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INTRODUCTION

I appreciate the opportunity to stand up here and talk to you. Steve Ramos and I came from the NRC primarily to observe and to learn and to see what role the NRC would eventually play in this program. I think we feel that it is a program that should succeed and we want to be prepared in the NRC. I am to give a more comprehensive and prepared statement by next Wednesday as part of the ANS meeting and as Dick Lewis said last night I am fairly limited to what I can say today because this does get close to being a policy-type decision, which has to be made by many more people than myself. However, as the result of chance remark by one of you yesterday, who said that at that time he understood quite clearly the problems involved with this program, but he did not understand what the advantages to be gained were, I would like to take just a moment to elaborate on the advantages that may be gained or might be possible through the relaxation of safeguards of all types. There were several comments yesterday about considerable expense being the result of safeguard implementations, not only in the U.S. but in other parts of the world, and last night, Dr. Lewis explained why this was a fact of life these days. I would like to give you a summary or sketch of what the U.S. Nuclear Regulatory Commission is doing right now to try to provide the level of protection against theft or diversion of SNM or against the industrial or radiological sabotage to meet the statutory requirement.

To start off, I would like to say that Steve Ramos and I are here representing only one of the major offices of NRC. This is Office of Nuclear Reactor Regulations. Under this office we regulate all phases, safety and environmental and safeguard aspects, of about 70 power reactors and about 70 non-power reactors. Another portion of NRC is the Office of Nuclear Material Safety and Safeguards. Under this office is regulated the licensing activities of around 600 licensees of all types. Including all licenses of transportation, import-export, and such as this, as well as special nuclear materials not related to the use of reactors. So when we talk about regulating the use and the protection of special nuclear materials, we are talking about all types of special nuclear materials, not just the type that is used in a reactor. Consequently, when a review is being made, such as now being made at the direction of the Commission to see if relaxation of regulations can be given to reduced enrichment, it is not only under the auspices of our office, but also of this other office. Therefore, it has to be more or less a policy statement of the Commission.

This meeting has come at a very auspicious time because although we are fairly well set up in the area of review of safety aspects of licensing, and Steve Ramos will become the contact of all such correspondence and communication in the future relating to this program. There is a real confusion, I'll admit, in the field of safeguards and physical security because of the requirement to continually upgrade this area of our licensing activity to stay abreast of what the Commission perceives to be the need due to a threat of whatever name you want to give to it. For instance, right now among these 70 research reactors, we have some that are doing everything they can to reduce their inventory so that they can get out from under some of our old and new requirements, while we have the anomaly that since General Atomic is about to go out of the business of making FLIP fuel, we have some licensees who want to increase their inventory. However, we have about eight different types of research reactors in here. From higher levels of the GE test reactor (50 MW) to those on down to a fraction of a watt, they have different types of fuel elements, they have different types of enrichment. We have relicensed 21 reactors that use highly enriched uranium which to us right now means anything above 20%. These are the ones who will be affected by this program unless some of the other 50 or so desire in the future to change their way of doing business.

As far as current regulations are concerned, the NRC has one threshold: it's either above 20% enrichment or it's below 20% enrichment. We are going to look and see if the SNM license in this area as well as the SNM license in that area can be changed so that some intermediate regulations can be applied to the steps in between 90% and 20%. We also regulate on the basis of the kilogram formula quantity. Most of our most stringent regulations are based on the possession of 5 kilograms of highly enriched uranium. Next Wednesday, I will go into more detail on the types of regulations that are in existence and are being proposed to provide an acceptable level of protection against theft, for more than a formula quantity or less than a formula quantity. We are in the process right now of developing a regulation that will meet international standards for the protection of less than formula quantities. However, this new regulation will be based on whether it is fully enriched or not fully enriched, so there will be steps within steps.

You recognize the confusion that all of these regulations are putting forth to this community. So I hope the presentation that I will provide on Wednesday, although I'm not going to be able to tell you what relaxation we can give or what incentives we can give, will show that the NRC is aware of this program. It is aware that it must be covered by analyzing the effects on all types of licenses, then it must be correlated to the effect on other government agencies, then it must be correlated to the effect on the international community. So our decision is not going to come up very quickly, but I do want to stand up here today and tell you that we are aware of not only the safety ramifications, but we are aware of the safeguard ramifications, and hopefully the NRC can work with all of the American reactors that will be affected in any way so that we can make any changes efficiently and without any adverse effect on the performance of the reactor.

Now when it comes to giving you advice or information on the export, I am not able to do that. After hearing the questions that have been presented here in the last two days, I think I should go back and see if someone from this office who regulates this area might not be present at the meeting next Wednesday. I cannot guarantee it, but I will try.

If uranium enrichment is dropped to the 45-50% level, then the composition of the alloys would have to increase from 21 wt.% (NRU) or 28 wt.% (NRX) to somewhere in region of 40 to 50%, possibly more. We know that the Al-40 wt.% U alloy can be extruded to the required diameter. We also know that the alloy is more brittle than the Al-28 wt.% U alloy and its ductility certainly will not increase with irradiation. The effect of this brittleness on behavior of the long NRX/NRU rods during thermal cycling in reactor would have to be investigated.

Therefore from a fabrication point of view, it may be possible to make the rods from Al-40 wt.% U but it is obvious that an extensive fabrication, safety, and irradiation study would be required before a definitive answer could be given.

Development of Al-50 wt.% U alloy for such rods would be even more difficult, the probability of success smaller, and the development program somewhat larger.

The development of a completely new design driver fuel for the reactors using Zircaloy clad powder packed UO_2 or dispersion type fuels would require an even larger and more expensive program.

At 20% enrichment level, the current Al-U designs of driver fuel could not be used even by increasing the number of fuel rods and/or by removing experimental facilities.

A new fuel design would have to be tested to burnups of 60-70% for NRX and over 80% for NRU before it could be considered to be acceptable. The defect performance of the higher uranium alloys would also have to be checked out.

In summary, the NRX and NRU are high performance, high flux research reactors having a very heavy experimental and radioisotope load.

With the present designs of driver fuel and reactor loadings the use of 50% enriched uranium would be possible only if the brittle Al-40 to 50 wt.% U alloys can be successfully developed for high burnups.

Extensive fabrication, safety, and physics work and irradiation of intact and defective elements would have to be done for each of the fuel designs considered before a definitive answer could be given. If these alloys could not be successfully developed, new designs of driver fuel would be required. The fuel developments would be in three phases: fuel alloy development, pin development, and irradiation testing and would probably take 3 to 5 years.

A change to 20% enriched uranium would require redesign of all fuels and more extensive fabrication and irradiation testing than with the 50% enrichment options. In either event, the operating costs of the reactors will increase, particularly with 20% enriched fuel designs.

DISCUSSION

SHERMAN (TI): Can you tell me if there is going to be a moratorium on the license submittal fees, particularly when these changes are at the request of the government?

ROSS: This is one of the questions that has not been addressed. We are just beginning our overview of what would be involved in this program, and I think we need to tabulate all of these potential problems and be ready for them when they come up. None of this has been addressed as yet.

SCHLAPPER (U of Missouri): In the comments that were made last night by Dick Lewis, there was an indication of concern over the use of HEU even in a highly irradiated form. Can you give us any information as to NRC action on this matter?

ROSS: I can tell you what the NRC position is. Now, again, we may want to review this concept. For some time, our regulations have given safeguard credit to SNM that has a radiation level of 100 Rads or Rems per hour at three feet. This is written into the regulations. This is on a somewhat subjective basis maybe, and it has been questioned that SNM of this radiation level is pretty much self-protecting as far as both the theft and the time required to process it into something more usable. All of our regulations that are now in the books and those that are in process retain this exemption. This differs somewhat from the international standards, especially for Categories 2 and 3 that have been developed by the IAEA in the users group, whereby they suggest that the categorization of safeguard risks be dropped only one grade because it is of a high irradiation level. Our regulations in this line were written somewhat vaguely. We do have a research program going to try to identify what technical means are available for obtaining an accurate measurement to determine whether this threshold has been exceeded or not.

CARTER (Institute for Research Management): Yesterday it was commented that there are about a dozen high powered research reactors that probably cannot cease using highly enriched uranium without very detrimental impact on their performance characteristics. How many of these are in fact currently licensed by NRC?

ROSS: I personally am not knowledgeable of which ones could or could not. Of these seventy, we licensed some of these high powered ones above 1 megawatt. However, there are many of the high powered reactors in the U.S. that do not fall under our jurisdiction. I have only obtained information informally by talking to people. Some of our licensees who are present, because of the type of fuel they are already using, have a feeling that they will not be able to operate effectively under any reduced enrichment or could not achieve any increased weight percentage. I guess Dr. Travelli could answer who they are better than I.

DOUMERC (CERCA): Research laboratories and fuel manufacturers will have to qualify the new fuel before they have them available. Do you think that the NRC will have to give an agreement on the safety point of view?

ROSS: Yes, and in fact we have already done that. We have given a license for the CERCA fuel for Union Carbide. We also have given a license to General Atomic for demonstration of their prototype fuel. Yes, any type of, well, maybe I should refer this to Steve Ramos, but any type of new fuel will have to be justified as far as not only to physics but to safety.

DOUMERC (CERCA): Do you think to settle clearly the requirements which will be needed?

ROSS: I think we will probably continue using the same requirements we use now. I heard Steve mentioning this this morning. Steve, will you tell us what those three are.

RAMOS: I don't know if you were involved with the Union Carbide gathering of data, but what we basically are looking for is the data to support that the new fuel will not reduce the margin of safety that already exists. So, if you can show in the data provided that the corrosion, blistering, swelling, etc., doesn't change the margin of safety, we will buy that. When a new fuel comes up, the licensee provides us with the safety analysis of how that fuel is going to be used in the reactor. We then take that analysis and do an evaluation of it. In many cases, it requires additional information. We are trying to circumvent this in the low enrichment program by working closely with DOE so that as we proceed, we will have a generic package so that the licensee will not have to go through all that justification. We even asked the DOE to provide us an environmental impact appraisal generically for this program.

DOUMERC (CERCA): Is this agreement necessary before a new fuel will be taken into consideration by the U.S. administration?

ROSS: I think that I can answer that. If it is shown through any of these demonstration processes that we talked about yesterday that some of these are viable new types of fuel, we will then use this demonstration data as our first basis for giving a license. As Steve said, if the information obtained from all of these demonstrations is essentially the same as you would provide, we can reference this and there will be very little that you would have to add to it. However, if there is anything in your process or the type of fuel that you end up with that is different from the information that we have received through this demonstration process, then you will have to provide the additional information yourself. Our reviewers do not like to have to make decisions that are not based on data. So the more information you can give us through either the DOE program or otherwise so that we can reference information that has already been achieved and then validate it, the better it is. We don't necessarily need to go back and have you repeat these experiments.

DOUMERC (CERCA); Will it be before that the new fuel will be taken into consideration by the DOE and State Department?

ROSS: If I understand your question, yes we will wait until a prototype has been provided to the degree that it is worth our time and efforts to review it. We will not review it on the basis of theoretical information.

DOUMERC (CERCA): It will not be a necessity to have your agreement before a new fuel will be considered as generally available, will it?

ROSS: I wouldn't say that because yesterday there were several types of fuels discussed. Until they are placed in one of our licensed reactors we do not have to make a decision. Before they can be used in one of our reactors or maybe, I'm not sure about this, used to fuel reactors in other countries as part of our international program, until that occurs we do not enter into the picture. That is why I said as of today, we are not an active partner in the program.