# FY 2015 DOE-NE Competitively Funded Programs Specific Workscope Q&A

## Consolidated Innovative Nuclear Research FOA Overview

**Q: In regards to the National Scientific User Facility, is the Letter of Intent optional?**

A: No, the Letter of Intent is not optional, it is required for NSUF applications. Without a Letter of Intent, you will be precluded from participation.

**Q: Why is Mission Supporting project only $400,000?**

A: Typically those applications in Mission Supporting projects tend to be a little higher in risk and not as closely tied to the mission of NE, and therefore, NE allocates less resources for less work to be completed on that type of an application until we have enough information to possibly move that area into a Program Supporting workscope.

**Q: Could you please clarify the January 14 date?**

A: January 14 is when the full applications will be called for. That will be the time when your pre-applications have been reviewed and you will receive letters on whether you have been 'invited' or 'not invited' to participate. Please remember that a 'not invited' application can provide a full application, although it is not guaranteed to receive a technical review.

**Q: Is it a requirement that the PI must come from NEUP approved colleges and universities?**

A: No it is not. That is only required in regards to gaining support through the Integrated University Program for Scholarship and Fellowship.

**Q: What is the difference between 'relevancy' and 'peer' reviews?**

A: Relevancy is just that, it is the relevancy to DOE-NE mission and program needs and how it supports or enhances DOE-NE needs. Peer review is evaluating technical merit.

**Q: Can we link a GSI proposal to a currently funded NEUP research grant or does it have to be linked to a new proposal?**

A: It should be linked to a new proposal; we would anticipate that you would have, from your prior proposal, all of the equipment you would need to complete the

work. You could enhance your ability to perform work with a current GSI application but it should not be linked to a previous application as being absolutely necessary to perform the work.

**Q: In collaborative projects with industry, how do you determine who is the lead and whether cost sharing is required?**

A: Cost sharing is only required if the application lead is industry. It is not required, but it is encouraged, for universities, and it cannot happen if it is a federal national laboratory since it would be the government matching their own funds with their own funds. The lead of the application would be the individual or institution that is not only responsible for the entirety of the work, but also providing most of the intellectual horsepower and actually performing the work.

**Q: At the Letters of Intent stage, should the PI, Co-PIs, collaborators, and institutions all be identified?**

A: Those must be identified by the pre-application and do not need to be identified in the Letter of Intent.

**Q: Is citizenship required for the all or part of the programs?**

A: Citizenship is not required but all applicants must be employed by a U.S. institution.

**Q: What is the maximum award for a joint proposal between a university and a national lab with the university being the lead?**

A: That will depend on the workscope area. NEET Cross-cut projects can be up to $1,000,000 for Program Supporting and $400,000 for Mission Supporting projects. For NEUP sponsored area, it would be up to $800,000 for Program Supporting and $400,000 for Mission Supporting. National Laboratories and Industry cannot lead in NEUP sponsored areas.

**Q: How much money can go to collaborators?**

A: If you are a collaborator for a university lead in a NEUP sponsored workscope, only 20% of the total allowable costs can be attributed to a national laboratory or industry. In NEET Cross-cutting areas, there are not limits on collaborator funding.

**Q: Can non-tenure track faculty be PIs?**

A: Absolutely.

**Q: Which proposals need a 'Letter of Intent'?**

A: Only those applications that are affiliated with the National Scientific User Facility as 'Access Only' or if the application is co-joined with an R&D project.

**Q: Why is the pre-applications review process semi-blind and not fully blind?**

A: The pre-application review process is not blind at all, but the full application review is semi-blind. The semi-blind process means that only the technical narrative is viewed without knowledge of the author or institutions involved. After those scores are entered, they are locked down and the rest of the information for the application is delivered to the reviewer that includes CVs, budgets, facilities, benefits of collaboration, and all the other associated documents. Those documents are reviewed fully open. That is the difference between a full blind and semi-blind review. For our pre-applications, they are not blind. The reviewer is cognizant of who the author is, what the institution is. Those are a limited 3-page effort only intended to vet the technical merit and the relevancy of the idea that results in an invited or not invited status.

**Q: Will non-invited full application get reviewed?**

A: They will receive a relevancy review, unless highly reviewed for relevancy and program priority per process described in the FOA, they will not receive a technical review. If deemed to have high relevancy and program priority they will receive a full technical review.

**Q: Why is the pre-application not a semi-blind review?**

A: It has not been part of our process because it makes it difficult to provide that information. We only ask for one document in terms of our pre-application, the narrative, collaborations, budget, etc. and to make that a semi-blind process we would have to ask for several documents. It would only make it that more difficult for applicants and reviewers. Additionally, it is difficult to hid anything in such a short application. The purpose of the pre-application is to get feedback to the individuals submitting a proposal, which is why the review is open.

**Q: Can an applicant submit an application from both a national laboratory and a university (if they have a joint-appointment in place at both institutions)?**

A: You have to declare one institution or the other, and that should be decided by where you get the most support. We do not allow individuals to apply on both sides of the fence, certainly if you are working at a national laboratory and you have a part-time faculty position, you can collaborate with that university, or visa versa, but those interactions would have the same restrictions in terms of total available funding that can go to national laboratories and industry.

**Q: Can an applicant submit a DOE career proposal for young scientists and also a regular university proposal?**

A: The career program runs through the Office of Science for the Department of Energy and not the Office of Nuclear Energy so, yes, you can submit a proposal to the Office of Science since it isn't typically the same type of proposal that you would submit here since our projects tend to be more applied. You can apply for that career award or other similar awards (i.e. NSF).

**Q: Do the same individual that review the pre-application review the full applications?**

A: No they do not. There is typically one technical reviewer in the pre-application stage, but we always balance the full application with three peer reviewers. Any review that is outside, either being high or low, is addressed. If that happens we have the opportunity to recuse the review, find a new reviewer, or interface with the current reviewer.

**Q: Is a full application declared invalid if the proposing institution is identified in the narrative?**

A: We do what we can to work with our applicants between the pre-application and the full application. We turn those applications back to the applicants and allow 24 hours for them to rectify any redaction problems they might have. If they simply refuse to change the application, we could recuse it, although we have not had that happen to date.

**Q: Can university PI leading an application also serve as co-investigator on a different national laboratory-led application?**

A: Yes, PIs can be co-PIs on other applications. Please be aware of the PI submittal restrictions when submitting several applications. There have been times in the past, because of budget restrictions, that PIs have proposed work that primarily goes to a collaborator. Those have not reviewed well in the past, so please be mindful of that.

**Q: How you identify the conflict of interest during the review process?**

A: Conflict of interest is attributed to the institution. IF we have a situation where applications are submitted by all of the active institutions in that group of applications, we find a reviewer who is not affiliated with those institutions to review the entire workscope. So what that means is, not only is anyone from your institution precluded from reviewing your application, they are precluded from reviewing any application in the workscope. If it is not possible to find a peer reviewer outside of the institutions involved, we can attribute the conflict of interest to the individual. To do that, we have to affirm that those individuals are not in the

same line of management, whether it be technical or managerial direction given to the applicant by the reviewer. Additionally, reviewers have to declare that they are not conflicted when they do the reviews. When you submit a full application, you can request reviewers that you do, and don't want as well. We look at all of this information along with as many sources of information as possible.

**Q: If a PI or co-PI change the institution during the awarded period, is it possible to transfer this award with him/her to the new institution?**

A: Yes, it is. I will note that any equipment you may have purchased during the award, your university may feel some ownership over that. The outcome of that equipment is something that happens between you and your university. We can only provide defense in terms of the equipment purchased with funds you have received from the program. It is a little more difficult than approving the change. The receiving university must be of the same quality and have the same capability to complete the work. There are some procurement issues involved in transferring grants or money so it's not an easy procedure. We prefer not to, but we understand that these things happen, and we will address each case on an individual basis. They are not always approved.

**Q: Can one PI from a university submit multiple proposals?**

A: Yes, a PI can submit multiple applications. You are bound to eligibility restrictions in the FOA. You can submit three as the lead PI and be involved in up to six applications in total.

**Q: Does the proposal require education component or outreach to underrepresented groups, similar to what NSF requires?**

A: No it does not.

## National Scientific User Facility Overview

**Q: What is the purpose of the Letter of Intent for NSUF since a pre-application is also required?**

A: When we looked at the overall timeline for the pre-applications and what we need to do to determine if the project is feasible we needed as much time as possible to evaluate the feasibility aspects of an NSUF proposal. So the Letter of Intent helps us identify a technical lead with the PI and allows us to get started on the Statement of Work and cost estimates right from the get go. It is especially impactful for the larger irradiations and some PIE projects to be able to get a firm cost estimate to forward fund all of the projects.

**Q: IS FOA out yet? I can't find it on the DOE website?**

A: It is not out yet. The FOA will be released next week. All the detail you are receiving now is in advance of that. If you have some ideas about what you would like to do, and a project that would require no-cost access to NSUF capabilities, you are more than welcome to contact the NSUF office to get started.

**Q: Will the owners of the ATR-NSUF facilities be involved in the review process? Should the applicant contact the facility owner directly or the NSUF Program Office?**

A: You have the contact for all of the partner facilities on the website, or you can always contact the Program Office directly.

**Q: Are Sandia and Brookhaven missing from the list?**

A: Yes, we only mention the partners. We have a process for those partners, and those institutions are not partner facilities. We would need to investigate new partners and see if there is any cost associated with that new equipment or facility. So the answer is no, all capabilities are open to NSUF access, the ones that are listed are institutions that we have special arrangements with.

**Q: Can a PI propose only a NSUF project (i.e. full irradiation and PIE), without doing a parallel CINR R&D proposal?**

A: Yes, it's called NSUF Access-Only.

**Q: Do you have in-situ testing capability that is under low-level irradiation?**

A: I'm assuming this means in-pile, in-reactor. The answer is yes, but it is quite limited because those are the very complex, expensive projects and experiments and the cost goes up from there. So, the answer is yes if you are talking about an ion irradiation. There are also capabilities existing on the national level.

**Q: Is this the only time when one can apply for the ATR-NSUF facility access (other than Rapid-Turnarounds) or will there be some other solicitations announced during the year also for projects not connected to this FOA?**

A: Yes, this is the one call we have per year for our larger projects: radiation and PIE, radiation only, PIE only, or the beamline. Then we have the three Rapid Turnaround experiment calls per year.

**Q: Will irradiation costs be included in the NEUP R&D budget?**

A: The NSUF access cost will not be included in the NEUP R&D budget. In the full application, there will be a location to enter the NSUF access value that comes out of our final cost estimate.

**Q: Can a proposal submitted as NSUF+NEUP be changed into NSUF only after the Letter of Intent has been submitted?**

A: I believe so. Nothing gets locked in until the pre-application. The Letter of Intent just gives us an idea of what the PI has in mind. The LOI is only included as part of the NSUF part, and runs independently of the NEUP portion if there is not a joint pre-application submitted.

**Q: How does the NSUF sample library work?**

A: If you visit our website you will find a link there to the sample library that lists a large variety of samples that are readily available. There are other samples that are not as accessible, and they are not listed on the website. Some researchers may not know about those. What we are trying to do is aim the research at the samples that are readily accessible, but we are not restricting it to those either.

**Q: How should one apply for the ATR-NSUF access if the intended research is not connected to this FOA?**

A: There will be a checkbox that you can click for NSUF 'Access Only'.

## Consolidated Scientific Infrastructure FOA Overview

**Q: Can we link Reactor Upgrade proposals to a R&D project?**

A: We don't have a formal application mechanism for that. You may create ties in the applications on how beneficial an upgrade could be. Without a formal connection, there does not seem to be any benefit. There are subjective factors that are applied by the selection official that could come into play. With no formal way to link, each institution is restricted to one Reactor Upgrade proposal.

**Q: If university has one ongoing GSI, but not at no-cost extension, will university still eligible for this year GSI?**

A: Yes, absolutely. Eligibility will start this year and will be enforce next year. If you have a no-cost time extension now, we do not look backwards. All eligibility restrictions will come into play after the FY 2015 cycle.

Fuel Cycle

**Q: We had a no-cost extension for an existing Reactor Upgrade project (it will expire next year). Are we eligible to apply for a new award?**

A: The eligibility policy is for future infrastructure projects only. As you have a no-cost extension now, you will be eligible in FY 2015.

## FC-1.1: Electrochemical Separations

**Q: Is there any interest in the area of amorphous halide melts (these are glassy)?**

A: Not at this time. It is not our current focus.

**Q: Can you please provide an example that is of interest to DOE for the solvent-solute interactions?**

A: That is one of the diagrams we showed here. The solid-solvent interaction in the presentation is something you can review. What is most important here is the data in the literature. There is some inconsistency of the results. If you can help us understand those discrepancies, it will better help us understand how to improve the technology. This is a good area for the universities to research. But again, I would like to emphasize that we like for you to work with university partners or laboratories that can help you expand your focus. This will help give you a better chance of being awarded funding instead of working independently.

**Q: Are corrosion issues with halide melts of interest?**

A: Yes, that could be of interest.

## FC-1.2-1.4: Materials Recovery and Waste Form Development

**Q: Is there any change in budget allocation for this year?**

A: No, there aren't changes. I wish you could have more money for all of these good proposals. We are going to fund an IRP, which limits our money for the NEUP call. Approximately 3 applications for Materials Recover and Waste Form will be funded.

**Q: When you say that there will be a call for advanced waste forms relating to glass-ceramic waste forms, is this the area?**

A: Yes it is. Even though this program was transferred to the Used Fuel Disposition campaign it has come back to this program. Although the funding is limited, it is here and it is very important.

**Q: Is there any interest in nanomaterial R&D being considered?**

A: Yes, of course. Be creative, get out of the box. But talk to the national laboratories; do not do that on your own. Team up with the national laboratories and be creative. Whenever something is created it is because someone was thinking outside of the box.

**Q: Are you considering metallic waste forms?**

A: That is a good question. That is something that we do some programmatic work on but it is not in this call.

**Q: How many lab collaborators would be appropriate for a successful proposal with only 20% of funding able to go to a lab?**

A: I would say to target one. National labs are expensive so you may need to find someone who is happy to advise but will not take any money. And remember, a lot of times national labs will not take a lot of money because they know they are so expensive. They can be a good resource as a mentor to your students to come in the summer, and do some experiments.

**Q: Could you please tell me which lab does work on capture of Iodine, Krypton, and Tritium?**

A: Yes, essentially it is Oak Ridge National Laboratory and Sandia National Laboratory.

**Q: Are there any other calls for Advanced Waste Forms other than NEUP?**

A: No, this is it.

**Q: Will new materials for the capture of off gas be needed in FY 2015?**

A: Yes, we work with the material organic framework. If you think of something related to this issue, please submit it. We have not found the perfect capturing techniques for iodine.

**Q: Is there any specific wasteform DOE is interested?**

A: We do not at this point. We are very open because we do not have a repository and it is not expected until 2048. The wasteform is linked to the geology of the repository. So, either we will pursue glass, or in a different situation a wasteform hat is adapted for a metal fuel. We are very open right now, and in a couple of years we will focus on specific R&D.

# FC-2: Advanced Fuels and IRP-FC-1: Evaluation of Fuels and Systems with Enhanced Accident Tolerance

**Q: Can you explain what you expect from the IRP?**

A: One of the things that we have been looking for is that people have been building tools using the MOOSE/BISON environment, which is the NEAMS program tool used for fuel performance. Primarily those efforts looked at the steady state performance of accident tolerant fuels. But there are models that need to put into the NEAMS tools, as well as capability, to go from steady state analysis to estimate of melt. We're not asking for post melt because that is a much more complicated endeavor. And I think there are capabilities in the university community that can help us with models, and modeling infrastructure, to help us using the NEAMS tools that can include the steady state analysis but provide an estimate of time to melt. We are interested in the time to melt because it will give us a metric that we can use to assess some of these accident tolerant fuel concepts.

**Q: Is the program considering using accelerators for transmutation?**

A: We are not at this time. This program has considered accelerator transmutation of waste a while back in the early 2000's but that is not something that DOE is interested in at this time.

**Q: You mentioned metallic fuel, are ceramic fuels also entertained?**

A: Yes, over the past couple of years we have defunded a lot of our activities with ceramic fuels for fast reactors. But we have some international collaborations that have considered and have access to data on ceramic fuel compositions for transmutation. I would say it would be a medium to low relevance, depending on what exactly is proposed by the community. And I would send me a note, or give me a call, to talk about what is being proposed. The difficulty for us with ceramic fuels is we have investigated, say, nitrite fuel systems as an advanced fuel in the ceramic system and had a lot of trouble incorporating the minor actinides in the nitride fuel system. So we have that information available to us and that actually drives us to choosing metallic fuel systems because it would be very difficult for us to envision fabricating actinide bearing nitride fuel reliably. So I would say be careful about what you propose in the ceramic fuel area, you would probably want to check with me first.

**Q: How would be get access to TREAT? Should we have a researcher from INL who has access to TREAT, or is there another option?**

A: So there is no access to TREAT at this time because TREAT is currently scheduled to be brought back to operation in 2018. In our program today, what is going on is the development, design, and construction of the test loops that would be used for

transient testing in TREAT. Send me an e-mail with your contact information and I will put you in touch with Dr. Dan Wachs, who is the scientific coordinator here at INL for TREAT transient testing. He would be very interesting is speaking with people in the university community with capabilities in understanding transients and what we need to do with transients in the future, or even proposing experiments in the future using the TREAT transient test system.

**Q: what is the funding level of the IRP-FC-1?**
IRP's have been funded at the $1 million level per year. That would mean $3 million over the three year lifetime of the project.

**Q: Are FC, or Fuel Cycle workscopes open to university, national lab, and industry leads?**

A: No, Fuel Cycle workscopes are only open to university leads. National laboratories and industry can be collaborators in these areas. If you look back to the CINR Overview, you will see that FC-2 is a Program Supporting area, and IRP-FC-1 is a Program Directed areas, both only available to university leads.

**Q: In regards to the IRP, time to melting greatly depends on accident scenario and transient thermal-hydraulics, ECCS, etc. Do you expect the IRP to develop such capability?**

A: Or us the tools that NEAMS has developed for that purpose.

**Q: Can you please re-state goals for FC-2.2: Advanced Characterization?**

A: One of the powers that the NEAMS fuel performance tool that has been developed is being able to model very fine microstructural behavior in fuels. And so we are looking for advanced characterization techniques that can provide us with data to supply those models. And then, if possible, to even develop the model to be put into the fuel performance tool, but you don't necessarily have to develop the model. So in the past, for instance, we have funded a NEUP last year with Dr. Peter Hosemann at UC Berkeley to look at advanced uses of the FIB technology to investigate micromechanical properties of irradiated fuel and understanding how to use that technique with irradiated fuel material. So that type of advanced characterization is what we are after with FC-2.2 but we are open to proposals because we don't pretend to be the experts in advanced materials characterization technique development. Much of that activity has taken place in other non-radioactive materials systems over the years. We believe there are characterization techniques that have been developed for other materials systems that we could possibly apply to irradiated fuels in the future., even if that may require additional development on our part in the laboratory system to handle those materials. What we have seen in the program is using FIB-type technologies to prepare samples that can be used on advanced characterization tools, but how to use those tools with irradiated fuels is of interest.

**Q: What about TRISO fuel type in different form for fast reactor**

A: Maybe someone in the NEUP office can tell us if there is a specific call for TRISO fuel for high temperature gas reactors. What we do have in our program is the use of a TRISO particle in a ceramic matrix, not a graphite matrix, for a control on containment of the fission products for advanced accident tolerant fuels. But this is not strictly the TRISO fuel concept for high temperature gas reactors. That distinction has to be made because our program does not fund the TRISO fuel work for the high temperature gas reactor. This is the only workscope that deals with fuels. We have a separate area called MS-NEET-1 that is new this year that you can submit other ideas to that may not fit underneath the umbrella of any of these programs. That is not just for this area, but for all areas in the FOA. That is also applicable to thorium, or molten salt technologies that our program does not fund.

**Q: Are additive manufacturing (3D printing) projects of interest for this topic?**

A: You will need to refer to some of the past proposals. I think there is an SBIR topic that is also relevant to because I think there is an SBIR that has just been funded in 3D printing. Please send me your contact information and I will put you in contact with the person in charge of the SBIR activity. We would encourage communication so there is no duplication. That would be a more appropriate for the NEET-1 area, which is Advanced Methods for Manufacturing.

## FC-3: Nuclear Materials Control and Instrumentation

**Q: When you refer to safety, does it include concrete structures?**

A: If they mean security, then yes. Generally the plan for these used fuel storage facilities is not that they would have a containment building, per se. They would have a fence or something like that. But the integrity of the concrete, the slab, and the casks themselves would definitely be part of the security analysis. Safety analysis is a bit of a different situation. There is a little less R&D on safety on our end because the NRC is more mature in the licensing process than they are on exactly what the design basis threat might be. So the short answer is yes, concrete as it pertains to the integrity of concrete and the vulnerability of concrete could be an applicable subject.

**Q: Is the non-destructive inspection part of the topic for dry storage applicable?**

A: Yes, if there are NDA methods of extracting information from the fuel, outside of the cask, or somehow being able to independently verify cask contents, that is valuable and something we would be interested in. Specifically, NDA would be applicable.

**Q: Are you also considering materials degradation over time?**

A: Yes, hopefully that would be incorporated into some of these performance models. Initially, you take a scan and how often do you need to retake those scans to verify cask contents? Is just using a burn-up model enough? Can you integrate your model with the accelerated aging models that the designers of these facilities are doing? That's a question that remains to be answered and is something that DOE is looking at, and should be incorporated into a proposal. We need recommendations on how to deal with those aging, or describing and giving a basis for why that is not important because it is known in this capacity, or isn't important because this part of it is unknown. But yes, it does have to be taken into account.

**Q: Is there a separate area in NE for high performance concrete materials research other than this program?**

A: I think the answer is yes. There are some people that are not in the Fuel Cycle R&D program that could answer the question better than I. There is advanced materials research and high performance concrete would probably fall into one of those categories, or possibly a Mission Supporting area. I wouldn't say that performance of concrete or something that specific would be relevant to this program. We are mostly looking for nuclear safeguards and things that pertained to nuclear specifically. It does not have to be a nuclear detection method but I would say that high performance concrete would be in a different workscope. You may want to follow up with someone from the NEUP program, to see where it would be appropriate. I don't think it would be for this area unless it were part of a larger analysis.

## FC-4: Used Fuel Disposition

**Q: Can you please provide an example of corrosion issues you are interested in this call?**

A: We seek better understanding of corrosion processes, meaning corrosion and leaching, for used nuclear fuels and waste forms. This disposal media, or rather, the form that the waste would be in would be glass ceramic or metallic. And there are going to be variable conditions regarding saturation, temperature, water chemistry, that sort of thing that would act in conjunctions, these would be coupled processes, that would act in conjunction to degrade the waste form. We are attempting to develop improved models to improve these processes. This is a small expansion to what appears on slide 12.

**Q: Do used fuel disposal needs cover security or non-proliferation?**

A: There is no non-proliferation consideration in the disposal research that we are doing at this time. The research that we are soliciting has to do with conditions that

develop at the point of disposal, after disposal when the waste form is in the ground. But there are no security or non-proliferation considerations involved.

**Q: How many FC-4.3 proposals would possibly be funded in FY 2015?**

A: The funding mechanism is subject to variable parameters based on the amount that is provided to used fuel disposition. Those parameters are dependent on management decisions and I am not prepared to speculate on how many research projects would be funded. It all depends on the amount of funding and the way that funding is split between the various programs.

**Q: Is concrete degradation also considered?**

A: Concrete degradation would be considered, although over extended periods of time. Concrete would be in perhaps in a placement drift lining as opposed to a cover or a cask that would cover a wasteform and actually be disposed of. So it would only be the surrounding and placement drift lining, or perhaps the invert that would be considered. Other than that, there would not be a concrete cover over the wasteform.

**Q: What waste disposition option would have a priority, mined or deep borehole?**

A: Both are being looked into at this time and we would encourage both types of research proposal in both mined and deep borehole.

**Q: Is there priority on salt, clay or basement rock?**

A: There are no priorities assigned at this time. We are looking at a variety of media, and there is no priority that has been assigned or will be assigned. We are trying to provide different looks to those mentioned.

**Q: Is it mostly modeling that DOE is interested in relation to corrosion issues?**

A: That is correct, it is mostly modeling.

**Q: Is geochemical study on subsurface transport of radionuclides within the current call?**

A: Yes.

**Q: Is there any interest in the transportation of spent fuel rods, such as the integrity characterization of spent fuel rod systems?**

A: There are two ways to interpret that question. The first has to do with the transportation from the spent fuel rods are to the ultimate location of the

repository, the answer to that is no. If it has to do with the transport of radionuclides in a disposal environment, the answer is yes.

**Q: Will sensor development for the monitoring of canister condition be of interest?**

A: Not in disposal, we have previously awarded research for canisters and casks in storage. In disposal, an offer or proposal could be made to provide health of the wasteform with regard to the degree of corrosion that has taken place. That is very innovative thinking.

**Q: Are you considering other waste form beside glass, ceramic and metallic?**

A: The wasteform include canister placement with a disposal over pack. Spent fuel itself is considered a wasteform as well.

**Q: Are the transport and interaction of radionuclides with the environment the priority of this call under FC-4?**

A: That is a component of the call.

**Q: What is the strategy to select a site and can we expect to have more than one sites depending on location?**

A: The site selection strategy is outside the scope of this solicitation for input. We are not going to address that question because it is outside the scope.

**Q: Are lab-scale studies of new techniques for measurement of host media properties of interest?**

A: Yes, they are.

## FC-5: Fuel Cycle Option Analysis

**Q: Is the option of buying fuel outside of the United State also considered?**

A: Most of our studies have been done for the United State. In the consideration of fuels, I guess you could consider foreign fuels as well. In fact, I believe the U.S. gets some of its fuel from foreign sources.

**Q: How many proposals will be funded for FC-5?**

A: One or two.

**Q: You talked about UK? Can we collaborate with anyone there under NEUP?**

A: Yes, you can collaborate but the UK does not get aid from NEUP funds.

## FC-6: Fuel Resources

**Q: Is there any interest in inorganic adsorbents? These will perhaps be more stable in marine environment.**

A: Yes, definitely. The key is how to control it. We want to make sure that you can find a way to have the inorganic adsorbent deployed in an actual marine environment. Here we don't want to pump the seawater because if you pump the sweater the cost is too high and we cannot afford it.

**Q: Is the fuel resources area focused exclusively on recovery from seawater?**

A: At this time our focus is seawater uranium.

**Q: What is uncertainty in the uranium price you quoted?**

A: The uranium price fluctuates quite a bit. After Fukushima, the price has fallen to a historic low. So now, the stock price is about $100/kilo and that is extremely low. We consider this a long term research activity to ensure the sustainable future of nuclear energy because even though the technology for mining uranium works, you will see the price begin to rise eventually and this technology can be used as a cap to the uranium price. If we had a cap of $300 dollars that would be much higher than the current uranium market price but we know that the supply of uranium would be intact for the future.

**Q: Are there any specific adsorbent identified/developed that should be focused on?**

A: No, if you have other good candidates that are not mentioned in the presentation, ligands, etc. please make that proposal to us.

**Q: For computational design and simulation, is teaming with experimentalist required?**

A: That would be beneficial if you team with an experimentalist. In that case you could do calculations to validate your model, and that is very important. I will say that is encouraged, but not required.

**Q: is there guidance for the cost of the adsorbent?**

A: We have a team to study this cost. So if you have questions about cost I can give you the contact information. We would like you to use the Japanese technology in the presentation. We would not want you to use any materials that were more expensive than the materials used by the Japanese. Newer materials eventually, after a couple of years of development, could have calculations performed to see how much that technology costs. We are doing that for some of our advanced materials now.

## IRP-FC-2: Cask Condition Evaluation Techniques

**Q: Does the condition involve water or water vapor during storage?**

A: There is a possibility there is water vapor after drying. If that can be detecting, yes it is included.

**Q: Are fuels immersed in water all the time of interest?**

A: No, the cask should have been drained of water.

**Q: Will the deliverables (as reports) be added to the CURIE database (centralized used fuel resource for information exchange)? If so, how would they be added?**

A: Not necessarily. They would be added after receipt by DOE and approval.

**Q: Does this call entail only evaluation of fuel rods inside the canister or does it include the canister and cask as well?**

A: It includes all of the internals, the basket configuration and the internal condition of the cask and canister.

**Q: Does cask condition evaluation include detailed study of degradation mechanism on casks?**

A: We are going to follow up with another IRP (IRP-FC-3) and that will be answered in that presentation.

**Q: Do you seek a 'consortium' type proposal?**

A: The nature of the collaboration to accomplish an IRP is outlined in the FOA. We invite the inquisitor to peruse the content of the FOA to identify the structure of the consortium or collaboration to do this research effort. This information is available on the IRP General Information page at www.neup.gov. which will give you a

general outline of what an IRP is. It is a collaboration with at least one other university and strong proposals typically include several organizations or institutions involved.

## IRP-FC-3: Canister Corrosion Evaluation

**Q: This seems to have a large overlap with the 2014 IRP-FC-1. What is the difference?**

A: The previous work that has been awarded has had to do with the different initiation processes for stress corrosion cracking. There is hydride induced, there is weld and connection induced, and there is external deliquescence induced. We want to make sure that we are not attempting to describe the elephant from blind perspectives. We want to identify the coupled processes that might results from those initiating mechanisms to be able to address the stress corrosion cracking that we assume will be taking place from an incorporated perspective.

**Q: Is using sensors to determine SCC susceptibility part of this call or part of last year's Sensors IRP?**

A: It is not duplicative because this is an attempt to coordinate and incorporate the different initiating mechanisms. Now sensors can be used to identify deliquescence of stress corrosion cracking on the outside of the canisters. But again, the main thrust is to make sure we are identifying how these coupled initiating processes could affect the other acting individually or acting in tandem.

**Q: Are you also looking for correlation between corrosion and radiation damage?**

A: Radiation embrittlement would be a part of the consideration because the radiation embrittlement would be a contributing factor to the stress corrosion cracking development.

**Q: Is delivery of the sensing system to the stainless steel canister part of the work?**

A: No, the deliver of the sensors is part of a previous IRP that will be awarded here very soon.

**Q: It was mentioned to work with national laboratories. Is there a specific national lab that is looking for university partners?**

A: There are several national laboratories that are involved in the NEUP program. Those national laboratories include Pacific Northwest, Savannah River National Laboratory, Los Alamos, Sandia National Laboratory, Argonne, Lawrence Livermore

National Laboratory, Oak Ridge National Laboratory, Idaho National Laboratory, Berkeley Lab, those are the labs that are involved.

## MS-FC-1: Fuel Cycle R&D

**Q: Are there any specific priorities to specific portions of the fuel cycle that should be focused on for this Mission Supporting area?**

A: There is not specific point of emphasis. If you look back to my near term and long term slide clearly the response to the Blue Ribbon Commission and the accident tolerant fuel area is an important area that we are looking at near term. From an urgency standpoint those have priority. But I think this topic, the longer term are a point of emphasis. I wouldn't want to steer you toward any steps in the fuel cycle.

**Q: How many proposals will be funded in FY 2015?**

A: This year we hope to award two, and those hopefully we be announced in the near future. I envision approximately two being awarded next year.

**Q: What are the criteria for evaluation of new idea, in addition to innovation?**

A: Technical content, technical clarity, and all of the similar point that you go through for the other areas. There is a relevancy portion of the evaluation but the technical portion has a greater weight. In this case, it can help carry the evaluation quite far in the process.

## IRP-NE-1: Transient Fuel Testing

**Q: Task 1a appears to be a very large task to complete in one year. How flexible is the overall schedule?**

A: The goal is something that can be negotiated.

**Q: How we can access to TREAT past experiments database?**

A: I think that if you are looking for information, it is mostly applied technology. But we can work through that and identify what experiments you may be interested in. It would start by contacting someone at the Idaho National Laboratory who can guide you through that process. Contact me, Dan Wachs, and I can put you in contact with those people. A lot of that data is on OSTI as well.

## MS-NE-1: Integral Benchmark Evaluations

**Q: Is Doppler Effect included in this area?**

A: Yes, Doppler Effect is included.

**Q: Does this area consider areas other than critical experiments and reactor measurements?**

A: The two areas we are interested in are very general. We are interested in criticality experiments and reactor experiments, and anything that is related to those two types of experiments.

## NEAMS-1: Nuclear Energy Advanced Modeling and Simulation

**Q: Does the area cover atomistic modeling as well?**

A: I think that if there can be a connection made to helping to accelerate our ongoing work and it is clear what role it would play in the scope that we described it, we would certainly be open to it. We have ongoing atomistic and mesoscale work in the fuel area and certainly, we would be open to proposals that would strengthen what is there.

**Q: can you specify other fuel types other than conventional oxide fuels?**

A: Perhaps I didn't cover that as well as I should have. Although our initial focus is on oxide fuels, BISON is not limited to that. It is very successful on metallic rod and plate fuel and TRISO particle fuel as well. So yes, we are open. In fact, I think that was in the scope, that we would like to extend it to other fuels. If there are proposals that you could offer that could accelerate the ability for BISON to apply to other fuel types that would be welcome.

**Q: How critical new experimentation will be for the NEAMS program?**

A: I would like to say that it is very critical, but I'm not the expert. We know that there is a lot of data that currently exists for validation. Sometimes it's a straightforward effort to obtain and make use of it. Other times it is a very heavy lift to make sure that this data is properly pedigreed and that we understand everything we need to know about it to benchmark it and rely upon it. That is not always a trivial thing and sometime we think that data we think we can use we may not be able to. Experimentation to fill those gaps or finding data that doesn't exist, that we know doesn't exist, would be very important. Dave Pointer has put together a list of data that needs to be provided, or would be helpful, possibly he could put together a list and provide that. We could provide that list of guidance that was

developed for last year's NEUP call, because I don't think it has changed that much. Our purpose in integrating universities into the NEAMS program is to seek their help in making the fuel set as robust as we can make it. If that means building new experiments to collect new data, that is certainly one path. Finding ways to get new value out of existing resources is also important.

## NEET-1: Advanced Methods for Manufacturing

**Q: I couldn't hear what Alison mentioned as an example of corrosion. Can she say that again please?**

A: So if you are referring to slide 6, the valve disc was an example that we tend to use here for the wear and surface corrosion applications. The other example I gave was replacement of welding cladding on the materials.

**Q: Is there interest in manufacturing techniques for metal/plastic joining?**

A: Metal joining, yes. The only technologies that I am aware of where plastic joining would be appropriate, and there is a lot of work being done here right now, is high density polyethylene for new nuclear power plant applications in low temperature, low pressure systems, like raw water systems, that sort of thing. So typically non-safety or class III. There is a lot of work going on there. For metal joining technologies, absolutely. We still believe that there is a long way to go, even though we have made great advances in welding and joining materials together. We still believe there are a lot of opportunities in that area.

**Q: Manufacturing is all related to the manufacture of the reactor and not in processes that are used to make materials for the reactor?**

A: Manufacturing reactor components, not making the materials, but manufacturing the actual components of the reactor.

**Q: Are you looking also for innovative concrete ideas?**

A: Yes, there are a couple of options that we are looking for there: concrete, chemistry, rebar, the interactions between concrete and rebar, and new design for concrete structures.

**Q: Are additive manufacturing projects of interest for this topic?**

A: Yes, it is one of our main components of this program. We do have a few additive manufacturing proposals already, but we are looking for other additive manufacturing processes as well.

**Q: How prominently do you think concrete research will be emphasized in NEET 1?**

A: We have a few concrete areas that we are looking at: sensing of the concrete pores and curing is on slide 5 as well, so there are a few options for concrete.

**Q: Are solid-state joining techniques of interest?**

A: Yes, I want to defer to Jack for detail. Solid state joining is always of interest, but one of the criterion that we use to evaluate these techniques as a program is: Can it be practically applied within the next three to five years, in general? Solid state joining, with things like friction stir welding, yes; Techniques that could be applied from other industries, yes; But some solid state joining technology is very basic research and we don't believe it would be applicable in the next five year. That is the distinction we make on these projects.

**Q: Innovation in concrete through reduced volume or thickness may involve higher cost. Would a study of mass scaling to reduce cost be considered?**

A: I understand the possibility of higher cost. It would be looking at the aggregate cost for all of the materials in the plant. So higher cost in forming up the concrete may reduce overall construction time and that could be weighed in that manner. If the overall impact is higher cost, for the actual construction, which includes time and cost of materials, the answer would probably wouldn't be a good one.

**Q: Would you be interested in reducing thickness and complexity of concrete containment structures through the use of SC technology?**

A: Yes, that is one of the areas we are looking at.

**Q: Does this area deal with concrete degradation in any way?**

A: No. We are looking at new builds.

**Q: Is there interest in rebar material development in this program?**

A: Yes. Rebar development is a key area. Once again, we would like to find rebar development research projects that could be brought to the industry within five years. But alternate rebar material, or alternates for rebar, we are always interested.

**Q: What is Jack Lance's e-mail?**

A: Jack.lanc@gmail.com

# NEET-2: Advanced Sensors and Instrumentation

**Q: Is radiation induced hardware failure considered in this year's topic NEET-2?**

A: Not specifically. I think we are more interested in the software and dedication aspects of the embedded digital devices. We have funded, and are sponsoring research into radiation-induced failures.

**Q: Are there any specific sensors in priority to other sensors?**

A: We are not looking for sensors, but for digital embedded system. So if it's anything that you can test in the environment it is of interest. We don't have specific sensors or types of sensors with embedded digital devices at this time.

**Q: Is Nuclear Plant Communication related to wireless communication of interest?**

A: For this specific call we are concentrating on embedded digital technologies, although that is part of the general NEET-2 program.

**Q: What is the appropriate Technology Readiness Level for sensor hardware development?**

A: It should be at a relatively high TRL. The NRC, especially if you look at the NRC-industry interactions on this issue, we are interested in technologies and methods that could be used now and could be demonstrated soon. That doesn't preclude technologies that could be developed within the next two or three years. That is the timeframe we are looking at. This is a demonstration project, so it would need to be ready to demonstrate. The project duration is up to three years, and this is a demonstration project so it should be accomplished within that time period.

**Q: Any interest in sensors for monitoring waste forms on storage?**

A: No, that is not under the current call.

**Q: Is materials development for sensor applications considered?**

A: No, that is not under this specific topic.

**Q: What is the technical basis of the US NRC testing requirements, and if a better basis could be found would this project be open to it?**

A: You need to go to the NRC website or talk to the NRC to discuss the requirements. They have a lot of public documents and information. We would be open to a better

basis. It would have to solve the issue that industry is dealing with right now but we would be open to better ideas. It would be important to bear in mind whatever the proposed new basis is, how it addresses what the NRC and industry position is on qualifying embedded digital devices. We're not proposing that we enter into a research project to change regulatory rule making, but if the project finds new ways to satisfy or address that, it could be considered.

## NEET-3: Reactor Materials

**Q: Can you identify or outline the innovative materials that need for further research?**

A: There are many, there are some examples in the solicitation. But I can't point to any specifically. We are looking at metal alloy systems that have greater radiation resistance. They could be used at higher temperatures, for longer periods of time. We are also looking at composite systems. We also funded a 2012 polymer system for cabling project. So any of these material systems are of interest.

**Q: What specific aspects of mechanical performance are important?**

A: The important characteristics are the ones mainly for mechanical behavior, these being creep, fatigue, strain, thermal stresses, mechanical stresses, and radiation resistance.

**Q: How do we establish relevance for the proposed activity?**

A: A good way to do that is to 1) to look through details in the solicitation and 2) to look at our Nuclear Energy website. All of the research programs, the applied programs, have sections on the website and you can get more details and reports there on what is of interest in each of those areas.

**Q: Is additive manufacturing of interest in this area?**

A: This topic mostly focuses on material discovery and development so I don't see how that would be part of the scope.

## NEET-4 and NE-1: Cybersecurity R&D

**Q: Does this focus only on reactor core or on entire fuel cycle?**

A: The entire fuel cycle for both research reactors and power reactors.

**Q: Could you expand on 'resolve consequences' as it is critical to understanding the scope?**

A: So what we are looking at here is anyone can come up with a threat. You can say, 'Oh, I think someone can hack the controller for the fire suppression system and cause actuation of the system". So what does that mean? What does that mean to plant operability and plant safety? If there is a threat factor and someone is able to execute on that, what does that mean for the condition of the plant, the operability of the plant, to the economics of the plant. That is what we are talking about when we say 'resolve consequences'.

**Q: Is there any interest in algorithm development such as encryption algorithms?**

A: I don't think so. I suppose it depends on the context. If you are talking about encryption algorithms for control signals to and from components, possibly yes; If you are talking about general encryption algorithms to protect people's information in a database, probably not. Steve is the expert in this so he would be the one to contact.

**Q: If a project is proposed for a specific facility, would results of the study be public domain information?**

A: Yes, if it borders on the security of your facility, then we could work out an arrangement for that. We wouldn't want to publish anything that could adversely affect the security of your facility.

**Q: which program addresses risk-based methods?**

A: We have a number of programs that address risk-based methods but not in the cyber-security realm. The Light Water Sustainability Program is probably the best example. But to some extent, all of our programs, both Reactor and Fuel Cycle programs, are risk aware and look at risk methodologies.

## NEET-5: Control System Modernization for the Advanced Test Reactor Critical Facility

**Q: Why is this a NEET workscope rather than a normal procurement?**

A: The benefit we see in NEET is that it opens it up to university, industry, and national laboratories, which is a broader audience than we could usually reach.

**Q: This seems to be engineering work. Are there any components that are R&D?**

A: No, that is a correct observation. This is more of a design effort than a R&D effort. We are not necessarily looking for a novel control system; we are looking for something that is tried and true that can get us through the next two decades.

## RC-1: Computational Methodologies for Gas Cooled Reactors

No questions recorded.

## RC-2: Advanced Technologies, Development and Demonstration

**Q: With regards to gas cooled reactor research, there are appears to be some overlap between RC-1 and RC-2. Could clarify the distinction and if a PI is submitting a proposal on gas reactors, how could they be sure that they are submitting to the correct workscope area?**
A: Traditional methods, computational methods analyses, safety methods analyses, are what go into RC-1. RC-2 is more focused on component performance and in the area of system studies, instead of modeling of a specific reactor's safety performance or a core neutronics performance, we are looking for an integrated system analysis of a reactor along with a hydrogen production system, along with a grid application. That would be a system analysis study. RC-1 is more focused on modeling and simulation while RC-2 is more technology focused.

**Q: What do you mean by generic technologies?**

A: Generic technologies are technologies that could be applied to several different reactor types, both fast and thermal or somewhere fuzzy around the line. That is where materials go. Some of our materials research goes to fast reactors and to high temperature reactors. It doesn't happen often, but it does sometimes. The energy conversion work, which can apply to a high temperature or fast reactor, you can hang a supercritical CO2 turbo machinery system on either type of reactor, so that would fall in the generic system. The third area would be instrumentation and controls. So these would be instrumentation and controls for any nuclear application focusing, however, on advanced nuclear reactors. If it is something that is in the light water community we would not be supported. We would refer that idea to light water industry to develop it.

**Q: In previous webinar sessions, the MSR and thorium based fuels were deemed not relevant for this FY15 FOA - are these also irrelevant for the economic analyses for advanced reactor technologies?**

A: In so far as molten salt reactor applications are dually applicable to fluoride cooled high temperature reactors, molten salt technologies could be considered. Thorium applications, however, is currently not an area the department is working on. Thorium based projects or other technologies that do not fit the Program Supporting workscopes can be submitted to MS-NEET-1.

**Q: What about proposals that address technologies or applications that are also relevant to water-cooled reactors?**

A: If it is dual purpose but the primary application is for an advanced reactor system, or in case it is something we really want for advanced reactor system, but the light water community is not willing to pay for it for their own application, if they are not willing to consider it. We will consider it as something we could put into future advanced reactor designs. We are looking for anything to make the overall reactor system better, including things that could make a light water system better, but they are just not paying for it.

**Q: So 'advanced' means only non-water cooled reactors?**

A: That is correct. And hopefully that is clear from our budget request and our mission statement. We are only working on non-light water concepts, which are done under the Office of Light Water Reactor Sustainability to some extent, and partially by the Licensing and Technical Support Program for Small Modular Reactors.

## RC-3: Advanced Structural Materials

**Q: Why alloy 709?**

A: We are looking for 2 additional alloys to add to the ASME code for high temperature reactors. Right now there are only 5 qualified materials from which you can construct high temperature reactor components: two stainless steels, two ferritic alloys, and alloy 808, that's it, no more. And they all date back to the 60s and 70s, except for one that came in the late 80s. At any rate, they are all very mature materials with relatively low strength. And certainly we know that there are materials with higher capabilities. So back about 7 or 8 years ago, DOE launched an activity to screen out what the potential materials might be for that. There was an extensive wide funnel that we looked a lot of materials, austenitic and ferritic, and we wanted to find ones with higher creep strength primarily but that did not sacrifice other properties, things like weldability, ductility, fracture resistance, microstructural stability, etc. And it turns out that after several years of study and

down select, it turns out that among the austenitic alloys, 709 came out on top. Sodium compatibility is also key for the application of this material and 709 is capable of performance. Considering one of the principle applications of this alloy would be for sodium fast reactors, sodium compatibility is clearly one of those multiple characteristics that we wanted to make sure we maintained in moving forward with this material. That's not a requirement for the ASME code, but it is a requirement for the potential application we are looking for.

**Q: Do you have any concerns about environmentally assisted cracking or stress corrosion cracking for this alloy system?**

A: I don't think that we have any for the high temperature coolants that we are looking at. That is not typically common for those, and we haven't envisioned these for use with LWR systems, but who knows what the vendors will come up with. I don't think that the ferritic materials that we have been looking at and the parallel studies would have that problem and with the high chrome and the high nickel contents of the 709 I would say that it would be highly unlikely that we would have that problem. Obviously that would be in a water environment. I am not quite familiar with the water environment but we haven't really seen any indication in the sodium environment. If there is data that suggests that there is a concern then we would be very much interested in looking at that. In any case, it should be emphasized that our primary concern with moving forward with this material is in support of higher temperature creep strength, higher temperature design margins for the class of advanced reactors. This work would be nice if it supported advanced LWRs but that's not the focus of this work.

**Q: Is there any interest in ferritic-martensitic steels in this program?**

A: But the NEUP itself does not include activities on that, but absolutely in the mainstream program. We have a comparable pathway that we have been developing in advanced version of Grade 92 and a slightly optimized chemistry and a thermally treated microstructure and we do have studies on that.

**Q: Are you also looking for uncertainty analysis due to difference in time scale and environment between the lab and the actual reactor?**

A: I think that is an inherent part of any basis for extrapolation. We are really looking for the mechanistic basis to support both these topics in the area of extrapolation. On the other hand, there will certainly be uncertainty; one can never predict things out to an order of magnitude further than the data we've got. So that would be a piece of it, but not the focus of it.

**Q: Are you looking for creep behavior of weldments too?**

A: We are really looking for base metal in this call, but in the greater scope that we are looking at for advancing these materials and moving them into the code, we

would consider weldments. I think that the work has focused on base metals but weld reductions factors and understanding how the welds behave with this material are an important thing. As far as this call is concerned, we really want to address the base metal. Obviously, that weld will be of interest but that is not within the scope of this call.

**Q: What about HT9?**

A: HT9 is a very interesting material. It has been around for a long time and it is an old material in terms of generations of steel. It has been used for high radiation environments, typically clad and duct. It has been around since the days of FFTF and earlier. It does not currently enjoy code qualification for high temperature reactors. It is a material of interest, and may be of interest to some proposals but it is outside of this call and we will not consider it for this area.

## RC-4: MAaD & RISMC Integration Models for Materials Degradation

**Q: What materials/alloys are used for the cabling that is of concern related to degradation?**

A: On the Materials pathway, there are no metals or alloys that are of interest to the cable insulation. There are a variety of standard electrical cable insulation forms that industry uses quite broadly. The highest value cable insulations for the 60-80 year period would be DTR or XLTR. There are several listings in a variety of DOE Light Water Reactor Sustainability plans with details on a longer list. DTR and XLTR are the highest priority cables.

**Q: What DPA value level you are looking for LWR materials in regards to aging and degradation?**

A: That is going to be very dependent on the material system, the location in the core, and whether it is a PWR or BWR. The highest fluence for core internals would be in BWR with 80 years of life and components with that. Stainless steel, in that case, may see 80 to 100 DPA. If we were talking a pressure vessel of a PWR, the highest possible damage level would be in the high ten to the twentieths, or a fraction of a DPA, around half a DPA.

**Q: When you speak about fundamental research on concrete deterioration, do you mean existing concrete materials or does the call consider research on new concrete materials with more durability?**

A: Materials Aging and Degradation for the LWR Sustainability Program can only focus on the existing plants.

**Q: Is degradation modeling software available in public domain? If not, where it can be found?**

A: The spirit of the call is to develop the codes and materials models. These would probably be written in codes that are compatible with the GRIZZLY tools or toolset and those codes would be commercially available. The source software or codes are traditional ones. There may be some software packages out there that look at different fundamental degradations, so one of the questions would be, can we either convert those or restructure those or are there new or updated versions of those that could be put into the MOOSE approach. But that is one of the key parts of the work, to figure out what those models look like, and find the gaps in those models, and what the implementation issues would be.

**Q: Are you looking for multi-physics multi-scale code development?**

A: In general, yes.

**Q: Are we focusing more on fuel degradation for degradation models?**

A: No, fuel degradation is not part of the Materials or the RISMC pathways of LWRS. Fuel is considered a replaceable component and not a long-lived component. Fuel is covered in other DOE-NE efforts.

**Q: For weld repair what type of process you are looking for?**

A: The weld repair can cover a variety of techniques. For the current LWRS program we are looking at advanced repair techniques such as friction stir welding and laser-assisted welding that can be applied to irradiated materials without significant loss of performance or onset of helium induced cracking. However, there could be other treatments such as traditional methods applied with different post-heat treatments on other irradiated materials. So weld repair covers a wide range of techniques from existing and traditional techniques to advanced and modern applications. In context of the RC-4 call, the call really involves supporting the GRIZZLY development, so developing predictive models for key degradation mechanisms for extended service. So weld repair does not seem to fit in this call, although I can see modeling weld repair and its degradation mechanisms within GRIZZLY may work. It is possible but it seems to be a bit of a stretch.

## RC-5: II&C: Computer Vision and Image Processing Technologies for Nuclear Power

**Q: For online monitoring of long-term aging, what kinds of materials or components are you interested in?**

A: Online monitoring of materials is of interest to any of the passive or long-lived structures that we are interested in materials degradation issues. That would

include the concrete structures, cable insulation, in a variety of different locations and environments, piping, nickel-based alloy casting, stainless steels for stress corrosion cracking for flow-accelerated corrosion. It could include fatigue, vibration, analysis of core internals, and all of the traditional materials for long-lived structures.

**Q: Is positional accuracy of the worker or the tools they are using important?**

A: The positional accuracy of the tool in relation to the equipment that it is being applied to would be important. If you think about an application, like a worker opening a cabinet that is full of breakers, and the worker is going out to respond to something that is malfunctioning, one possible application of image processing technology is being able to identify a mispositioned breaker. Or, at the end of an in service inspection or a scheduled maintenance, image processing technology could compare the desired status of a piece of equipment with the actual condition of that component at the end of maintenance. It is actually a combination of things, not just the positional accuracy of the tool or worker, but a little bit of both, as well as the desired condition of the equipment, for that particular example. Other examples include, is the worker standing in front of the equipment he is supposed to be working on? What is the condition of the equipment that the worker is supposed to be working on versus the actual condition of the equipment using some type of scanning technology? For example, if it's supposed to be hot, is it hot? Is it in the right position? Are there other hazards in the area that you should be aware of?

**Q: Would research investigating the installation of imaging techniques be considered in this call?**

A: It could be. It depends upon the application of those techniques. What we are looking for is how we would use those technologies, especially, in the content of computer-based procedures for field workers. So we imagine, although the response shouldn't just be limited to our imagination, we might find it necessary to have a helmet-mounted camera or something on a computer-based field device, that could look into the field of work performance, and gather information that sends back to imaging processing software or vision processing software. I think that sets the context we are thinking about but it should be done within the context of a procedure or work package of some kind. That's usually how field workers use these types of technologies in nuclear power plants.

**Q: Are specific imagery data of special interests? Range Image, Thermal Image, Satellite Hyperspectral Imageries, or any visual data?**

A: We don't' have particular data in mind. Some of that data that you are referencing is very specific to geo-spatial positioning, which could be important for certain types of tasks. But most of the time when a worker is going to the field to perform work on a component or a device, geo-spatial positioning is not usually referenced in work orders. Typically, work is performed on components that are called out by

component identification numbers, locations within the plant that are uniquely identified, and then are further documented in work packages. Information that would be very useful are things that could help the worker go through their procedure or work package that would help them collect data visually, independent of the worker so to speak, and be able to integrate that directly into the work order or procedure itself.

**Q: Are spatial change analysis and cascading effects of changes within the scope of this program?**

A: Yes, they certainly could be. You would have to link it to the specific application you have in mind and how that relates to workers performing work in nuclear power plants, but it certainly could be.

**Q: are you interested in using recent technological tools such as Google Glass like equipment for augmented reality applications?**

A: I think we are open to any types of technologies that people would like to propose, including the type you propose, Google Glass, or any others. There are other industrialized technologies that we have heard about or worked with in the past. So we are rather technology neutral when it comes to specific types of technologies. So we are very open to that.

**Q: Does the scope of this pathway include severe accident monitoring?**

A: I wouldn't exclude severe accident monitoring, although we did not call it our specifically. The main focus here is helping workers perform their work during routine maintenance, surveillance, inspections, tests and those types of activities because that does consume the bulk of their efforts. That is what nuclear power plants that we are working with are interested in. But, you point to a very interesting possibility. If you have some ideas in mind on how these technologies could augment human response to severe accidents, we would also be interested in hearing about that.

**Q: Some times visual imaging or thermal imaging is insufficient to make a judgment. Is fusion of imaging techniques considered?**

A: I think that would be a very useful type of application. In fact, when we provided some examples, saying that applications of interest include, we were really just trying to spur some thinking and some ideas. I do think that fusion is going to be necessary. In other words, to impart the ability to take disparate pieces of information from imagine processing and do something with it is going to require some fusion. So I do think so fusion is necessary.

**Q: Are you interested in activities the outside or inside the plant?**

A: I believe that it is on the inside of the plant. By that I mean in the balance of plant, within the plant, on plant equipment and components. That is what workers routinely perform surveillances, inspections, tests, maintenance and those types of activities upon routine operations, or any types of operations. I can think of one area that we are not interested in. You could certainly apply this technology to security aspects of the plant, like guard forces and that sort of thing. We would not be interested in that. If they were thinking about how these detection technologies could be used as part of plant security that is not what we are interested in.

**Q: Can you give an example of safety margin characterization?**

A: That is generally characterized by two concepts: load and capacity. So the load would be to represent impacts to the plant that might affect the safety margin. The capacity then is the ability for the plant to withstand those challenges, and that's when things like materials degradation and the strengths of the plant itself come into play. It's really the interplay between the load and capacity that gives you information related to the safety margin.

## RC-6: Computational Methodologies to Support Design and Analysis of Sodium –Cooled Fast Reactors

**Q: Are looking specifically for Doppler effect and/or other reactivity feedback effects?**

A: Not necessarily on only the Doppler effect, but it is one of the items in reactivity feedback mechanisms, which could play into the subassembly analysis portion of this call. So that is one of the small items that could play in to it but not the overall objectives. It is something that is being looked at and is important in general for sodium fast reactor development.

## MS-RC-1: Reactor Concepts RD&D

**Q: What is a proposed range of core coolant outlet temperature in sodium fast reactors?**

A: For this particular scope there is no designated range of the outlet reactors. From a technical perspective, current reactor concepts are in the 500 to 550 degree C outlet range. There are some concepts that look at higher temperatures but most of the designs to date are in that range.

# MS-RC-2: Space Nuclear Power Systems R&D

**Q: Can I collaborate with NASA? Will NASA co-PI will get funding from NEUP?**

A: I don't believe that NEUP is set up to get co-funding from NASA.

**Q: Is compact fission power considered in this solicitation, and what is the expected lifetime?**

A: Compact fission power is considered in this call. The lifetime we would like to see, when I was involved in the fission surface power division a few years back, we were looking for a five-year lifetime. I would think somewhere in that same range.

**Q: Who are potential national lab contacts for this?**

A: We have support at both Los Alamos National Laboratory and Idaho National Laboratory. For the materials work we have support at Oak Ridge National Laboratory. For safety support we have Sandia National Laboratory.

**Q: How many proposals will be funded this year?**

A: We do not know at this time.

**Q: What is driving 2-3kWe at the lower end of the power system range? Would a lower power reactor system also be of interest?**

A: We find that is about where fission power starts to make sense, right around the 2-3 kWe. But I think you could propose something smaller still, but I don't know that it would be efficient. If you are building a reactor, you might as well get some higher power out of it.

**Q: Should the conceptual design be tested?**

A: Testing gets to be rather difficult, but we could do something that was an electrically heated conceptual design where the fission part would be replaced with an electrical component.