment? Have you considered the opposite, using this opportunity to improve your designs, that tolerance you say you always round it to the more tight tolerance, may it's time to relax that tolerance that you -- and take a fresh look and that's part of the idea of going SI.

If you really want to get all of the advantages and the benefits, we could be on top of the world right now because basically the standards are as old as they have been written and you have an opportunity to -- have you looked at that and how much that might save you by relaxing the tolerance when you go to SI, do that with some thought?

Has that been considered?

MR. MCINTYRE: I don't think that we have looked at it. As the reactor vendor -- it's kind of a strange business, there is not a lot of -- I don't want to say there is not a lot of competition, but anything that we were going back looking at like that, I think gets lost in who has the best financing, who has the best number of features, who can supply the most, quickest spare parts.

Our market drives us by those forces.

MR. FISHER: This discussion you are just having

here points up the fact that whether you are converting a standard or converting in the plant, you can't turn that activity over to clerk who knows the conversion factors. You have to have somebody who thoroughly understands the meaning of that number and why that number is out to a certain number of decimal places now, and that's why it has to be done by a person very thoroughly familiar with the subject.

MR. HALL: I have been involved in trying to specify metric dimensions and you make a good point, Oscar, that's the largest problem we run it is that while we have suppliers willing to bid metric, somewhere in their process they take that metric design and especially fabricators turn to English inch pound units.

You would be amazed at how we lose tolerances in that, especially in large products, steel fabrication primarily, where they do not have enough accuracy in the conversion factors they use.

They have all the standards they need for accuracy, but somewhere in the sale floor, going the manufacturing floor that accuracy is lost in the conversion and that's not a small problem, that's a common problem.

CHAIRMAN ROSZTOCZY: Brian, I would like to ask two questions, they are kind of interrelated, so let me

ask them one by one.

The first is in connection with the SP90. You mentioned that the Sp90 is being designed or developed together with a Japanese company and they are doing their business in metric and you are doing yours in inch pounds, and then on your drawings you said the second units, so they can use the same drawings and I assume that they do the same thing in the information that they give to you.

My question is that do you have any way to estimate the cost associated with this process of putting in second units everywhere in your communications, in your drawings and so on, and since you are not talking of a design that starts from scratch, you are taking an existing design and these are just modifications to it, the best way to express it would probably be in a percentage of the cost of the modification.

Like if a certain system is being redesigned and it costs "x" dollars, then what percentage of this was due to the fact that he had to be handled in dual units?

MR. MCINTYRE: Yes, I asked a couple of people who were closely involved in that and they had no idea of how much time -- basically I think it's the draftspeople who are making those conversions and unfortunately, what

they are doing is sitting there with the conversion tables, multiplying things by 2.54.

I don't know if Mitshubishi is actually constructing to that, to those dimensions or not, but they are things like for the reactor vessel. I don't know if Mitshubishi is constructing things like the guide tools -- there is not a lot of -- that's a pretty exacting piece of equipment, the control rod mechanisms going up and down, and I don't know if they build those with a metric equivalent or they purchase them from us and we make them in Florida and ship them over.

CHAIRMAN ROSZTOCZY: Like for example plants, that was used for reactor vessels, are they doing their own and are those manufactured in metric units?

MR. MCINTYRE: For the reactor vessel, it's so customized that it comes out to the 173 inch diameter that we are looking for, plus or minute a quarter of an inch.

CHAIRMAN ROSZTOCZY: The second question relates to the end of your talk, you mentioned that in connection with equipment or instruments, you said that if you would to provide some of those in metric, then you probably would go outside the country and you would buy from a supplier.

Well, that's kind of the area, what we are very

interested in, because that is the subject of the Trade Act. If at the current time you would have to go outside the country to buy it since nobody has it in our market, then maybe this is an area where the manufacturers should look into the future of what is coming and maybe this is an area that those who will be doing the buying in the future should project their plans as far as possible into the future so the manufacturers can keep that in mind.

Any comments on that, what could be done along those lines?

MR. MCINTYRE: The way that we came up with it, we were sitting around looking at some of the more -- components of the nuclear steam supply system and little things came up, the people who were making qualified equipment, which qualification is a lot of work to start with, and we said, do they supply those in metric and sort of the conclusion was, of the people that I had collected in the room was, no, they probably didn't because there is no call for them to do that.

You guys don't call them up and ask for things in millimeters and those pipe sizes because you have nothing to hook them to, but neither does anybody else right now, except people who are offshore and people offshore are getting them locally, so the reaction was, if you wanted something that was done to truly standard

metric nominal sizes, that you would have to go somewhere else today to get it.

That's why the one slide said it has to be consistent with some sort of a national to policy to convert all of that stuff that supports us at the top of the chain, to sit there and make the drawings.

CHAIRMAN ROSZTOCZY: I would like to ask a third question. The third one is you said somewhere along the line there ought to be a time when it's appropriate to take the step and turn over to metric, but just exactly when, that's kind of uncertain.

Keeping in mind the rather unusual situation in the nuclear power industry, namely that there have been no sales for some thing like the past 10 years or more within this country, it's likely that there will be a few more years like this, keeping in mind that because of other circumstances the plants are being redesigned, some of them from really, from the very beginning, like your 600 megawatt plant, wouldn't this might be an important time, the type of time period that comes in maybe once in every 40 or 50 years?

MR. MCINTYRE: There is certainly a lot to be said for that and we were -- I guess I was talking to Gary, Gary from EPRI and he said it's convenient because we are in a hiatus right now in building our plants and

the AP600 is scheduled for certification in 1995, with a five year construction. So you would be looking at, possibly by the year 2000, actually having one of these things operational.

I guess the question we have to go back to is there going to be enough stuff to support actually constructing the plant?

I look at it, Zoltan, I look at it from the NSSS -- we really, I think the person who would have the most effect is going to be the guy who does the BOP stuff, the becquerels and the people like that because they have to buy all the standard steel sizes, all the standard nuts, bolts screws and all of that stuff that you see -- which is a pretty small portion of the physical plant.

There could be a lot to be said for doing it in this time period.

MR. LARKINS: Comments, questions?

All right, Jack, could you give us the utility perspective?

MR. BERGA: I will make the usual disclaimer, I doubt that I can give the utility perspective. Just a few words about what the EPRI program is and where it came from. The Electric Power Research Institute of course if an organization of the electric utilities and early in

this decade it became apparent to a group of utility CEO's, utility nuclear CEO's that the nuclear power was not an option for the future, so we began looking at how we might try to make it an option again.

One of the things that we wanted to make sure that came into the utility plants in the future was the utilities perspective from the beginning and not just buying a product off the shelf because they have been largely not totally satisfied with what they had gotten the first time around.

So, we also wanted to put some certainty in the program. So this was the utility initiative to start to advanced light water program. The reason it's a light water program is because we made the assumption that a utility executive would want to restart the option with the type of plant that he had grown experienced with, maybe he didn't love it, but he had grown experienced with it, and building on that base of proven technology.

But among things we wanted to do was to make it simple, make it easy to operate, make it easy to maintain and of course, make it as cheap as we could, but not make a fancy, complex machine.

We wanted something that if you-- you might say, go back to a more conventional utility mode of operation and one that required a special group.

So in that regard, we went out and we worked with the supplying industry to see whether they would help us write performance specifications for a machine that fulfilled these goals, that would have technical excellence, would have a lot of margin in it -- margin against -- for safety, margin against investment.

We didn't want to have a thing that was doing to be costly. I don't ever think we thought units was very important when we started out this program. We were really in some ways trying to down design a plant rather than optimize design of plant.

We wanted to -- so I don't think units were ever our problem. We were, as operators of nuclear plants or in dealing with nuclear power plants, we were familiar with the units that had been used in the past and never thought that they were a problem.

Maybe they are. Jerry mentioned that these plants are going to be around if we get them a long, long time.

To tell you the truth, I don't think we have ever thought about it, which units to use. In our program, as Brian and I chatted in the hallway this morning, we have never put any requirements on the supplying industry folks who are working with us on units.

Have we, Brian? So, I guess that was considered a non-problem in the past and maybe it still is in the future, I don't know.

What we are writing is what I sometimes call a "buyer's guide." We are the buyers, the electric utilities hopefully one day will be the buyers, but they have to buy it from somebody and so whatever units it comes in, I guess that's what we will buy, and Brian has given you a little notice probably and us, unless somebody forces the system somehow, it will probably still be in English units.

We have at least seven overseas utilities working with us on this program, and if they have ever brought up the question of units, it's news to me. We have Italy, Taiwan, Korea, Japan, England, France, all having been involved in this program.

I don't think anybody is worried about the units that we were discussing. Now we are writing performance specifications, we are not designing hardware. Brian and his folks and other folks like that are designing the hardware.

The NRC is involved in this program because they are reviewing what we think our performance specifications are for their safety implications.

The DOE is involved in this program because

they are funding the certification of some of these designs, through your licensing process.

So if, I guess to say we are probably the most disinterested group in here right now in the sense that if those government agencies are going to be the driving force to change the unit system, then I guess the main thing we are worried about is that somehow it doesn't mess up our program or cause us to have to go longer or cost us a lot of money.

I guess that's basically all I have to say.

MR. LARKINS: Jack, some of the reactor vendors that are not marketing in the United States are overseas vendors, and I know their designs are in metric. Is it fair to assume then that utilities would be willing to buy a design that was designed in metric?

MR. BERGA: Well, I think, what I said here, I think we will have to design -- when a utility gets ready to buy and whenever that is, I am not sure, they will probably buy what's available and learn to use what's available.

Our program, by the way, you do bring up a point, our program has concentrated on the domestic reactor suppliers and we have not considered any overseas designs in our program, and our program is concentrated on light water reactors.

MR. LARKINS: Any other questions for Jack?

CHAIRMAN ROSZTOCZY: Sorry, Jack. You indicated that maybe you haven't even talked too much about units because it just wasn't an issue.

Following up on the line of what we discussed with Brian a few minutes ago, is this maybe a time when utilities as a whole should give some thought to this of what units should be used in the future and should they do it together as opposed to each individually and if they do it together, then what would be the proper forum for this?

Would EPRI be something who would be doing this or would you be looking more to NUMARC or some other organization or other body?

MR. BERGA: Well, there are a whole bunch of questions embedded in that statement, one of which was should we do it together and of course, the answer to that is obvious, yes, we probably should do it together.

Can we do it together, I don't think the answer to that is quite so obvious. I am not so sure -- it's probably easier for our organization which is writing performance criteria, to -- all we have to do is rewrite the paper, but those folks out there that have to supply the hardware that goes against that paper probably have a much harder time and I guess I don't think EPRI is the

right organization to take the lead on this.

I would presume from what I heard today that the federal agencies one way or another are going to be forced to take some kind of action in this regard, and I guess we would hope that our response or that the vendors' response to whatever that action is not onerous and not costly.

But the basic question, as Brian mentioned before from Gary -- yes, this is a good time to do it. There are no orders, there is nothing under construction right now. It would be a good time to do it.

MR. LARKINS: Thank you, Jack. Professor Ruby, could we hear from you on your views on future plans please.

DR. RUBY: Well, being the last on this panel gives me on advantage and that is, I can if I choose, pick on any or all of the preceding panelists and actually the only one I want to single out is Mr. McIntyre in this regard because as we used to say in the Nixon administration, I have good news for you and I have bad news for you.

The bad news is that you may think that you are using English units to design modern reactors, but this is not really strictly speaking correct, because you would never dare to use British gallons or British miles

or British tons in any of your design calculations. They don't match the currently accepted set of units in the United States, which are called U.S. Customary but which I would also prefer to call "U.S. Customary Hodge-Podge Units" about which I will have more to say in the near future.

But the good news is that I think that you are undoubtedly the foremost expert on the most important problem in metric conversion, which is that of manufacturing and constructing in metric for an American concern, and the questions of converting from one set of units to the other or converting even from old metric units to new metric units pale by comparison to the problems of the engineer and constructor in getting the job done once the design is completed.

I again also will say something about that.

To get back to the subject that I was supposed to talk about, advanced reactors, advanced reactors are of course part of the responsibility of the Nuclear Regulatory Commission, and part of their responsibility as regulators of a number of nuclear activities that include advanced reactors, but also include many other things.

Now, hearing what I have heard today and looking at what I wrote before I came here, I must say

that fortunately I don't have to change my mind about anything, but I am now much more appreciate the thinking of regulators on how to cope with essentially a new law, and the answer I think from their standpoint is to add that amount of regulation which is the simplest that can be done, consistent with complying with the law, at the same time also with the overriding objective of protecting the public, health and safety; and in addition, making the new regulations fair to all.

So as a result of that kind of thinking, you come out with one overall rulemaking guide which would apply universally to all activities and therefore be fair and would also take account of dates to the extent that compliance with the Act is concerned.

From my standpoint however I look at other objectives which are totally different from these, and the first of these would involve implementing metric conversion in the most expeditious manner possible, and this is not consistent with uniform regulatory action that would be the same for all programs because in some programs it's going to be difficult and in some programs it's going to be simple and if we don't want to get into the World War II bind where you needed the goods overseas as soon as you could get them there, but the convoy had to adjust to its speed to take account of the slower

ships that made a part of it, then we don't want to get into a situation where all programs are regulated at the same rate.

Finally, I would like to maximize the economic advantage of metric conversion for American industry, because this, after all was the impetus that made the law that made this meeting, and therefore I look for ways of doing that and there I differ markedly in what the NRC seems to want to attest to do which is to make applications after a certain date in, required to be in metric. This is only going to encourage soft conversion.

Instead I would divide NRC activities into programs and to say for programs which involve substantially new activities of the NRC, and that would include advanced reactors and some others, notably, probably the next one along the line would be high level waste isolation.

Those new programs have necessary to be born in metric and to me born in metric means total metric regulation, every document having to do with not only application, but design, safety verification, that means codes, everything is going to be metric and I believe by so doing, we would then give advanced notice to those programs which still cannot spend a lot of money on hardware that they should be changing their thinking.

Now with respect to the other activities that aren't advanced reactors, I am in agreement with the views that have been expressed so far on those activities moreorless. I see no reason why environmental impact reports or safety analysis reports or problem risk assessments should have to be rewritten.

I had -- I see no reason why the regulatory activities, the procedures that exist in plants today cannot continue, perhaps to comply with the law, some new activities such as relicensing or license amendments ought to be framed in metric, but again, the opportunity exists there for soft conversion which should not impact too heavily on operating personnel.

I have the greatest regard for what responsible plant people have to do to run the plant in a safe manner and I wouldn't want to unnecessarily make their job any harder than it is.

Nevertheless, I note that if a total conversion for a new industry has to be undertaken as has been mentioned here today, the automotive industry has done it and so it can be done.

I also think that where conversion is cheap, then and where it would even be readily accepted, such as in those activities that are now largely metric, the medical industry, academic and government reactors are

two good examples of those, it ought to be done with speed and not wait for any kind of 1992 deadline.

The Act says, and these are the words put on by the Congress, "industry in the United States is often at a competitive disadvantaged when dealing in international markets because of its nonstandard measurement system, and is sometimes excluded when it is unable to deliver goods which are measured in metric terms."

Well, that to me means that if advanced reactors are going to be an outstanding product developed in this country and saleable everywhere, then they ought to be in international units from the very beginning and when I hear that a Westinghouse licensee converted everything from U.S. to metric before being manufactured in Europe, I could understand why they choose to do that, but I cried at the wasted effort that had to be undertaken in order to get that kind of a job done.

Now why are we so interested in converting to metric? Well, we have heard a lot of speakers already on that situation, even I wrote something in Nuclear News once about the advantages to advanced reactors if they were in metric.

There is a case that can be made that I am not going to belabor here, but certainly the SI units are less ambiguous, more logical and inherently simpler than

the units we presently use, but from what I have seen, presently use, unfortunately apply to the current activities of the people in the business of designed advanced reactors.

So let me show you what I mean. All reactors tend to start out metric and that is because of the big influence by physicists in designing the core.

Their traditions are basically metric. Here is something out of a document on PRISM -- General Electric advanced sodium cooled reactor, and what you see here is largely metric units describing the core, with one exception which is the unit right here, kilowatts per foot which I will have more to comment on in a minute.

Now as soon as the heat transfer engineer gets a hold of the core design they say it's a whole new ball game and we see the kind of units referred to by Brian McIntyre here as the ones we are the most at home with in designing the rest of the energy recovery system and those are what we usually refer to as U.S. customary units, although these units are certainly not unique, meaning that other units could still have been used for many of these quantities, for many of these volumes and they would still be considered to have customary units.

Okay, of course this all disappears under metric and as it is now, these engineers have to interact

with the people who design the cores and when they come to talk a common language, they sort of compromise a little bit and that's why you see this strange unit of kilowatts per foot for the specific power removal from dual pin[illegible]n here, but that's nothing new, that's is the way it is done and it works this way, believe it or not.

Okay, the situation even can be a little more complicated than -- we get this question of coherent versus noncoherent units, and in my paper as I referred to it, incoherent units.

Here is something out of the Rockwell Advanced Liquid Metal Reactor which has been cancelled by the Department of Energy since this was written and they again have, as you can see, largely the same kind of units as you saw before, but here they identify something as "little G's" which is the gravitational constant with these units.

Unfortunately, the thing that they mean there is that little G is not a gravitational constant and it isn't even the acceleration of gravity, but instead it a conversion constant to get you from incoherent to coherent units and as Bob Nelson would say, this is the number of poundals per pound force that somebody would need to do that calculation.

That's okay, engineers understand this and this is the way we now do business. But it isn't a very good way of doing business because there are lots of ambiguities that can creep into this system and the possibility exists for error in many places where it is needless.

I believe that the born in metric pronouncement for advanced reactors, if it were to be made by the NRC at an early stage would have the additional advantage of causing an immediate change in the thinking of designers in this country.

It would also have the effect of saving a considerable amount of money that is going to be spent on hardware sooner or later that will be made according to the old units.

So this seems to be, it seems to me, to be an opportune time to institute a change which everybody admits is going to be made someday anyway, and once this problem of then designing and manufacturing in metric is met, which I believe is the central problem, we will be well on our way to joining the world metric nuclear community.

Thank you.

MR. LARKINS: Professor Ruby, one additional question, what's your perception of the public's

understanding of nuclear safety and nuclear reactors if the NRC starts talking to the public in metric units? DO you see a problem there?

DR. RUBY: Well, I don't see a problem there because the questions of safety that have arisen are not one that are beclouded by their description in terms of the units involved.

They are mainly sins of omission that have occurred. The major accidents that have occurred have been those which involved a large amount of human error and this is certainly not a question of units.

In my district the most major nuclear event recently was the discovery by the NRC that the sump which is important in a loss of coolant accident in the Trojan Power Plant has not been inspected and cleaned according to the schedule which was certified by the plant operators.

This is a very serious problem, and yet, you know, you don't have to inspect and clean in anybody's units, and so therefore, I don't think the public is going to be upset.

The public wants to be assured that nuclear plants are safe, at least what they consider safe to operate, they would like a guarantee from a very vigilant government that this is true and from the standpoint of

advanced reactors, I look there as a definite improvement in the fact that such reactors should be much less prone to operator error that that generation of reactors which I now consider imminently safe that we are now using, and therefore anything that I could help, to get advanced reactors off the ground and into widespread use, seems to me to be a good thing to be doing.

MR. LARKINS: Any other questions for Professor Ruby?

MR. DiMEGLIO: Frank DiMeglio from the Rhode Island Atomic Energy Commission. I would like to comment on one comment that you made and that is that the NRC should do those things which are easy and you selected as one of the things that is easy a conversion of research, university type research reactors.

I would like to just point out that they have all been designed with inch pounds. The research going on may use the metric system but a nuclear physicist designing a spectrometer uses the inch pound system, so they are probably not so easy to convert as you suggested.

DR. RUBY: That is the subject of another panel tomorrow and we certainly should get in on that and find out whether or not it is true or false, that some programs could be on an accelerated schedule toward

metric conversion or perhaps whether this idea is totally impractical.

DR. NELSON: Dr. Ruby, could we see that last slide you had again, please, I would like to make a comment about that.

Many of these comments have been stated informally during the break , but I would like to put into the record the following observation and that is that it's not simply a question of aesthetics in terms of going to SI units.

There is a very real need to use SI because of the precision that is involved. There is only one Joule which is the unit of energy. It's a kilogram meter squared per second squared or a Newton times a meter by definition. There is no ambiguity involved in that.

But yet if you were to go to a handbook of chemistry and physics or some other equivalent handbook, you would find at least five different definitions of the calorie.

You might find a similar set of definitions of the Btu. The millimeter of mercury has an unbelievably complex precise definition.

Do you know for example why you should reduce the reading of an actual barometer to zero degrees celsius in order to get a pressure in millimeters of

mercury?

The question of the definition of the pound force, we are speaking of pounds per square inch, but the pound force itself, although precisely defined cannot be found precisely defined in much of the literature.

Now in this table there of Dr. Ruby's not only are the units for this gravitational factor which takes you from mass units into weight units have a funny set of units there, foot pound mass per pound force seconds squared, but notice the value given there, 32.2.

Now actually if somebody unfamiliar with the history of that unit and I would venture most people would not have taken the trouble to learn the history, they might take that number to be literal and in fact, that number is wrong.

In fact, that number cannot even be expressed exactly. The numbers should be given as 9.80665 meters per second squared divided by .3048 meters per foot exactly, and that's an irrational number. It turns out to be 32.17404856...

If an engineer used that number thinking it was accurate, he would have made an error by 2.6 percent.

Now it's okay to have a mental picture of what a pound force is supposed to be or what a millimeter of mercury is supposed to be or what a calorie is supposed

to be and if one is only dealing with the size of a piece of paper, or the mass of a calculator, one doesn't really need to worry about such things.

But if you are dealing with precise scientific measurements that are expressed to six significant figures, you can't use a calorie because nobody knows what a calorie is to six significant figures. In fact, if the National Bureau of Standards and NIST now, were to specify a value of a heat energy in calories, probably they would be talking about the thermal chemical calorie which is defined as 4.184 Joules exactly by convention, in the same sense that the gravitational constant there is given by some value there by convention.

So I would like to just reemphasize the fact that it's not a question of aesthetics, it's a question of precision.

DR. RUBY: Notice how careful our engineers have been, he never uses the simple -- always pounds mass or pound force because he knows, there is likely to be confusion if he is not very specific, although what he meant here -- this would be what Bob Nelson and I would call the number of poundals per pound --

MR. LARKINS: Uri?

MR. GAT: Just a very small addition, Uri Gat. I am sure no one has calculated the affect of 2.6 percent

difference in the numerical values on a 10 to -6, 10 to -7, 10 to -8 probability in a PRA. My first guess would be that there are cases where the difference would be 2.6 percent which is 10 to the fourth times larger than the number we were trying to calculate.

MR. LARKINS: Zoltan?

CHAIRMAN ROSZTOCZY: I don't have a comment, I am simply asking if we are finish with this session?

MR. LARKINS: Does anyone else want to make a point on this particular subject?

(No response.)

CHAIRMAN ROSZTOCZY: Thank you. I think that was a very informative session and in the meantime I see three empty chairs here, so if those people if they are here, please move here, we have John Larkins, Mr. Stangler and Daniel Clark.

Our next session is approximately the same, what we have just discussed for future reactors but this time it is for the existing power plants, existing power plants already have been designed in traditional units and are operating in traditional units which somewhat complicates the question of conversion.

I would like to ask John Larkins from NRC's Nuclear Regulatory Office to give his introductory talk and then introduce his speakers.

John?

MR. LARKINS: Thank you, Zoltan. Zoltan just mentioned that I am from the Office of Nuclear Reactor Regulation. The NRC is responsible for the licensing and regulatory oversight of the nuclear reactors in the civilian sector.

These include both the nuclear power reactors operated by electric utilities and research and test reactors such as those operated by various universities.

There are currently 111 reactors licensed to operate at full power in the United States, plus one facility with an operating license for less than full power.

The licensing activities of NRR begin with the extensive review given to applications for construction permits and operating licensing for new reactors. The NRC responsibilities includes the inspections from the onset of plant construction throughout a facility's eventual operating lifetime.

The NRC responsibilities also include the examining of reactor operators and the issuing of operator licenses, these include both initial licenses for operators and requalification exams.

The purpose of my short discussion this morning, this afternoon is to provide you with idea of

the options of the NRC that is considering in making recommendations to the Commission for consideration of implementing a policy on metrication.

The subject of metrication of nuclear power plants is complex, with many technical, safety and economic ramifications; however it seems that it is inevitable that such a conversion will occur.

The NRC policy should consider diverse viewpoints, preclude prejudice against metric goods and services offered competitively , provide for public involvement before final policy development and implementation, and should not impose obstacles to voluntary use of the metric system.

NRC recognizes that the implementation of the metric system could in some case cause an undesirable upheaval of the plant operating system and have considerable potential for operator error and other safety considerations.

The impact of conversion of the measuring standards to the metric system on the plants that are currently operating in the English system should be assessed. The NRC is currently developing a policy on plant life extension. The issue of metrication needs to be addressed as part of this activity.

As you aware, as I mentioned, there are about

112 plants licensed to operate. My best estimate right now is somewhere between 70 and 80 of these plants will come in for plant life extensions for an additional 20 years or so. Should we consider this group as currently existing, or as new licenses and is there a need to require that these plants now switch over to the metric system.

The question of how to handle the transition period between 1990 and 1992 should be addressed. We are supposed to be implementing some type of policy during that time frame or at least providing some type of guidance for a policy. Do we need to develop a transition plan for this?

Is it desirable to have a period of time when you have dual units to make a change from the English system to the metric system.

After operations begin, both routine -- power plant facility, both routine activities and unexpected events at these facilities can result in the need for licensing actions on the part of the NRC. Routine post licensing activities affecting the reactor operations include license amendment requests and any related public hearings, request for exemptions from regulations, new regulations requiring backfit modifications to operating reactors, orders for modification of a license, new

generic activities, petitions for actions under 10 CFR 2.206 by members of the public, or review of information supplied by a licensee for the resolution of technical issues.

During FY 1989 the NRC received roughly -- undertook 3,000 licensing actions. Of that, three-fourths of those were initiated by licensees for some type of change in their plant which we had to review.

Conversion to the metric system would have an impact on a large fraction of these and reviewing the merits, either by us or by the licensee.

The question of how will the industry handle all the various detailed operations that occur in the plan such as obtaining spare parts, replacing existing hardware, making modifications and reporting to NRC need to be addressed in a metrication policy.

In order to fully explore the ramifications of implementing the metric system in the nuclear power plants, certain areas must be explored with the licensee and the public to assess the impact: safety as well as operational and financial of the implementation of the metric system.

Towards this objective I have posed a series of questions that I think some have already been addressed and some we might, we would like to address during this

session.

These are the existing conditions currently. I think the slides are out of order.

Okay, what's the economic impact of converting from the English system to the Metric system in the following areas:

Maintenance; reworking simulators; training personnel and licensing organizations; owning and operating plants built and constructed; replacement of parts.

Let's go on to the next one. How is the industry planning to implement the program to convert from English to metric in the following areas:

Should we do something in the area of instrumentation? This is a question that came up this morning for currently operating plants.

I mentioned that there are about 3,000 submittals that come into the agency just in the area of licensing actions, not including things like topical reports.

Obtaining spare parts, there is a problem. As I understand right now, just being able to keep certain vendors alive and providing parts for the industry's current operations; replacement components; extension of current operating license, I mentioned in the area of

plant life extension, we are currently developing a policy in this area and as a matter of fact, there is a three day meeting going on right now discussing this subject.

How we do handle decommissioning? I think decommissioning is probably less of an issue in most cases, but it's something that should be looked at also.

Last slide. What would be the safety implications in making the conversion from English to metric? What impact would it have on operations?

Operators who have been operating plants for 10 to 15 years who saw a change in the instrumentation in the plant, could have a negative impact on their response.

If a licensee developed or bought a new plant that was operated in metric, and you had an engineering group which was trained in English units and now we are starting to have the engineering support service both plants, could this potentially be a problem?

Operator testing and certification: obviously, if we switch over from English units to metric, we will need to start testing the requalification in the different units.

I think I will leave off with these questions and allow time for others to think about and respond.

Thank you.

MR LARKINS: The next speaker in this session is Daniel --

VOICE: He is not here, John.

MR. LARKINS: Okay, is there a substitute? What about Bob Hall from Duke Power?

VOICE: He is here.

MR. LARKINS: Okay.

MR. HALL: I am going to deviate from my prepared text for a minute. I think after discussion this morning, it's important to give you some background over what I am going to cover.

My perspective is going to be a little different, and it's not going to be specifically related to nuclear plants. It is going to involve metric.

First of all, I think it's important to understand my position. I am the Engineering Project Manager at the Bad Creek Pump Storage Project and I guess the differences I see there, I am the one who has to take, I guess, the theory, the text, the codes and the standards and that team that works with me, convert them to specifications, procurement specifications, design specifications, buy all the equipment that goes into the plant, issue all the drawings that go into the plant, buy all the commodities that go into the plant, the steel,

the pipes, the block, rebarring, trade, cable, and then go down to the plant and make sure that's put in right, working with our construction department.

So that will be the perspective this is coming from.

First of all, I would like to say that I appreciate the opportunity to share with you Duke Power Company's experience with the design, construction and design of the Bad Creek Pump Storage Project.

This is a 1065 megawatt facility which since its inception has utilized SI or metric system. While Bad Creek is not a nuclear facility, it shares many of the same types of equipment, structures and operating interfaces as nuclear plants.

There are lessons to be learned of this application of the metric and hopefully, these lessons will assist NRC in appropriate implementation of the Omnibus Trade and Competitiveness Act of 1988.

Duke Power Company's active interest in metric conversion dates back to the early 1970's. This interest has resulted in Duke Power Company's membership on the Metrication Committee and the American National Metric Council for many years. The planning process for Bad Creek coincided with this interest and in 1976, the decision was made with concurrence of the turbine vendor

to provide a metric product, to proceed with a metric plant design to the extent practical.

When this decision was made it was anticipated that the United States transition to the metric system was imminent, that Bad Creek was evaluated as an appropriate starting point and pilot application for Duke Power Company.

The project was subsequently delayed for several years and restarted in 1984, the tough decision was made. While the United States' conversion to metric had substantially slowed; Bad Creek design proceeded to the point that it was schedule and cost effective for the majority of the electrical, mechanical and structural portions of the project to proceed, utilizing a metric design to the extent the marketplace was prepared to support it.

Drawings, procurement specifications, design specifications and start up and testing and operating procedures have been prepared utilizing metric or SI units.

Suppliers have been encouraged to provide hard metric designs in associated documentation, utilizing metric units to the extent practical within a bid competitive bid environment.

Currently the project is nearing completion

with most design documents issued. Construction is active and plant operations are just starting now. As we look back, our experience does fall short of our 1976 and 1984 expectations. We have learned that a metric plant can be designed, constructed and operated, with without the consistency, precision and accuracy that we desire.

We learned from our internal interfaces that while a metric design is achievable, there are obstacles to overcome. Training and defining a consistent philosophy for implementing the metric is not difficult. Implementing this training and philosophy into a consistent hard metric design is a challenge, employee acceptance takes time.

Even with employee acceptance, there is a lengthy period of time required to start thinking metric without constant conversion. Once acceptance and comfort with metrics is obtained, the implementation of commonly used codes and standards, many of which only exist in English or common units, into a "hard" metric product becomes the next and the most difficult challenge. Emphasis on a hard metric design has to be ongoing to be successful, and document and consistency monitoring are essential.

As personnel become familiar with the metric system, drawing productivity does improve. Dimensioning

is faster and easier than with the English inch pound or U.S. customary system, and computed aided drafting packages that we use do support metric.

We cannot consistently achieve supporting documentation and calculations in metric. Most of our analytical codes, references and other resource data are only available in customary system. Constant conversion in the body of the calculation is impractical an increases the opportunity for errors, as a result, even though we have good intent to achieve hard metric calculations, this practically has not been achievable.

We learned from our suppliers that: that while major suppliers, even those committed to the metric system through international trade are certainly capable of providing drawings utilizing metric units, the result actual projects are hybrid customary, English inch pound, metric SI designs based upon limitations of machine tooling, subsupplier availability and even lack of metric acceptance by their engineers and designers.

We have observed, it's not uncommon for a supplier's design to be initiated in customary units, converted to metric units in fabrication or shop drawings and then converted back to customary units in the manufacturing process itself, two conversions.

Procurement specifications have to utilize dual

customary/metric units. It became apparent at the onset that many of our traditional U.S. suppliers and their representatives are not familiar enough with metric to reliably bid on specifications utilizing only metric units.

Hard metric products either do not exist or if they do they are limited suppliers and associated economic penalties. With few exceptions, our domestic suppliers have proposed conventional products supplying drawings with soft conversions to metric units.

Supplier drawing quality has suffered. While many suppliers provide drawings with accurate metric dimensions, there are enough suppliers that have problem with metric dimensioning that detailed dimensional checking of supplier drawings is required. We do find dimensional errors attributable to metric conversion.

Fabricator acceptance of metric is widely varied. Some fabricators, even smaller ones, accustomed to dealing in the international marketplace have adapted well without any difficulty. Most fabricators consistently convert our documents from metric to customary units in performing their work. Close monitoring of their work is required to avoid cumulative dimensional inaccuracies as a result of conversion.

We learned during construction that with all

the aforementioned potential problems fewer than expected errors are attributable to metric problems. Those that have occurred have been aggravating but small and primarily due to the confusion between dimensional systems.

A supplier interpreted a 38mm thick washer to be three-eighths inch. Our construction personnel interpreted an erection tolerance to in millimeters rather than mils. Some dimensional inconsistences between drawings and equipment supplied have shown up as fit up problems in the field.

Round off errors used during conversion continue to a minor but constant aggravation. More than a normal effort has been require to establish consistent dimensional and conversion standards for nonmetric bulk items such as block and piping.

Overall, while our craft worker still struggle in their acceptance of metric, they have excelled in implementation, but I thin it is primarily through their determination to make it work. There have not been any delays or significant problems attributed to the metric design.

While we are early into our operating experience there are some interesting lessons.

Midway in the project we revisited operator

interface, response time and split second accuracy were critical. Should we proceed with metric instruction and plant control systems as planned or revert back to customary units?

It became apparent that with the extent of metric plant documentation, the consistency of a metric operator interface is more important than the training and cultural change required to accept metric. We have proceeded with metric instrumentation and controls.

What have we learned? Metric plants can be built, but with minimal real metric content. The marketplace simply does not support metric plants. The codes, standards, products and suppliers do not exist in the utility market segment. Consistency, especially in codes and standards and reference material is important.

We can deal well with either metric or customary dimensional systems, but we have difficulties when we try to mix both.

What is out next step? Our recently announced combustion turbine project is proceeding with customary units consistent with our major suppliers' product.

This is the reality of the marketplace as we see it. From our experience we have not been able to identify the multitude of metric suppliers, fabricators, codes and standards and associated references required to

support successful metric implementation of a product as large as a power plant.

We do recognize that the acceptance of consistent codes and standards is essential the United States competitiveness in world trade. We continue to support an orderly and cost effective transition to metric.

We have learned that the marketplace, not our good intent, will drive that transition. Conversion will appropriately be implemented in much narrower market segments than ours.

Capital intensive market segments such as the utility industry will probably be among the last to convert. When narrower market segment conversion happens and overall availability of products, services, codes and standards, indicate that conversion to metric is our ratepayers' and stockholders' best interest, we will make the metric transition.

In simple terms, summarizing I guess my company's position, specifically addressing nuclear power plants, the metric system should certainly not be retrofitted into existing plants, nor it is a proper time to mandate metric into near term future designs.

That's the end of my prepared presentation. I guess whenever appropriate, I would be happy to answer

any questions.

MR. LARKINS: Our next speaker is Thomas Donoho from Baltimore Gas and Electric.

MR. DONOHO: Thank you. A while back I came across a friend of mine who was working on his car and I am afraid that the language that he was using, the adjectives, adverbs and participles describing metrics were not quite as pleasant as those I heard here today, but I enjoy dumping a little gasoline on fires when it's appropriate, so I asked him whether he was aware of the fact that the recently passed Omnibus Trade Act in 1988 included a section on metric usage?

That was about as far as I got with that because he obviously remembered back to the false starts of the Metric Conversion Act of '75 and he gave me a sarcastic, well, here, we go again with the metric road signs.

By this time I was beginning to enjoy myself so I told him that this was not the same ball game, that the new Act did not include the word "voluntary," as the Act of '75 did and I went on to outline for him the requirements of the federal agency for which we are discussing today.

He gave me a dirty look, but then he thought for a moment and he said, well, this doesn't mean

anything to you, you utility guys have it made, you already sell your product to the Federal Government in metric units.

Here again he was wrong because the kilowatt hour is not a metric unit, even though I am sure it will be usage for many, many years to come.

But obviously my friend was thinking about the direct impact of the Act and quite frankly at that point so was I, and to an extent I agreed with him. I come from the transmission and distribution side of the business and for us, we have got a hugh embedded plant out there and quite frankly, the activities of the federal agencies, I don't think are going to have near term effect on us in those areas.

Certainly, as far as our nuclear plants are concerned, I am now well aware of the fact that we are going to see some significant impact.

But even at that time, my feeling was that the indirect impact is going to be far greater not only on the utilities, but on the country in general, that the direct impact.

When the largest buyer in the world decides that it wants to buy in metric quantities, that is going to have a tremendous impact on nongovernment buyers not long thereafter, maybe not in 1992 or 1993, but I do

believe that not too far down the road, that we are going to have a situation where we are going to go to a manufacturer to buy a customary motor and the manufacturer is going to say I am currently on a production run, 50,000 motors for the Department of Defense, I am tooled up in metric, you want one in customary units. If I will design and build it for you at all it's going to be at a healthy premium.

What the timing on this will be, I really don't know, but I really think that down the road, that this is going to be the big impact on our industry and I include the nuclear aspects as well, and I think the trickle down effects of this on our social issues will probably be significant, and I think our population over a period of time will become acclimated to metrics and some of the conversion problems that we have discussed today will no longer be significant.

I offer these comments because I feel that the NRC is going to be considering a far larger picture than simply compliance with the Act as regards metric conversion.

First, there is the Commission's own interest in improving the safety and efficiency of the industry it regulates.

Secondly, the nuclear power industry itself is

always concerned about safety, economics and technological improvement; but behind all of this must be due consideration of what is happening with all the interfacing elements.

I think any action contemplated must deal with all of these factors. This afternoon I am going to use a pair of terms that have been used a number of times already today, hard and soft conversion.

I want to take them a little bit further than they were taken earlier. Soft conversion to me denotes design in customary units followed by an exact mathematical conversion to the equivalent metric units.

Hard conversion, again to me, involves design in metric units with the establishment of standard metric links, pressures, et cetera, which may or may not be exact equivalents of the customary standards.

An example of this might be the selection in customary units of a one inch widget, for this the supplier might make available a soft converted 25.4 millimeter widget but if his stock of widgets consisted solely of rationalized metric standard sizes, he might respond, we have a choice in this range of either 20, 25 or 30 millimeter widgets.

25.0 seems very close to 25.4, but is it an acceptable equivalent for the purposes at hand? If it is

what about the new widgets other qualities, has it an equivalent alloy, heat treatment, even color? There times when color is significant to us, most of the time it's not, but there are times when it is very significant to us.

So it's not simply the equivalency of the length measurement that we have to consider. At this point I would like to digress slightly in connection with what I have just been saying.

A number of times today we have talked about dual units, parenthetical units and so on. I think today that is a very comfortable way of handling things, but 10 years from now this may result in some real problems for us. IF we see dual or parenthetical units 10 years from now, to go back to Oscar's point earlier, I hope we have somebody who is looking at these who understands the significance of them.

Are we looking strictly at a soft conversion, a pure mathematical conversion or are we looking at something that was originally designed in customary units and for which we now are showing the standard metric equivalent? Or do we have something that was design in metric and now we are showing a standard, a hard customary equivalent? I think this is something that we need to concern ourselves with.

If we are going to require dual units, then I think we need to have an understanding of what the rules are, applying to these specifications.

I have been talking about equivalent widgets and I think that the issue of equivalency is critical to the issue of conversion of existing nuclear power plants to the metric system.

Electric utilities are subject to industry codes and standards, as well as governmental regulations and laws in many areas of their operations, and in the nonnuclear areas, compliance with most of these is essentially self-administered.

Selection of an oil circuit breaker or an air break switch for distribution substation applications is made by a utility engineer based on his knowledge of both the application and also the fact that the manufacturer has recognized in his design the appropriate codes and standards.

If that piece of equipment eventually needs to be replaced and a soft metric equivalent is offered, review of the specs would be cursory. We would take a quick look, we know it's the equivalent and we have no problem, we make the decision that we are going to use the soft metric equivalent.

If only a range of hard metric replacements is

available, the equivalency review would be more detailed, but still within the purview of the engineer's judgment.

Costs associated with the conversion analysis would be minimal. The rules become drastically more stringent though when applied to a nuclear power plant, whether the metric conversion results from replacement of a single item or a planned retrofitting program.

Current licenses are based on technical specs written basically in customary units. Any programmed conversion of existing functions to metric presumably would require equivalency analyses, rewriting the specifications and possibly relicensing. Any benefits realized by the conversion would appear to be far outweighed by the costs, certainly contrary to the economic objectives of the Act.

Now what I am talking about here is essentially run of the mill replacements, the hundreds of thousands of common items that we have in the plants, not major custom items, but for the run of the mill items, the fasteners, the motors, the pumps, the piping, the standard piping, replacement of an individual item of equipment with a metrically specified equivalent would presumably required a formal equivalency analysis and certificate of compliance.

If an identical customary replacement were

readily available, conversion costs generally could not be justified, but even if costs are ignored, acceptance of a metric replacement would require consideration which has been touched on earlier, of operating mixed metric and customary units in the same plant.

Even if we were able to convert all similar units in one unit of a multi-unit plant, we would have the potential for similar concerns, safety, operating concerns.

However, despite what I have just said, over a period of time, as the objectives of the act are achieved, with suppliers becoming oriented to a metric market, I think that customary and soft metric replacements will be less and less available and as this occurs, then economic and operating considerations no longer control, the conversion of necessity must come about.

I believe this imbalances sizeable resources requirements versus questionable technical gains applies to conversion of most activities of existing plants.

However, consideration should certainly be given to possible conversion in the areas of chemistry and radiation safety. Here the associated costs, while still considerable, may not be overwhelming, and conversely, the benefits may be more significant.

Waste management would be a logical function for conversion. The presumption that any new nuclear plants would be metric, leads logically to the presumption that all off site handling of rad waste would be in metric units.

A change for existing plants would seem to have minimal impact.

Use of metric radiation units in the area of emergency preparedness would appear to be very feasible. Today's values of absorbed dose and dose equivalent as has been said several times a day, would require only a decimal adjustment, not the application of a constant, to be expressed in metric Grays and Sieverts.

The agencies which would use this information would find expression or releases in doses in metric units to be of value and certainly those terms could be provided.

Whether conversion to metric radiation units would enhance or hinder public understanding to me is a moot point.

I personally don't feel that the general public has any interest in any mathematical expression of radiation, as compared to a very simple subjective, dangerous or not very dangerous.

In conclusion, while I see many disadvantages

to a program conversion of most activities of existing nuclear power plants, I feel that a continuing monitoring and evaluation program must be maintained.

Over time opportunities will appear and problems will disappear. The inherent advantages of the International System of Units will in my opinion be rapidly accepted, particularly in technical areas. This will change many things from the way we see them today.

We must be prepared to recognize these changes and to turn them to our advantage whenever safety, operating and economic gains can be realized from metric conversion.

Thank you.

MR. LARKINS: Thank you very much. I think Joe Colvin, is he here?

MR. PRICE: Joe is not here but I am substituting for him. I don't have any formal presentation at point. I stand by his previous statement that present reactors are both inefficient and ineffective, to convert those --

Sorry, I will speak again, I am repeating Joe Colvin's previous comment earlier today, that conversion of existing power plants, existing nuclear power plants to the metric, the SI system, is both ineffective and inefficient for meeting the intent of the Act.

I am here to answer any questions.

MR. LARKINS: Thank you, Tom. I will open up the floor for questions. Maybe, in that light, I ought to ask you a question, Tom, since you are not going to stand up here and give a presentation.

The statements about you made about existing plants, what about for those plants which are in for plant license renewal, where we are talking about operating them for another two decades, 20 years or so, where we have a national policy in place to move towards metrication.

Shouldn't we at some point start thinking about converting those plants?

MR. PRICE: I think the answer to that question from my point of view, again, I am not sure I can answer for all of the U.S. utility market, but I think you have to look at those power plants as if they -- we have used the expression in life extension in the licensing process, setting aside the metric conversion for a minute, used the expression that operating the nuclear power plant on a day 40 years in one day, is pretty much the same thing as operating the power plant 39 years and 364 days.

To tell a power plant that its equipment and its operators and its tech specs and its documentation

and its notification of all of the things that it does or wants to change its way of doing to both the NRC and all of the state regulators that it goes through is, as I said, certainly inefficient and ineffective from day one to day 40 if it's already operating, from year one to year 40 if it's already operating, and I suggest that to extend the life of that plant for another 20 years will not change the pattern of converting to the metric system for the United States, especially in its competitive market overseas and that we are much better off leaving that plant to run, just like you maintain an automobile, even though it might not use the same set of systems of weights and measures that the market has today, it still runs just as well.

MR. LARKINS: Thank you. Mr. Hall, I thought it was a very interesting presentation on the Bad Creek project. I was curious, you sort of imply that it was not too much of a problem with you craft people or your support people in making the conversion, is that a fair interpretation?

My questions leads up to the point if you are -- the future for nuclear power, and we start building new plants in the metric system, and we have existing facilities in English units, do you see this as being a problem maintaining engineering support for two different

types of -- plants of differing units.

MR. HALL: I am going to say it is a significant problem. We do it now at Duke with I guess nuclear plants, we deal with Bad Creek and we are doing it now and it hasn't presented a problem. We do have crews that move back and forth between Bad Creek and other projects and it hasn't been a problem or a significant problem.

I may have mislead you a little bit, not intentionally, with the statement concerning our craft people. They are having a very difficult time in dealing with metric. It hasn't slowed them up too significantly. It hasn't affected quality too much.

We still have a large segment of those workers who I guess will regularly bring in their feed inch tapes and make conversions to do that work in that plant, although we issue them metric tapes and we encourage them to use those tapes. It's an ongoing situation. It's hard to draw any conclusions.

We have a certain segment that accept and a certain segment that do not and that's just where we are at. But the bottom line is we are dealing with it, and we do encourage them to continue to utilize metric in their work.

Their drawings are metric, there is no point in

them converting, they have all the tools it takes to do that work in metric, but there is a built in resistance, yes.

MR. LARKINS: Thank you, Brian?

MR. RICHTER: I am Brian Richter with the NRC, and I have a question for Mr. Hall. What sort of experience does Duke Power have with respect to costs by having gone with metric at Bad Creek as opposed to English units?

MR. HALL: Addressing equipment procurement?

MR. RICHTER: Correct.

MR. HALL: We exist entirely in a competitive bid environment and to be quite honest, the people who were usually low bid were those who brought in their common product, converted to metric dimensions. We did not pay any additional costs for metric products. We did look at some such as instrumentation tubing, instrumentation fittings and items that were available in metric, there were some additional costs there.

We did not elect to pay that, probably for even a stronger reason though, that we keep a large central inventory of those materials and you reach that hard decision point, am I going to buy 200 of one item when I have a stock of 2,000 over here and I need a replacement long term, and that was a tough decision, so we made a

decision to go ahead with conventional bidding sizes, but we did see some premiums for metric products, yes, we did not pay those.

Again, this is the dilemma we are in, I think from an advocacy standpoint, we would have liked to have pursued perhaps some of those metrics products where they were available, which were very few further, but I guess our obligation to our shareholders and ratepayers takes over too and that's the balance that we are faced with.

We have to answer to them, especially when you look at prudency hearings.

Yes, sir?

DR. RUBY: Where you interact with the external world, because this is not a nuclear plant, is in your environmental emissions, and there do, you find that the state wants to regulate you in U.S. customer units and check these emissions in U.S. customary units?

MR. HALL: Again, for the sake of brevity, I perhaps did not break down our plant segments as much as I should have, it actually exists. I guess there are two different entities of that plant. All of the underground work of the plant, the power producing segment is metric.

All the above ground part, where we have to interface with the FERC was done in the English or the U.S. customary units.

So that part, we did interface in inch pound or customary units.

I will say that we did submit a number of our internal drawings of the plant to the state agencies for things that I -- perhaps to you gentlemen are minor permits, but to us are large permits, waste water treatment, drinking water permits and items like that, were submitted to state agencies in metric units and I don't recall much discussion on that. They seemed to accept them fairly well. It was not an impediment to us at all.

MR. LARKINS: Other questions? Uri?

MR. GAT: Uri Gat, Tom Donoho mentioned that the kilowatt hour is not in what we call a metric SI unit. I might mention that several others today and Jerry Wilson specifically mentioned that the SI that NRC intends to go to is the International System of Units as modified for U.S. usage by the Secretary of Commerce.

This is a problem that should not be underestimated. What is that thing, unless NRC would have to define that more than that because to the best of my knowledge, there is no place where the SI is defined as modified by the Secretary of Commerce, specifically the kilowatt hour is a good example

It's a unit that in all the official documents

appears as a unit in use temporarily with SI, it's definitely permitted for use if you go permanently because a kilowatt is a unit, an SI unit without question and the hour is a unit for indefinite use with SI.

If that uncertainty is introduced at this time, this will make for some reluctancy into a system that may be undefined.

So I guess my question is to NRC what is this modified SI as modified by the Secretary of Commerce, that they intend to go, and I might point that for instance DOD has defined that the ASTM is 380, I believe I am correct, John, right?

And several other agencies have also defined it as such.

CHAIRMAN ROSZTOCZY: Jim, would you like to comment on this, Jim, McCracken?

MR. McCRACKEN: At this point, excuse me, Jim McCracken, we do have a standard, there is a federal standard, 376A which does define a certain number of units. We have sought government input to update it and list units that have specific requirements within government operations.

We are reviewing whether or not the ASTM E380 might replace it, but at this point, if there are units that need -- I have made a note before because there was

mention made when the SP330 was put out John came up and made the comment about a Federal Register notice.

Truly there is no, as of today, federal standard or federal document that clearly defines the metric system up through the latest change which was the change defining the meter to the wave length of light through a vacuum. There has been no updated change.

So that's something that we are going to have to be dealing with and I guess to specifically answer your question in a way, Uri, the Department of Commerce through the National Bureau of Standards or NIST as it is now known, when it puts out another Federal Register notice or issues a subsequent publication, would define as many units as are existing in the Systeme de Internationale of Units, the international system of units, and that would be the unit, the metric system as "modified" by the Secretary of Commerce.

At this point there is no particular modification that I am aware of. We are accepting the units as are supported by the International Bureau of Weights and Measures.

CHAIRMAN ROSZTOCZY: Do I understand correctly, Jim, that the idea would be that in the future if the U.S. would accept new standards then it would be done through the Bureau of Standards, used to be the Bureau of

Standards and endorsed by the commerce secretary which would make it official?

MR. McCRACKEN: Agreed. The only -- the Secretary of Commerce would be the person, but it would really be done through the National Bureau of Standards of the NIST.

MR. LARKINS: Bob?

MR. HALL: John, Bob Hall again, Duke Power Company. I would appreciate the opportunity to follow up on your earlier questions preceding our discussion, and would like to make it clear.

We at Duke Power see the issue of, I guess what I call operating plants and future plants in significantly different perspectives.

I think and would like to make it clear, we see that existing plants are entities that have been build using common units. We have operated them for years using common units, going back 20 years, our operators are familiar with that, our tooling is geared up to that, our procedures are geared up to that.

I guess the amount of paper boggles my imagination when I think of what's gone into that as far as design documents, calculations, specifications and all of the products that go into that.

I just do not feel that that is the proper

focus for conversion. That's going to be expensive and that's cost is going to be passed on to our ratepayer and I don't just don't view that as appropriate and I don't think it's going to change I guess where this country is going as far a metric conversion.

I think the analogy if an existing car is very good. Future plants, I know we are having a difficult time getting our arms around what to do with those, but I thirk those are the appropriate targets, if you are going to have an effective policy for conversion.

Those are entities we have not paid out capital costs for. Those are entities we do not have to go back and pay to convert. So I don't know how Tom is going to get his perspective, I think he spoke it, but I guess the degree of consideration of existing plants here today so far is Bob and me at least from the utility perspective, just as even being considered to the extent it has been.

MR. LARKINS: Zoltan?

CHAIRMAN ROSZTOCZY: I would like to follow up a little bit along these lines with a somewhat different question. I know you probably don't know the answer, but I would be interested in your ideas or speculation on this.

Let's assume that Duke Power has a nuclear facility operating somewhere, whether it's one units, two

units, doesn't really matter, and let's assume that they select that site for development of new nuclear plants on the same site. So they come in and they get an approval for a site application and they can put four more units on that site.

Let us assume by the time they ordered those units those are metric units, so here would now be a site which has the two currently existing conventional units plants and they know that they are going to build four more plants there and those are going to be metric.

In looking out into the future, what would be Duke Power's approach to how to eventually convert to metric? Would they consider running the existing plants which with life extension have 40 more years and the new plants which will have 60 years after they get into operation, would they consider running them on the same site in different units, or it is more likely that one day, they will say, well, from now on, they all should operate one way?

MR. HALL: I would say first, I guess it would be my assessment that's a hypothetical question. As I view our sights, I don't believe they could support additional units. We have managed to pretty well box in existing units with additional facilities as time goes on.

I think we have pretty well demonstrated, we are willing to entertain metric plant designs if we can find that marketplace that supports it. This is not a philosophical question.

I think philosophically we see a lot of advantages to metric and we see the importance of this countrys' conversion to metric; but we just cannot find the timing at this point in time and as somebody said earlier, timing is everything and that's our difficulty, trying to figure out appropriate timing.

I did not totally discount future metric plants you will notice.

CHAIRMAN ROSZTOCZY: My question was kind of going a little bit beyond that and yes, it's hypothetic, so let's just take it as a hypothetic, but if you pass all of those and you arrive to the point that you are buying metric and you are putting the metrics there and then you are, 20 or 30 years into the future, so now you have side by side these plants running and then it would be much of a difficulty to continue running the old plants in the conventional units or is that something you think one can easily live with?

MR. HALL: I feel we could live with that, through assignment of operating staffs or other things, as long as we can look at it and justify it in a cost

effective fashion, yes, we could live with it.

MR. LARKINS: Tom, I was going to ask you a question --

MR. DONOHO: May I add a little bit to Bobs. Last year I and several other members of the Edison Electric Institute Metrication Committee met with people from Ontario Hydro in Toronto to discuss their experiences with their Darlington Nuclear Plant.

As you all know, the Canadians began their conversion efforts in the early 1970's. In '76 I believe it was, Ontario Hydro saw the need for a new plant and they considered constructing that plant in hard metric which is what they did.

They stated when we met with them that part of their decision was based on the fact that this was a new plant at a new site, ground up, unrelated to any existing units.

I won't go into the discussion that we had with them, although I suspect a long the way you all may want to get in touch with them and get some inputs from them, but I won't go into now their assessment of their experiences with the construction of that new plant, but as of last year they stated rather vehemently that they would not consider going back an retrofitting any existing plants, that they felt for the reasons that have

been expressed a number of times today, that the reasons for not retrofitting were compelling from their standpoint.

MR. LARKINS: Tom, I was going to ask you a question, does DCBG&E in their planning for additional capacity, adding systems which will be in metric or company made any planning in this direction?

MR. DONOHO: All I can say is not that I am aware of. As far as I know, our next plant is supposed to be a combined cycle plant not nuclear, I do not believe that there is any nuclear construction in either the near or immediate term picture.

MR. LARKINS: I wasn't talking about just nuclear, I was talking about any facilities.

MR. DONOHO: The combined cycle, as I understand it, will be in customary units.

MR. LARKINS: Any more questions?

MR. GAT: No, a comment, perhaps a partial answer to your question, Zoltan, is that in 1959 when the foot was changed, the old foot is still is in existence and in use is the socalled survey foot, is still in existence and lives side by side indefinitely until, it says, literally until a new decision will be made. This foot is the U.S. survey foot.

So that is, we have at least, what is it now,

what 20 years, 30 years?

MR. LARKINS: Zoltan, we are just about back on schedule. Maybe five minutes over.

CHAIRMAN ROSZTOCZY: Thank you very much, John, we appreciate that, and I think our next step is to have a coffee break, and this being now 3:35, let's have a 15 minute coffee break which is going to bring us back here at 3:50.

(Whereupon, a short recess was taken.)

CHAIRMAN ROSZTOCZY: Gentlemen, we are ready to start our afternoon session. In the intermission I have been reminded that it's not easy to hear us in the back of the room unless we are talking into the microphone. So please, when it's your turn, get close to one of the microphones and you have to talk relatively closely to these microphones so you can be heard.

Within the various areas, what we discussed today, there is one which has kind of a required special attention usually and this is the emergency planning and emergency communications.

The emergency planning area, we have to have direct communications with the licensees involved and decisions have to be made on a very short time schedule, typically in the order of minutes or hours as opposed to licensing reviews which normally take months or sometimes

years.

The session chairman for this last session is Jack Heltemes. Jack Heltemes is the Deputy Director of our Office of AEOD, Analysis and Evaluation of Operational Data. Jack?

MR. HELTEMES: Good afternoon. Thank you, Zoltan. As Zoltan mentioned, I represent AEOD within the NRC.

AEOD has a number of responsibilities. First of all, we are responsible for the reporting requirements of our agency. You may know them as the OER reporting requirement, 50.73, as well as the immediate notification requirements, the oral notification within one hour or four hours, 50.72.

So we are very interested in metrication because of the ramification on the reporting requirements as well as our analysis program within the office.

Another reason we are very interested in metrication is that AEOD operates the technical training center at Chattanooga and the technical training center will be responsible for the training of all NRC technical personnel in the metrication and its implications and ramifications on our technical subjects that we teach in Chattanooga.

The third reason is the reason that we are here

now. The NRC has an operations center that falls within the responsibility our office and also AEOD is responsible for the definition, implementation and training of the emergency response capability and program within the agency.

In the emergency response program is, we consider one of the most important of the agency's mission, of its responsibilities, and as we all know, to have an effectiveness emergency response program you have to have effective and prompt communications among a wide variety of organizations and agencies.

They exist not only within the utility industry, that is the utilities as well as their supports such as the industry organizations such as NUMARC and NEPOL and EPRI, and others, but also the NSSS and architecture engineers.

Then you have the state and local governments, you have the NRC and many other federal agencies and you have the general public, all of these different organizations, all of these many, many individuals have to have a common understanding of what their problems are.

The way you get that common understanding is talk about parameters, and thus, the units involved in those parameters become very important. They become key

to understanding what the particular problem is, what the implication of that problem is on public health and safety, and that of course, is the central theme of emergency planning.

You have to understand what is occurring in order to classify the event properly or at within the NRC, that will trigger a response and if that response is inappropriate, it could have very serious consequences.

To assure that the proper response is made, you have to understand the event and then we can take the proper action.

The key to this again is communication, and the key to it is making sure that everyone has a common and very rapid understanding of what is occurring and that is significant.

We get that information through various links. One is oral communications, we are directly involved through the operations center to talking with the control room, and so our first point of contact would be the operators themselves.

Then we get written communications, often times by fax, and as many of you may know, we are tying electronically into the SPDS, the plant instrumentation system to urge the emergency response data center and so that we will have an automatic data transfer on emergency

classes of alert or higher in the future.

But all of this is to communicate the parameter type of information and to assure that there is a proper understanding and we get back to units.

Again, there are many organizations and individuals involved and we have a real training priority on our hands here and I will talk more about that in a minute.

This is a chart that we use to classify events into our four emergency classes. You can see on the left, the general emergency, area emergency alert and unusual events and then you have the 50.72 and 20.403, notifications.

The reason for showing the chart is that we have different criteria for how we classify events and you can see that we have values such as rem involved in our release criteria and you can see references to technical specifications. You see references to protective actions guidelines.

You see references to other units there such as the reactor coolant system leak greater than 50 gpm. The point of this is that the entire matrix here is tied back to English units. It's tied back to some fundamental documents such as the technical specifications and the protective action guidelines which are in English units.

This is a listing of typical parameters that we obtain in a response to a nuclear power plant event, and it's not complete, but I show it only to give you a feeling for the type of information, the mass of information if you will, that is transmitted during an actual emergency.

You can see that the information is very broad in its nature. We talk about levels. We talk about pressure. We talk about flows, temperature, volumes, quantities, weights and radiation units for many systems, essentially all of the principal systems of the plant can be talked about.

We have a great number of people involved in an emergency response who would be analyzing these types of information, trying to get one step ahead on the "what if" questions if you will, in order to thoroughly understand the potential significance of the event.

And there will be a lot of communication links going on between the different organizations, trying to analyze and compare notes and to get further information, and again, it is all set up on English units.

This is a chart that kind of shows you the number of organizations involved, if we should have an emergency at a nuclear power station. You can see the governor, a designated representative and oftentimes when

you are talking about the 10 mile EPZ or the 50 mile junction pathway EPZ, more than one state will be involved. You can have a number of states involved, any time you have the various states involved you have a number of state agencies involved.

You certainly have a number of local communities such as counties involved.

Coming down you can see the great number of federal agencies involved, and they all are active participants.

Then way in the right hand corner you will see state department and a dotted line. That's the link to the international community, and of course, a serious event in one nation is a very serious event in all nations as Cherynobol taught us, and thus through the state department we make notifications and receive notifications of events through the NEA, the Nuclear Energy Agency in Paris and IEA, the Internation Atomic Energy agency in Vienna.

Additionally, if we have a very serious event I can assure you, a number of countries will call directly, all obtaining information, and during the Cherynobol event it was a bit troublesome in our own country because we use different units in this country than these international communities and most other countries as you

know and the information we were getting had to be translated so that our decision makers could understand the particular levels and significance of what they were being told.

Although there was not a great impact on the United States in the Cherynobol event, it was still troublesome in the way the information came and was translated and was fed back through our own communication links.

Just one more point I should mention, to give you a feel for this, in 1987 we had our second federal field exercise at Zion in Illinois and that was a three day exercise that brought in all of the federal response groups and during those three days at this simulated exercise we had, I believe it was around 1,200 individuals involved. We had 12 different federal agencies. We had two states involved, Illinois and Wisconsin and a number of the state agencies and a number of the counties involved. It was a very large and massive undertaking if you will.

When you start filling out this chart in terms of the number of people involved, and I say that again in the sense, the number of people that have to communicate, understand and implement in the sense of decision making it becomes a very large undertaking to do this in the

sense of switching units.

This some of the potential problems associated with metrication. Since Three Mile Island 10 years ago we have put a very large emphasis, priority if you will and lots of resources going into the definition of our emergency response program, into the training of personnel and periodic exercises in order to assure that the people are trained, that the procedures do work and that people know what to do if they suddenly get the call in the middle of night.

We approach any change to this somewhat cautiously if you will because of the potential negative impact on the public health and safety if there is a change in the scales that could introduce a new source of error or missed communication or if people do not think in the right units and do not react intuitively, instinctively and if their decision making therefore is slow, sometimes decision making as Zoltan said earlier, has to be made in real-time on an order of hours or perhaps even minutes.

Again, going back to the effective and rapid communication, the key there is a common understanding of the units and we are set up now in terms of English units.

The next bullet talks about the investment that

we have in emergency plans, in procedures, in design documentation and I should add quickly, hardware has been talked about a lot, now that our system of course is tied into the plant instrumentation, it involves an awful lot of off site instrumentation, particularly for radiological monitoring that's owned by the states and others, and that point was made earlier.

The training of personnel is key. All of our people have been trained to implement these procedures and act on the instrumentation readings and again, the key to it is the intuitive reaction, the understanding of what a value means.

What Chernobyl told us, that people do have problems when they switch units to Sierverts and becquerels and the SI units, at least for radiation monitoring.

Most of people quite frankly, do not have the training and the reaction that they would have to have.

As we are aware in the United States, is a little bit out of step with much of the world with regard to progress toward SI units, and so that we have a problem perhaps communicating if we have a problem in a United States plant that could impact either Canada or Mexico or if they have a problem with one of their plants, could impact our country, and I mentioned earlier

that when you do communicate internationally through NEA or IEA, there is a unit shift and that's been troublesome.

The first bullet talks about each site must assure that licensee personnel, state and local personnel, NRC and other organizations involved with emergency response are prepared to implement the changes, what we are really saying is that this is a highly coordinated response, tightly knit and we have to be in lock step because of the probability of missed communication if we are all not talking the same language.

Therefore, if we were to change all response organizations at each level and all the individuals involved have to change at the same time. We must be geared up in order to handle the new units without any real problems in communication.

Again, the third bullet just talks about the ability to communicate clearly.

So finally I come to some questions to raise and to allow people to discuss and feed back. First of all, on the first one, is there an incentive to adopt the metric system for existing reactors?

In the NRC we have the -- regulation, 50.190 so if we were to require the backfitting of existing

reactors in order to use such a system, we would have to demonstrate, to show that the safety benefit associated with that change will equal or offset if you will the high cost of doing so.

We are a little bit at a loss to see the safety benefit. We don't see the real benefit, but I raise the question to see if anyone here can see a safety benefit from trying to use the metric system for emergency response for existing reactors.

We have heard a number of people talk about this morning that they do not see a benefit, but I wanted to raise the question just to make sure that we do address it head on. Is there something we are missing? Is there some sort of a safety benefit with the use of SI that would in some way offset the high cost of trying to go back and to retraining and to modify or revise all of our procedures?

Next is you get pass the existing reactors, you get into the next generation of commercial reactors. We have heard this morning from Westinghouse for example that the next reactors they are working on are really being designed using English units and our thought is that it is generally pretty well agreed upon that SI units are going to come, the question is when are they going to come and how do we make this transition,

particularly for emergency response.

How do we get far enough ahead of the first plant that's going to be operated with SI units so that the transition is smooth and we do not have any negative impact on safety, which is our fundamental objective here.

We have to have an idea as to the schedule we are on and the approach that we will follow that the response community can move together in order that we all retain the ability to communicate without regard to what units we are using.

The third bullets talks about thoughts that or suggestions that some people have advanced; that perhaps we can break apart the metric units, for example, use SI units for radiation, go to the Sievert, to the becquerel, to the Gray, and not for everything else, that there may be an advantage in international communication or in domestic communication.

So I throw it out as a question, if somebody sees an advantage, if we should think along those types of lines or whether it's all or nothing?

The fourth talks about what do we do when we are slightly out of step with the rest of the community. How do we communicate? What should we do to be able to communicate better with our neigborhoring nations and

with the international community, both to receive the information and to act appropriately as well as to transmit any concerns that we have regarding one of our reactors that could potentially impact the public in other nations.

That concludes my remarks. I would be pleased to answer any questions or if you wish, we could proceed to the next speaker if no one has any burning questions right now.

MR. GAT: It's not a question, a comment, answer to your question. Uri Gat, you asked the question, is there any incentive to adopt the metric system for emergency for existing reactors. My unequivocal answer is definitely yes. The first reason is it is not adopting, right now we have both systems and we cannot ignore that.

The medical, as we will hear tomorrow, the medical area has already gone SI, the rest of world has gone SI and in a real big international emergency we have seen that we get international interaction and you get experts from elsewhere and if you are using units that nobody else knows what they are, then as you described the case in Chernobyl, and I will talk a little bit about that tomorrow, you get close to disasters and the panic that may be result is by itself an emergency.

So when the fact that physicians who may need

to treat cases that they are totally unfamiliar with or mix them up and we have a factor of 100 here which is too big to tolerate, so that's another one, why you definitely should go, even in emergency cases, in emergency treatment. To look at the emergency treatment is something that is totally separate from the rest of everything else is in my opinion inadequate and will hit us when an actual emergency occurs.

I already mentioned the international cooperation in this case and these are really the major reasons.

There is another reason perhaps and that is the IAEA imposes on transportation the international units now and they are going to be implemented as I understand or are being implemented under the safety series six, and as such there is no escape from these units and we will soon be, as with the other units, the only country that -- we perhaps are already the only country that uses these old units and it is a double problem when you combine them with say areas such as curies per square foot and try to convert that to becquerel per square meter, you are in a real problem there. By the time somebody tries to make that calculations he makes 20 mistakes.

MR. HELTEMES: I appreciate the comment. I must point out to you that my comment or my question was quite

narrow and specific. It had to do with the incentive to adopt the metric system for emergency response for existing reactors. It was limited to commercial reactor industry. It was not the nuclear industry as a whole --

MR. GAT: My answer was for reactors. Chernobyl is an example. Three Mile Island is an example. If you have mixed units out there you are going to create a panic that by itself may be a disaster, that may cause more deaths because of people trying to run over one another because they totally misunderstand what's happening then if you had everything in clear units and single units and that's the whole idea of going to SI, is that the entire world will speak a single language.

You won't have the Tower of Babble.

MR. HERTEMES: Yes, sir.

DR. RUBY: Well, I certainly agree with everything that you said and nearly everybody today who has spoken on the subject of what to do about existing reactors agrees that the public health and safety won't be served by trying to convert them to metric operation or metric regulations or both, but I feel however the Act says that the NRC must begin to do business in metric by a given date and that eventually something is going to have to done to satisfy that requirement.

My proposal would be to try and live with both

of these objectives at the same time by making future licensing activities accessible to a dual dimensioning system in which the metric equivalent would be given first and the U.S. customary equivalent included in parentheses with the NRC agreement on the following things: that either unit could be used to verify the requirement; and two is either unit could be used to satisfy a question regarding the regulations because it's important not only that existing instrumentation be continued to be satisfactory in every way to monitor the plant, but also that the operators suddenly overnight don't need to learn double the amount of information that they presently do.

Now, perhaps that sounds like an artifice to comply with the Act without really going metric, but I think that it may from my lawyer standpoint, be satisfactory and at the same time, from the standpoint of the operators be a way to live with the requirements with only a moderate amount of extra inconvenience.

MR. HELTEMES: Would your suggestions be for the existing reactors?

DR. RUBY: Yes, only for the existing reactors.

MR. HELTEMES: Would you have the NRC mandate that through regulation?

DR. RUBY: I just would offer that as an option

because I can't imagine any of the existing reactor owners not adopting it.

MR. HELTEMES : Well, the problem I get back into is the one I discussed, that if we backfit that's what we would be doing, be imposing a requirement than is different than their licensing base, that we would have to show a safety benefit --

DR. RUBY: No, I don't mean that it is different. In other words, supposing you were going in for a new technical specifications for example, whose purpose is only to comply with this regulations. Then they could be written by your legal department rather than your technical department because they would be exactly as before, excepting with the metric unit first and the units that you have always used in parentheses and as I say, the NRC would be incumbent, once it had accepted this new document to then allow verification in either unit and to allow examinations to be answered in either unit.

So therefore, I think that it would involve a little more difficulty from the standpoint of the operation of the plant, to have the documentation with both units, so long as you knew you could use the older ones.

MR. HELTEMES: Well, the modification of the

tech spec I believe would still fall within the scope of the backfit rule, and as resolved, for us to do that, to justify that, under our regulations, we would have to show there is a safety benefit associated with that, and right now we believe that our system is effective, that it exists, and that it has proven to be effective during exercises, and it's that demonstration of a safety benefit that can offset the cost placed upon the utility to retrain its people, to modify its procedures, in accordance with the revised tech specs for example, would be the problem that I am posing as one that we have not yet found a solution for.

DR. RUBY: BUt will the NRC say that the congressional supersedes their rulemaking in this regard?

MR. HELTEMES: Well, the question comes back to practicality and the one that we talked about before, that the legislation has a number of escape roads in it and practicality being one of them.

So is this the practical thing to do is the question we are talking about now, and we have to answer that. But if under backfit, it's not practical to do, then it fails that test under our own regulations.

Let me turn it over at this point to our second speaker, Marlow Stangler from FEMA.

MR. STANGLER: Good afternoon. I may duplicate

a little bit of what you just saw and heard, but I have a few numbers that I want to point out and I have a reason for doing it.

There are approximately 72 nuclear power plants right now that are on line or very close to it, a couple of others I believe that might come into operation sometime in the next half of dozens or so, Lets Bar for example.

Each of these have an emergency planning zone which was dictated by the Federal Government jointly between NRC and FEMA back in '80, right after TMI and the ten mile circle for the pen EPZ which is primarily an evacuation area as well as an area in which state and local governments have to have the capability to alert essentially all of the people, I wouldn't say 100 percent, but essentially 95 or more in a matter of 15. Now generally the utility has about 15 minutes to make a decision when a general emergency is being declared if it is a fast breaking one.

The siren or alerting system in most of the sites have system which have been installed by the utilities and are siren systems.

There are a couple that use radios in addition, but most of those are now supplemental and they alert hospitals, schools, things like that.

The 15 mile circle is an ingestion zone, which is truly solar response area because it's primarily from ingestion because it's going to be some time, but in the plume area apparent fast response might be required.

In the case of Pennsylvania for example, their plans are to evacuate everybody within a 360 degree circle. Most states have plans in which they will evacuate only about three 22.65 degree sectors and go from there in terms of whether they need to evacuate a larger area.

Now this involves approximately 100 state plans, when you consider a lot of these reactors are on rivers which are state boundaries, each state has to have a plan, each local government within the 10 mile plume EPZ has to have a plan.

So we are talking about something like 400 locals or a total of about 500.

If you could shift that slide up just a little and deviate from the peace time side of the program to FEMA's involvement in civil defense, war time involvement.

There is about 5,000 state and local governments, 500 counties I think a number of independent cities and other jurisdictions that want to have their own plan in addition the county.

About 60 percent of these 5,000 currently have plans and we have been working on the civil defense side of the program since the late 1950's. We have been working on the peace time side really since about '73 or '74 I think is when we first got involved.

It really didn't take on -- it was only primarily with the states. It really didn't take off until after TMI, and since about '80 we have been doing much, much more and working with local governments in addition.

The next vugraph shows some of the instruments that we have in civil defense. I couldn't find the slide with some good commercial ones so I brought this one, but we basically all do the same. They measure radiation, they are really exposure meters, probably more than anything else. This is an itemization chamber, it's an air itemization chamber and it has a can in it. That can has got a carbon filter in it inside to attempt to make it as tissue equivalent in terms of response as you can make it.

The front, the bottom ratio, it has been adjusted so that it's fairly independent from the direction that it receives radiation, from the source.

It would also be somewhat independent in terms of a large area or field -- it's hermetically sealed so

it won't change with altitude between Washington D.C. and Denver for example.

The 750 is a charger which goes with what we normally refer to as docicemeters. More properly they should be called exposure meters and they read your exposure, attenuated over time and can zero these and reset it with the charger.

On your left is a geiger counter, survey meter, a particular range on this one is about zero to 50 MR per hour. We have three ranges, zero to .05; zero to 5 and zero to 50 MR per hour.

There is a shield on the top here which rotates and this comes off and you can detect air radiation if that's open.

The chamber here is a principally a gamma detector only. I think we have a dosemeter we will look at later.

The next slide shows the quantity of these instruments that civil defense has invested in. We have roughly $2.6 million in -- throughout the country. We have got 230,000 of a zero to 20 or zero to 100 decimeters throughout the country.

We have about 100,000 of the zero to 200 MR decimeters, 210,000 chargers; 580,000 high range survey meters that read up to 500 R per hour and about 300,000

low range survey meters.

These were all procured between 1955 and 1964 as total costs of about $53 million. Right now we are maintaining this inventory which is -- it's all throughout the states. We are spending about a dollar an instrument per year on maintenance, on batteries on recalibration.

I may want to point, on this instrument, we use a dial that reads in whole numbers, zero through five and then we use a multiplication scale to get up to the 500 R and a .1 range to get us down. We found that there was so much more accuracy with a meter that read zero through five than the typical geiger counter which you have a zero to point something, the one olds used to be zero to 20 MR.

We used a very lousy tube and got this one up to zero to 50 MR. But we found that there is a real difference in accuracy of reading in terms of what that dial says.

I will get back to that a little bit later. If we could go on to the next vugraph. Really, this is what we refer to as SI units, but in a way, these are all derived units and from where I stand I don't see too much difference between our conventional derived units and the socalled SI derived units, especially when we are

really talking about instruments that primarily measure exposure.

You have to then convert to the dose or the absorbed dose.

If I could go on to the next one.

We have a federal agency committee that is called an FRPCC, it's Federal -- Preparedness Coordinating Committee which involves some 12 agencies, the major ones that are involved in radiation I have listed below. It's DOE, NRC, EPA, HHS, Department of Agriculture.

There are a number of others that are involved but these are probably the ones that have the main investment.

If we had an accident, DOE would also have -- we have a Federal Radiological Emergency Response Plan, and DOE would be the major agency that would be expected to do radiation surveys, primarily external to the plant and would have some assistance probably from the four agencies below them, or the three agencies below that.

In addition, in any accident you have the utility, you have got the states and you have the locals, so it's critical I think that we use the same units, whatever we use.

If you don't use the same units you are just

going to create additional problems is our feeling.

If I could have the next vugraph. The EPA has put out a action guide, manual protective action guide. They were coming out with a revision a few months ago and once we circulated the manual throughout the Federal Government there was enough resistance by a dozen agencies or so that they asked them to hold up on the release of it because there weren't really that many changes, but it would have involved some 72 utility sites and probably some 500 state and local plans that have been revised.

The doses or exposures that we primarily are working with are 75, an upper limit, and down to maybe one to five roentgens in terms of evacuation of the public or shelter. In peace time you are talking about even more dose rates which get down into the MR per hour.

One of the problems with the Gray and the Sievert is that they are a factor of 100 larger than your roentgen so that when you are working with them you are working with some prefix, usually to get down to the type of exposures that you are involved with or doses, absorbed dose, et cetera.

If I can have the next one, I think there is one more. Yes, this is the point I was trying to make is that for many of the radiation levels that we are working

with, you are talking about a fraction of a Sievert or a fraction of a Gray, strictly speaking if we changed our -- I think we probably should put a microcoulomb per kilogram on the scale, but I would be the last one to suggest that, that's what I get out of what I read.

I think that's the late vugraph, isn't it? The only other thing I would like to say is that we have put a lot of faith I guess the Chirbick document which let me just mention one thing in there that they bring out emergency preparedness a couple of three times.

If I car find it here. Well, essentially, although safety is a primary concern, there are a number of nonsafety related impacts in the area of communications that can come about and one of the things that ends up in the Chirbick recommendations that however it is recognized that in certain operational situations, by reason of economy or safety, the utilization of dual units is undesirable. Therefore in justified situations agencies may adopt that system of units which best meets their needs.

I guess that really is where FEMA is coming from, and is FEMA's position at this time.

The public law, I also note that in Section 3, paragraph 2, "it's the policy of the U.S. to require that each federal agency by a date certain and to the extent

economically feasible, by the end of FY 1992, use the metric system of measurement in its procurements, grants or other business related activities, except to the extent that such use is practical or is likely to cause significant inefficiencies.

I think that is where FEMA would come from by saying, we really would rather stay with the current units, but whatever we do, we have to have a coordinated effort between the 12 federal agencies and if the change is made I think all of them have to use the change including the utilities.

So with that I will shut up. Part of my feeling is, if it isn't broken don't fix it, but I am not sure but what we are trying to fix something that really isn't broken.

MR. HELTEMES: Any questions? There maybe questions after we get done.

As you know, Mr. Quillan could not be with us today but Mr. Flynn would be here and has volunteered to provide a state perspective and to answer any questions you may have regarding state participation.

MR. FLYNN: As was just said, I am a substitute for a substitute because Roland Fletcher was here first today.

In emergency response we are familiar with the

units that we are working with, namely, the English units and the old metric units of curie, rems and rads, so forth.

These are being used in the emergency response. All of the teams that are working there in calculating the exposure to the public, converting the source, into what the public will get if it's going out of the boundary, those who are going out in the field are using survey meters and roentgens and they are familiar with working with these units.

If you convert to the SI units, you are going to have a heck of a problem, especially if as has been suggested, that new plants coming on line use SI units and the existing plants continue to get the old English units.

If we have to convert that way it would be rough. If we have to change over to the SI units, let's make it all or nothing at all, otherwise you are going to have a heck of a problem with people trying to remember - how does this particular plant work with the old English units or does it use the new SI units?

You will have a hell of a lot of confusion there. I think that is about all I wanted to say, except to comment that are five counties in Maryland who have teams working, the emergency response team in Maryland is

used to the old units. We are also in the process of getting an EIS mapping system which will be computerized which is information -- listing what is on the maps and you have the English being miles and will probably be using the curies, et cetera and if you convert, you have some problem converting your units, there is a whole problem of retraining all of the people who are used to the older units.

That's about it.

MR. HELTEMES: Question?

DR. RUBY: I don't agree with your view on the fact that because you want to preserve the older units for the older plants, it's going to make it very difficult to convert to newer units for newer plants.

The problem is one that the automobile manufacturers faced with the speedometers calibrated in terms of miles per hour and kilometer per hour and what they did was to put both scales on the instruments.

Now there is no reason why both scales cannot be put on radiation instruments. In fact, it seems to me to be highly desirable if we are going to have any segment of the technical society using Sieverts and Grays even just the medical segment would justify it, so that a person who was either doing surveying or regulating could use the units which are appropriate to his particular

concern.

Therefore, it seems to me that your argument in that regard doesn't hold water. Once the instrument manufacturers are willing to cooperate that is.

MR. FLYNN: Okay, in the calculation of the dose assessments you would have to have either two computer programs or convert. Either that or you are going to have the problem, in Maryland, you have Peach Bottom and Calvert Cliffs, which are old units. If we get a new one you would have to stop and say, are they old and new, which formulas do you use?

DR. RUBY: Yes, I don't think you have to stop and think very hard. The problem of the new units isn't really very imminent. A much more imminent problem is how do you live with this metric conversion act if it requires the NRC to do business in metric here for the older plants. I am much more worried about that.

It's so far away when we see an advanced reactor sitting in the state of Maryland that I am sure that we can even educate the public by then.

The problem is, I am scared to do much about, try to comply with the Omnibus Trade Act with dual units which is the only way I can think of to do it because of the fact that so many nontechnical people, such as county and city, emergency planning people, they read the

emergency plans, they don't read the technical specifications and the internal procedures, but they do read the emergency plans, and I don't dare confuse them any over what they already are.

MR. FLYNN: But the point is that you will probably end up with another plan coming along so that you will have both the old and the new units and even more confusing.

DR. RUBY; Which plant is that?

MR. FLYNN: I say, will probably get a new plant, I don't know that there is any coming along.

DR. RUBY: Not for a long, long time, and when that time comes, it going to be advanced reactors and advanced means it is advanced. I mean, not only in the design, but also the way it operates and is regulated. So I think the whole idea is consistent of using our best ideas in measurements, our best ideas for design in putting it altogether for the future.

An operating plan that we are talking about is at least 10 years away and maybe much longer.

MR. GAT: Just a little comment if I may, Uri Gat, the emergency plan doesn't have to only for nuclear power plants. What about shipments? Don't you have radioactive shipments through the state here, even the medical shipments?

MR. FLYNN: Yes.

MR. GAT:And if they go in other units then you will have dual units if you will allow them to happen and you will get emergencies in which case people will not know what you are facing because if the fuel is transported from a reactor it may be in SI units and it may be not in SI units, how will you know. If the fuel comes from a different state, how will you know? If it comes from a plant that you may not know, how will you know? I do think that this is a real issue.

MR. HELTEMES: Jack?

MR. SOLANDER: I would like to make a point of clarification regarding at least my interpretation of the law. I do not read the law to say that it requires the NRC to change or impose new regulations that impose metrication on nuclear power plants or people with possession licenses.

The law as I read it says that the Nuclear Regulatory Commission must come up with a plan for procurement, grants and other business so as to meet some other criteria.

The law does not say that the NRC will incorporate into i s regulations for future, existing plants or possessors of other licenses, SI metrication.

I believe that's a more correct interpretation

of what the law is.

CHAIRMAN ROSZTOCZY: Would you please state your name and affiliation?

MR. SOLANDER: Lars Solander, Office of Controller, U.S. NRC.

MR. HELTEMES: Thank you, Mr. Flynn. The last rpeaker for this session was scheduled to be Joe Colvin from NUMARC, and unfortunately he had to leave but Tom Price is here from NUMARC and would be pleased to summarize the industry's position.

MR. PRICE: Thank you. Allow me to make a few comments. The presentation Joe made earlier this morning didn't address this issue enough because I think this is one that stands aside from the technology that we have beer studying most of the day.

I think this has to do with people, much more people oriented and much more society oriented that how the industry is dealing with the Nuclear Regulatory Commission.

A minute ago we were talking about or we saw a slide of all the federal agencies that are involved in this effort, emergency planning, well, I think there are probably tenfold the number of state agencies within the state plans that also have to be speaking the same language.

Let me stand up and make a statement that maybe the utilities should listen to this, but I predict that the utilities will change their meter that they give the indications to the state and local governments and the Federal Government too, when the state and local governments are ready for that.

The utilities are not going to be the driving force to tell the state and local governments, I am now going to speak to you in Sieverts and never will I mention rems or any of the other more conventional systems you were using.

We are not going to say that. The states are going to come to us and say, from now on you must deal in such and then and probably only then will we be able to do that, and that's only going to happen when the states are ready to do that.

The states have to have not only an education system within all of their agencies and all the local governments and all of the Federal Government all have to be aligned, but all the people in the community have to be aware of this too.

We have been having the idea of a public campaign to communicate on the value of nuclear power and we find it very difficult. What's going to be even more difficult I think is to convince them that they should

speak in Sieverts now instead of rems and other parameters.

The fact -- that's the driving force, that's where we have to start. We can't, the utilities and I only speak on that, the utilities can't walk up to the states and local governments and say, I am going to change the way I am going to do business with you. It's going to happen the other way around.

Now let me put one parameter on that, I think in order to accommodate that when the states are ready, we are not going to take a three or four or five billion dollar plant and change every nut and bolt in it. We are going to take the outgoing meters and the elements on the stock and not even change the transducers but to change the meters and the amps. The dual indicator on the automobile speedometer, the transducer was on the inside of the system is the same transducer they had 1,000 years, they just printed a different face.

We are willing and ready to do that when the system is ready, but make sure the system is ready for that.

Final comment I have, we mentioned radiation elements not only in the nuclear power plants but in the transportation of fuel, state and local governments have to deal with emergencies that are nonradioactive

emergencies and they deal in feet and pounds and other parameters too. That system has to be in the mode of changing to metric. It has to change all at the same time. You can't -- in one this, in this case along I think we are the tail of this elephant and we can't ride the elephant, you have to convince the elephant to change.

MR. HELTEMES: Thanks very much, Tom. That concludes the formal presentations. We have had --

CHAIRMAN ROSZTOCZY: Jack, I would like to ask a couple of questions if I could. The first one relates to a statement that you made but I would like to address the question in a broader sense also to Mr. Stangler and Mr. Price also.

This relates to the next door neighbors, if you wish, other countries who are on the metric system and are next door to us, it's obviously a much bigger problem for smaller countries like in Europe than for us, but nevertheless we have a relatively long boundary with Canada and also with Mexico.

What is the present practice and what kind of difficulties are we facing or would we be facing if somebody picks a site very close to these boundaries, for example, very close to the Canadian side?

What responsibilities do we, meaning both

Federal Government, local governments have in terms of notifying people on the other side of the border and what is the agreement on the units, the measurement units, the language that we are going to talk to those whom we are calling on the phone, but they happen to be on the other side of the border?

MR. HELTEMES: Is your comment for future plants that we have not yet committed or existing plants?

CHAIRMAN ROSZTOCZY: Existing plants, what is the present practice, is there any agreement for example between us and Canada and if there is an existing plant close to or if somebody, if a utility would be considering tomorrow to ask for a site approval next to the Canadian border, what type of things does he have to face in terms of potential notifications to the other side of the border and dealing with authorities on the other side of the border?

MR. HELTEMES: Our obligations are clear through international conventions that we are a signature to through IEA, and we have no agreements that I am aware of with Canada per se, specific agreements on any formal communications. We would go through IEA and anytime that we would have a radiation release that would go past our borders and impact other countries, we are obligated to inform those countries through IEA.

But we are trying to establish informal communications with such countries as Canada so that if we have any reactors such as Fermi which is very close to Canada or Pickering which is very close to the U.S. on the Canadian side, that we would have instant communication if you will.

BUt those discussions have not progressed to the point that I am aware of that we would talk units, and getting back to the conventions, I am trying to think of the specific units, Marlow, you can help me out on that, but I quite frankly cannot recall if those conventions specify communication in terms of units. We very much, almost routinely communicate with IEA through an electronic mail system and but we have not had real unit problems except in the case of Cherynobol, units were a problem.

The units came to the United States in terms of Sieverts and had to be converted here and people struggled to do that and struggled to understand what the number meant.

We are always quite nervous about the conversion.

CHAIRMAN ROSZTOCZY: Does FEMA have any arrangement?

MR. STANGLER: I know we have had some meetings.

Marshall Sanders in our policy branch, I know has met with his Canadian counterparts. The only thing I can remember is that they have agreed to exchange alert levels, general emergency, site area of -- et cetera.

I think they agreed to provide radiation data, but I think it's very general. I don't think any units were tied with it. I am sure that if there were from our standpoint it would probably be put down in roentgens per hour.

But I can check that out and see if we have any specific units, but I don't think we do.

There is one unit up in the New England area that -- isn't there -- within the 50 mile ingested zone, it maybe in Maine, Maine Yankee?

CHAIRMAN ROSZTOCZY: Maine Yankee is probably within 50 miles.

MR. STANGLER: I think it's within 50 miles and I think that's the one that they were primarily talking about. Now I don't think -- Fermi, but I don't think there are any others that are that close.

DR. NELSON: Ginna.

MR. STANGLER: Is Ginna that close? Oh, yes, it would be, across the lake. If I could just make a comment on the dual scales, we used to have a dual scale on our geiger counter.

It was zero to 300 counts per minute on the bottom and zero to .5 MR per hour on the top. We had so much confusion trying to train people to use that instrument that we finally took the -- against our better judgment, took the count per minute scale off because that's really what a geiger counter is reading. It so happens that we designed a tube in the shield to make it read essentially in MR per hour against high energy gamma which is what we find in a fall out field.

So as long as you using it for cesium and colbalt you have no problem. If you try to measure some extra x-ray machine or something you can get yourself in real trouble, because it doesn't measure milliroentgens per hour.

I guess also wanted to mention that I didn't want to leave out the fact that there are a lot of instruments other than civil defense instruments. Civil defense instruments are not primarily, the primary ones that are used around the nuclear power plants, certainly, by the utilities.

Now I think a lot of the locals use them offsite but I just wanted to pointed out the problems of how many instruments we have out there and we have made estimates that it would cost over $100 million to try to change those scales.

Frankly, whenever we bring it up in our agency, the people who are red lining the budget, red line anything like that out because they think there is better ways of spending money than trying to change scales.

So we are going to need some support if there is ever a change.

I also agree with you on the public law. I think it says that you have to do this by a certain time if it's economically feasible and then except to the extent that such use is impractical, so I think that there is an out in that public law as I read it.

I also sort of brushed over the communications, but certainly, communications to the public is critical and I think to a large extent you may not have to use units with the general public. You are going to sooner or later, but a lot of the guidance is going to have to be in general terms of evacuating certain areas, taking certain protective actions and to a certain extent, hopefully you can stay away from the units, because I am not sure that the public understands them now or ever will regardless of what units we use.

I do believe there is a lot of state and local people though who have gotten familiar with the roentgen per hour, et cetera.

We have been in training since the mid-1950's,

we have been involved in exercises since 1981. We have had at least five exercises in almost every operating plant. You have some 70 some operating plants, that's a lot of exercises for a lot of people. So they sure should have some understanding of the roentgen by now.

CHAIRMAN ROSZTOCZY: Marlow, since my last question, second and last question relates to you, would you please for us, stay for a moment.

You should us a long list of the various instruments which are currently in use, that's an impressive list of instruments.

Taking the large number of instruments which are currently in use, taking the fact that conversion to metric is inevitable in the long run so somewhere along the line we will have to convert, and taking the fact that the number of instruments tomorrow will be larger than it was today, where does that leave us in terms of practicality of conversion or costs associated with conversion?

MR. STANGLER: The biggest problem would be these exposure meters, decimeters. We have something like 2.6 million -- out there. Now we can rebuild these but we have to go in, take out the bottom guts, take it apart, put in a new scale and reassemble it, which is a time consuming, it doesn't cost an awful lot of money in

terms of material, but it's a time consuming job to do it.

The other decimeters would require the same thing, to be disassembled and rebuilt and in fact, we are repairing all of the bad ones, but we would hate to have to do this to approximately three million instruments.

CHAIRMAN ROSZTOCZY: What is the average life of those instruments?

MR. STANGLER: Well, the last ones I bought was in 1964.

(Laughter.)

The first ones I bought was in 1956. Most of the instruments that we bought after 1958 are still in service. We got rid of everything that was not transistorized. Some of the first ones were made by Nuclear Measurement Corporation used 45 volt batteries and we thought we couldn't afford the 45 volt batteries.

Every instrument that civil defense has uses a D cell, they are commonly available. They are cheap and basically all of our instruments are transistorized. We spent a little over three quarters of a million to put a different himick resistor in some half million of those geiger -- those -- chambers.

When we were doing that we basically cleaned them up, made a few improvements in the circuit and put

this good himick in. Now a good glass himick changes maybe one percent per year if it's bad, if it is a good one, less than that.

They were bought in the early 1960's, I plan on retiring in seven years and I assure you they will be around well after I retire.

We probably will buy some more, but I don't know when, we can't get the money.

MR. HELTEMES: Any final questions or comments by anyone?

Thank you very much, Zoltan, that concludes this session.

CHAIRMAN ROSZTOCZY: Thank you very much. Jack, now comes the most difficult task for the chairman has, to close the meeting on time since we are already five minutes over, I think that is not possible, but we certainly can keep close to it.

I would thank all of you for coming, expressing your views, making your comments and participating in this workshop.

We certainly appreciate your presentations and your comments and we intend to put it to good use.

Where do we go from here? As Eric Beckjord mentioned in the morning, we have already collected some information together with NRC. Today we have received a

lot more from outside groups and tomorrow we will be receiving the same relative to other subjects which are under our responsibilities.

After this we are going to have a few more meetings with other agencies that we are interfacing with and based on those three sets of information, we are going to formulate a proposed policy statement for the NRC's commissioner's consideration.

It is my expectation that we will have a proposed statement in front of the Commissioner sometimes in the spring and it probably -- shoot for public comment late in the spring or early summer.

At that time you all will have another opportunity to comment on the actual proposed policy statement and we are looking forward to your comments.

Thank you very much for coming and have a nice evening. We appreciate your participation.

(Whereupon, the meeting was concluded.)