Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title:	Advisory Committee on reactor Safeguards eVinci Design Subcommittee Open Session
Docket Number:	(n/a)
Location:	teleconference
Date:	Tuesday, February 28, 2023

Work Order No.: NRC-2288 Pages 1-50

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UNITED STATES NUCLEAR REGULATORY COMMISSION'S
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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eVINCI SUBCOMMITTEE

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OPEN SESSION

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TUESDAY

FEBRUARY 28, 2023

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The Subcommittee met via Teleconference, at 1:00 p.m. EST, Walter L. Kirchner, Chair, presiding.

COMMITTEE MEMBERS:

WALTER L. KIRCHNER, Chair

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GREGORY H. HALNON, Member

JOSE MARCH-LEUBA, Member

DAVID A. PETTI, Member

JOY L. REMPE, Member

MATTHEW W. SUNSERI, Member

ACRS CONSULTANTS:

DENNIS BLEY

STEPHEN SCHULTZ

DESIGNATED FEDERAL OFFICIAL:

CHRISTOPHER BROWN

TABLE OF CONTENTS

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

(1:00 p.m.)

CHAIR KIRCHNER: It's 1:00 Eastern Time, and this meeting will now come to order.

This is a meeting of the eVinci Design Subcommittee of the Advisory Committee on reactor Safeguards.

I am Walt Kirchner, Chairman of today's Subcommittee meeting. ACRS members in attendance are Charles Brown, Jose March-Leuba, Joy Rempe, Dave Petti, Ron Ballinger, and I think we have -- and Greg Halnon are present here. I believe we have Vesna Dimitrijevic and Vicki Bier on virtual connection. And Matt Sunseri. Our consultants, Dennis Bley and Stephen Schultz, are also present.

Christopher Brown of the ACRS staff is the Designated Federal Official for this meeting.

During today's meeting, the Subcommittee will receive an overview of the eVinci Micro Reactor Design. The Subcommittee will hear presentations by and hold discussions with the NRC staff, Westinghouse representatives, and other interested persons regarding this matter.

Part of the presentations by the Applicant and the NRC may be closed in order to discuss information that is proprietary to the licensee and its contractors pursuant to 5 U.S.C. 552 Bravo, Charlie, four.

Attendance at the meeting that deals with such information will be limited to NRC staff and its consultants, WEC, and those individuals and organizations who have entered into an appropriate confidentiality agreement with them. Consequently, we will need to confirm that we have only eligible observers and participants in the closed part of the meeting.

The rules for participation in all ACRS meetings, including today's, were announced in the Federal Register on June 13th, 2019. The ACRS section of the U.S. NRC public website provides our charter, bylaws, agendas, letter reports, and full transcripts of all full and subcommittee meetings, including slides presented there.

The meeting notice and agenda for this meeting were posted there. We have received no written statements or requests to make an oral statement from the public.

The Subcommittee will gather information, analyze relevant issues and facts, and formulate proposed positions and actions, as appropriate, for deliberation by the full Committee.

The rules for participation in today's meeting have been announced as part of the notice of this meeting previously published in the Federal Register. A transcript of the meeting is being kept and will be made available as stated in the Federal Register notice.

Today's meeting is being held in person and over Microsoft Teams for ACRS staff and members, NRC staff, and the licensee attendees. There is also a telephone bridge line and an MS Teams link allowing participation of the public.

When addressing the Subcommittee, the participants should first identify themselves and then speak with sufficient clarity and volume so that they may be readily heard.

When not speaking, we request that participants mute your computer microphone or phone by pressing star six. Again, please, those here in the room, please mute your laptop.

We will now proceed with the meeting, and I'd like to start by calling on Mike Wentzel, the Branch Chief from NRR.

Mike, good afternoon. Go ahead.

MR. WENTZEL: Good afternoon, Dr. Kirchner, and thank you for the opportunity to be here today.

My name is Mike Wentzel, and I am Chief of Advanced Reactor Licensing Branch Number 2 in the Division of Advanced Reactors and Non-Power Production and Utilization Facilities, also referred to as DANU. And, as you know, we're in the Office of Nuclear Reactor Regulations.

So I'd like to talk today a little bit about the staff's focus on preapplication activities. In accordance with the advanced reactor policy statement, the NRC encourages early interaction with advanced reactor developers and prospective applicants.

While preapplication interactions are not unique to advanced reactors, the NRC recognizes that such interactions may be particularly beneficial for advanced reactor developers, because they allow the early identification of resolution of technical and policy issues that could affect licensing.

In the staff's draft White Paper entitled Preapplication Engagement to Optimize Advanced Reactor Application Reviews that was issued in 2021, the NRC staff proposed a set of preapplication activities that, if fully executed, will enable the staff to offer more predictable and potentially shorter schedules and other benefits during the review of a license application.

The White Paper states that if an advanced reactor applicant completes preapplication interactions on certain topics proposed by the staff that we would anticipate a review schedule that is tentatively six months shorter than the NRC's generic milestone schedules, depending on the complexity of the design and other issues associated with the work.

The staff can then compare the list of preapplication topics in the White Paper against those that are completed and anticipated submittals that -- from vendors to evaluate the effectiveness of our preapplication interactions.

Another thing that we're doing to ensure effective and efficient preapplication reviews is implementing a core team approach. We anticipate that the core team that is created for the preapplication phase will be the same that is assigned to future license applications.

In this approach, the overall responsibility for the staff review lies within our division referred to as DANU. The core team review includes a project manager and technical reviewers from DANU and subject matter experts in other divisions and offices for selected topics.

Technical reviewers from within DANU with significant advanced reactor technology expertise have responsibility for broader portions of the design, including many of the topics that are integral to the reactor design, such as thermal and structural analysis, fuel and core design, and accidents.

Some topics that are being reviewed outside the core team include instrumentation and controls, emergency planning, fissile security, and seismic methodology.

In the case of eVinci, the core team will work very closely with staff of -- from the Office of Nuclear Materials Safety and Safeguards due to the unique transportation and storage aspects of this particular design.

So, again, I'd just like to thank you for the opportunity to be here today, and we continue -- we will look forward to continued interactions with the ACRS as the review of the eVinci design progresses.

CHAIR KIRCHNER: Thank you, Mike. And now we'll turn to Westinghouse. I think Mike Shaqqo is going to make an introduction for the team. Thank you for being here, by the way, as well.

MR. SHAQQO: Yeah. Thank you for the opportunity to be here, and thank you for taking the time to listen to our team as we share with you our progress with eVinci.

Go to the next slide, Anthony.

So just jumping into it here, I guess to make sure our team will have the opportunity to share the progress we've made, I'll keep mine short.

Again, my name is Mike Shaqqo. I'm the Senior VP for Advanced Reactor Programs with Westinghouse. As you see here, Westinghouse has -- and you probably know -- Westinghouse has a very long history of developing and successfully licensing the reactor technologies.

We really appreciate the NRC's past effort with our AP1000 and the design certification that we received from the NRC to support deployment. This really has enabled us to deploy AP1000, certainly here in the U.S., but as well as internationally.

eVinci, as you see here on the list of our portfolio of reactors, is one of our -- is our smallest reactor technology that we are talking about today. This technology is -- as you'll hear from our team, we're very excited about it. The reason we're excited about it, certainly because of the innovative aspect of it, as well as the advancement the team has made in progressing this technology.

But just as important, as you will hear

from our team today, we are excited about this technology because of the broad range of applications that this technology will have. We heard many feedbacks from our customers, potential end users, on how this technology will actually help them achieve their net zero goals. So that really gets us excited and gets our engineers excited as we talk and advance this technology.

So, in addition to eVinci, as you see here, we have two other areas that we are focused on as well. Specifically, we are working on -- soon to deploy -- our Westinghouse SMR. It's a 300-megawatt electric unit, and it will be based mainly on the advancement and the lessons learned from our AP1000 technology and deployment.

In addition, with our innovation team, we have our Lead Fast Reactor, which is in our innovation R&D phase as it is our next generation and gen forward technology that our team is also working on.

So, with that said, the focus of this team here today is really solely on eVinci, and which is, as I mentioned, it's one of our key products that we are investing significantly in the development, and I believe -- maybe it's self-serving -- I do believe we have the smartest and the brightest people working on this technology.

So looking forward for this interaction, and looking forward to see where this will take us.

And thank you.

CHAIR KIRCHNER: Thank you.

MR. HALACKNA: All right. Thank you, Mike. So you can see on the screen the agenda we have for today.

Oh, yeah. Joe Halackna. I'm Deputy Director for Advanced Reactor Engineering at Westinghouse. I'll lead us through a number of the slides here, and then -- between myself and Anthony.

So you can see the agenda. We're going to walk through some of our technology, our design, how we got to this point, what's the market that we're targeting, why we created the product. And, as Mike just mentioned, you know, we had a set of products -- reactor products -- in our portfolio, and what sort of differentiates eVinci from those existing products that we have today.

All right. So, first and foremost, right, so why are we, you know, designing this -- you know, this technology for this market? And it is a very different market than we have from our past large centralized power facilities, like an AP1000, but we are seeing a lot of customers that are very interested in different market sizes.

So, again, in our case, we're designing towards a 5 megawatt electric plant to really provide a solution to some of the net zero carbon-free energy solutions that customers are seeking and providing energy security, energy resiliency, and really driving that new nuclear demand in the market today.

So you can see on the screen a number of our applications that we can deliver this technology to. We're focused, again, on a land-based terrestrial 5 megawatt electric plant that primarily will provide electricity but is also capable of providing thermal heat and thermal energy as well.

MEMBER BROWN: Can I ask a question?

MR. HALACKNA: Yes.

MEMBER BROWN: Why did you pick 5 megawatt electric?

MR. HALACKNA: So we'll get into that in a little bit, but there is --

MEMBER BROWN: If you were going to do it later, just wait.

MR. HALACKNA: -- but I think -- so, one, I think it's the market differentiates ourselves, but I think there is a number of constraints, for example, around being able to passively remove decay heat in terms of -- so there are some technical reasons in addition to the market that we're seeking to deploy to.

MEMBER BROWN: Thank you.

MEMBER PETTI: Question. How many units do you anticipate on the previous slide, the market? How big is the market? 50? 100? 300?

MR. HALACKNA: Good questions. I think -- Mike, do you want to answer the market question?

MR. SHAQQO: Sure. The great question is -- I would say we're really being guided by the recent INL study, Idaho National Lab study, that was done about a year and a half ago. And they are projecting this market to be in the thousands -- in the thousands of units of a 5 megawatt or equivalent type microreactors to support and to decarbonize the market sector that INL analyzed.

So that's really one of our key reference points, so it's really in thousandths.

MEMBER BROWN: Is that worldwide or just U.S.?

MR. SHAQQO: It's worldwide. It's globally.

MEMBER BROWN: Okay.

MR. SHAQQO: Right.

MR. HALACKNA: So, first, I'll start off with what's really driving the technology of eVinci. That's the heat pipe itself. So that's really the technology that makes this unique. For us, it's a game changer in terms of making the -- really, the reactor coolant system, a passive system that's not dependent on a force flow, single pressure boundary, reactor coolant.

So heat pipes are, again, a passive thermal transfer device, primarily functioning off of capillary flow, and the difference in pressure and temperatures in -- within the core to our primary heat exchanger. So that really is what separates that, and we have an array of heat pipes within the core, and that -- what that enables us to do is those operate in a sub-atmospheric pressure.

So that allows our core design also then to be operating at just over atmospheric pressure, which is a real game changer in terms of different failure modes and effects that we have to analyze, all the different design basis events and accidents that go into the safety case for this reactor.

So it does very much follow sort of the nuclear battery model. In essence, during normal operation, there are no moving parts in the core outside of the sodium within each heat pipe, and there is roughly around 800 heat pipes in total within this reactor.

So that's really what separates us. Again, it's the low pressure design where, again, as much as possible there is nothing moving within our core, and that really is what excites us about having a solid state reactor that, again, can operate upwards of eight years or more without refueling, and then, again, like a battery can be taken back to the factory, refueled and refurbished, and delivered again.

Go to the next slide.

All right. So just, really, where did this technology come from? First, going back even before what I have on the slide here, going back to the sixties, heat pipe technology was invented out of Los Alamos National Lab. Through the '80s, it was a big focus of the space reactors. So whether it's SNAP 10A, SP-100 programs.

From there, Los Alamos and NASA most famously worked on the Kilopower and the KRUSTY test, and that's really when we started to work with Los Alamos in a more commercializable sense on different opportunities there, through the Department of Energy in many cases, to further that technology and really take it to the commercial market from the focus that had been on space and defense applications.

So we've had several different awards through the Office of Nuclear Energy and ARPA-E that really led to us being able to progress the design and do a lot of the yearly technology development within this product, ultimately to show this is demonstrated as a technology that we can take to market and is the right technology readiness levels for us to pursue this product in the licensing that we are currently in the preapplication phase in.

So you can see some of our milestones there. We completed -- we have an eVinci laboratory and test facility just outside Pittsburgh, Pennsylvania. We built our first heat pipes in 2020 and have built dozens essentially every year since.

Sort of capstoning, we did an electrical demonstration early in 2021. So, basically, electrical silicon carbide heaters to simulate the fuel temperature. So that reached an operating temperature of 800 degrees Celsius, steady state operation. We're continuing to expand upon that facility today to do more transient and more thermal benchmarking of our codes and analyses. And, again, a lot of compatibility testing.

So I mentioned our work in fluidized sodium within each heat pipe. So a lot of sodium compatibility testing, material interactions, to demonstrate the safety and longevity of this design.

So, and again, we've had a very robust preapplication phase where we've submitted to date 24 technical White Papers as part of our preapplication on a host of topics.

And then, lastly there, most importantly, you know, we've built our prototypic heat pipe or what we're planning as our nuclear test reactor that would be demonstrated at Idaho National Lab that we're working as part of the NRIC organization on.

So you can see just on the bottom there a timeline as we've progressed, iterated on the early design phases, the different concepts, continued to mature the technology, the integration of these systems, ultimately to the design that we're at today, which is a transportable 5 megawatt electric reactor.

MEMBER BROWN: Another question?

MR. HALACKNA: Go for it.

MEMBER BROWN: You mentioned sodium. Obviously, it's solid. Do you transport it in the solid mode and then heat --

MR. HALACKNA: Yes.

MEMBER BROWN: -- and then you heat it up

MR. HALACKNA: Yep. Well --

MEMBER BROWN: -- the reactor or without the reactor?

MR. HALACKNA: So --

MEMBER BROWN: Do you have to have an independent system, is what I'm saying, to put yourselves in service initially?

MR. HALACKNA: Right. So right now we will start up without any external heaters.

MEMBER BROWN: If I say something that's proprietary, tell me to be quiet.

MR. HALACKNA: No worries.

MEMBER BROWN: I'm trying to avoid that after reading the paper.

MEMBER PETTI: I have a question. Why sodium? Why not another liquid metal? Is there unique about sodium that makes it better as a heat pipe than, say, potassium or NaK or --

MR. HALACKNA: Yeah. So it's really -- it goes to the power level that we're seeking to get at each heat pipe, which drives which operating temperature we're in, which drives back to really the liquid metal properties, right, between the viscosity of each heat pipe, the working fluid, the surface tension, so the different materials all drive to the performance factors.

So you can look at a number of different curves that analyze the sizing between your vapor and liquid regions and your operating temperatures and -- but also having all of those materials actually be compatible to work together.

So it's a combination of those things that we did robust sort of trade studies and parametric studies to really find what is the highest TRL of our materials, which ones interact with the rest of the fuel and the core structure all together.

But sodium has sort of the best high power properties. Once you go beyond that, you would go into, let's say, something like lithium, which then really requires a much higher temperature, which then takes you back to some of the other core materials that would be challenged.

There's a number of different options. We focused on sodium because it has a pretty robust, one, basis in terms (audio interference) designs.

CHAIR KIRCHNER: I think there's another reason, too, and that's your power conversion system, that you want a higher temperature and you would --

MR. HALACKNA: Absolutely. Yeah. So, and I'll touch on that in a slide or two. Yep.

All right. So what's our deployment vision? We envision two different, basically, modes of operation show on the screen here. One is your 5 megawatt electric output with some thermal heating as well, basically reusing that waste heat. It is open-air Brayton cycle power conversion.

And then the second one would be really we're seeing some other interests in really just thermal energy. There is a lot of industrial processes, district heating, and others that need a high temperature or a very large thermal energy that they can't get today in a carbon-free solution.

So there is an opportunity for our technology there to marry up against some of the existing technologies and processes that industry is using today for many of our products to deliver the thermal energy that they need to move themselves into, let's say, a carbon neutral or net zero state for their company or facility or organization.

So, again, it's 15 megawatts thermal, 5 megawatts electric. Again, we're focused on right sizing, you know, for us how many onsite personnel for operations and maintenance, given that we are very different from a large light water reactor technology.

And, really, for this design, it has been, how do we take very, you know, mature technology but integrate them into a combined system, such that we're actually meeting the customer expectations, meeting the costs that we need to to be competitive in this mater, but also deliver something that actually builds on the resiliency, the security, and the other attributes, the transportability that we're looking for for the features of this product.

So, and lastly there, the biggest one, again, is for us avoiding any onsite cooling waters or any other interaction, really minimizing the environmental impact, such that we can easily deploy and license these to a number of different sites.

MEMBER BROWN: So the sites probably won't have normal power grid availability, so -- based on looking at the report, it looked like you all were talking about a micro grid locally that you all would come along with this package. Is that -- is that correct or --

MR. HALACKNA: So I would say we envision a number of different options. I think there could be certainly normal grid-enabled sites where there is an existing grid or an existing micro grid. Some of the remote, let's say, mining or remote community applications, though, may be on a micro grid where there is hydro wind or solar as well. So we are designing basically a micro grid interface system to deal with any grid demand changes that will interface

MEMBER BROWN: So we're still -- you'll stick with the 5 megawatt electric --

MR. HALACKNA: Yes. Yep.

MEMBER BROWN: That's pretty small when you connect it to a large --

MR. HALACKNA: Yeah. So --

MEMBER BROWN: -- really heavy-duty utility grid.

MR. HALACKNA: Yes.

MEMBER BROWN: In terms of its, you know, paralleling capacity and everything else that you're so that's why I asked the question. So whether you were going to be independent or not, so it's a mixed bag in other words.

MR. HALACKNA: Yeah.

MEMBER BROWN: Okay. Thank you.

MEMBER MARCH-LEUBA: And on that, so I'm sure he has thought about this -- not every one, but you only usually have to run your I&C systems, the protection system and monitoring communications, all those.

Are you planning to bootstrap yourself or have a listen button in there, or what are you thinking about?

MR. HALACKNA: Yeah. So there certainly is energy storage onsite for the safety systems to deal with any number of design basis event conditions. So that -- we'll get to that in part of the later slide deck. We'll go through some of the I&C and electrical that support the design basis.

MEMBER MARCH-LEUBA: I'm willing to wait.

MR. HALACKNA: Okay.

MEMBER BROWN: So am I.

MR. HALACKNA: All right. So, again, just high-level overview of the design that we have, again, the focus here for us is it's a TRISO-fueled reactor with heat pipes to transfer heat from basically the core there in the center of the picture via heat pipes to a primary heat exchanger on the right side of the screen.

As I mentioned, that's an open-air Brayton cycle, so we have a sleeve basically over each heat pipe, which then is -- that air is then cooled and taken through the open-air Brayton cycle, which will be adjacent basically area to the reactor.

Again, graphite moderator core structure there. And just over one atmospheric pressure inside the core.

Go to the next slide.

All right. So our focus has been, again, simplicity, flexibility, transportability. We want to design this with as simple of an architecture as we can. One of the key initiatives for this design is to load the fuel before we transport this to site, such that we are transportable and we can deploy this to any number of locations.

So it will be transported, and then on the other side of the operation transported offsite for storage and decommissioning.

Again, with the number of markets that I showed on the first slide, there's a lot of non traditional utilities today, non-traditional applications, in which case we don't envision storing spent fuel on those locations, in which case we would take it back to a centralized storage facility, and later for potentially refueling and refurbishment, and then eventually for decommissioning.

And, again, with the open-air Brayton cycle, both really as our ultimate heat sink, it is really just the ambient air environment as well as our normal power conversion system working fluid. So in case of -- for us, we can flexibly deploy this to any number of sites, have a very generic operating model that can apply basically anywhere.

MEMBER HALNON: Well, I was going to say a couple of times I've seen the nuclear battery branding. Is that how you're going to brand this thing is a nuclear battery? Because it's not intuitive to the public to say it's a nuclear battery. I can just pop in the remote control and start working, so --

MR. HALACKNA: So I'd say we're still -- this is still an eVinci micro reactor. It is still a fission reactor in that sense, but that is the model that we are driving towards is where the operations really are and the system operates autonomously.

MEMBER HALNON: Okay.

MEMBER BROWN: Transportation. When you look at existing fuels, at least the ones I'm familiar with in the naval nuclear program, when you're transporting stuff that's wrapped up like this, you've got to meet a lot of rules like stay 300 feet off of a bridge on sharp, pointed rocks, or --

MR. HALACKNA: Yeah.

MEMBER BROWN: -- steel pillars. So you're anticipating having to meet those transportation goals --

MR. HALACKNA: Exactly. Yep.

MEMBER BROWN: -- as well.

MR. HALACKNA: So what you see on the screen here basically is a transportation cask that will be designed to all of those regulations.

MEMBER BROWN: Okay. Thank you.

MEMBER BALLINGER: So you're not going to take an exemption to Part 70?

MR. SCHOEDEL: So I'll weigh in. So this is Anthony Schoedel. I'm the manager of Advanced Reactors Licensing. So thanks, Mr. Chairman, and the Committee, for having us here today.

So as we've communicated through some of our White Papers, and focusing on the transportation topic specifically, we are going to conform and comply with Part 71 transportation requirements, and that includes the allowance for transportation PRA, right, where we would look at, say, things like the drop in the testing that you're talking about, really optimizing it for our design and making sure the transportation PRA is part of that strategy.

So it's -- that will look a little different, maybe from things that have historically been in the past, but the end game is conform with Part

71.

MEMBER BALLINGER: So you'll be the first to do that?

MR. SCHOEDEL: My understanding is that we are going to -- we are going to be exploring territory that is allowable but maybe not fully expressed in the past.

MEMBER REMPE: So I'm not sure how much of this can be said in the open session, and feel free -- and I even saw a later slide where I was going to bring it up, but I think I'll bring it up here.

I'm curious about the startup of not only the first one but the second one and the switch out, holding time, and how quickly you'll go -- because it seems like you want to do some checkouts, in fact, I think I saw that somewhere when you first bring it onsite. And then you've got to plug it into something and get the other one unplugged, and how quickly that happens, and then there has got to be a follow on.

And can you talk about your -- whatever you can say in the open session on that switch out and

MR. HALACKNA: Yeah. So --

MEMBER REMPE: -- time, et cetera.

MR. HALACKNA: Good question. So

certainly we will walk through this a little bit in more detail later on today. But the overall architecture and design for each site is that we would switchover in a matter of days as we take -- after that first eight years of full power operation, we will shut down the primary reactor.

We will have already brought in our second reactor into an adjacent structure, and basically reusing the same architecture for I&C, electrical, power conversion, and all the rest of the site facilities and infrastructure we will switch over.

So you can see an example on the screen here. There is basically two pipes between the power conversion system and the heat exchanger attached to the reactor. Right? So those two pipes we will basically valve out and switch over at reactor number 2, and basically same with the cabling.

So we can then, after reactor number 1 is shut down, it will basically go into decommissioning, and we will wait until it cools down from a radiological perspective before it's transported offsite.

MEMBER REMPE: Any time that you have to wait for the cooldown or you'd rather not say here?

MR. HALACKNA: So, yeah, we'll talk more in the closed session, but mostly to meet the applicable design limits for the shielding that is part of the transportation cask.

MEMBER MARCH-LEUBA: While we are talking about this, there are two things that drive you to the eight-year operating in my mind. One is, how much uranium you can load into it. Another one is, how long does your fuel last.

MR. HALACKNA: Mm-hmm.

MEMBER MARCH-LEUBA: Because I can conceive of making a reactor has less reactivity and more mass, allows six to 10 years. Taking this used reactor out of the facility and transporting it somewhere in the desert is going to be a significant fraction of your cost.

MR. HALACKNA: Yes. So transportation, the cask itself, obviously, it will be, let's say, one cask for -- that can transport a number of reactors. And, yes, so there are -- there are limits from the fuel perspective, also from the reactivity control systems between our control drums and shutdown rods for their ability to maintain sufficient shutdown margin as well.

MEMBER MARCH-LEUBA: And, again, feel free to go to the proprietary session, but do you have sufficient confidence in your fuel that it will last for eight years?

MR. HALACKNA: Yes.

MEMBER MARCH-LEUBA: Do we have sufficient data?

MR. HALACKNA: Yes. So we are leveraging, certainly, the topical reports on TRISO fuel, and that is one of the things that we will go into more detail in the closed session.

MEMBER MARCH-LEUBA: You don't have special flex shifts and inspection shifts as things burn? But we can talk more later.

MR. HALACKNA: Yes.

MEMBER MARCH-LEUBA: But the question is, do you have sufficient confidence that they will last. And if it doesn't last, do we have enough I&C monitoring to detect it?

MR. HALACKNA: Mm-hmm.

MEMBER MARCH-LEUBA: But keep that in mind and hopefully answer later.

MR. HALACKNA: No. Thank you for the comment.

All right. So I'll talk briefly on really our development timeline that we have, where we started the last -- really, 2021, 2022, focused on finishing the conceptual design. That has been important really to -- for us to be able to engage in a meaningful way with the NRC staff having a fixed design that allows us to do a lot more analysis and testing and provide that data into the technical White Papers that I mentioned earlier.

Again, our electrical demonstration unit, which we will talk about more in our closed session. And again, also, something we've been doing is meeting both in the preapplication phase with both the U.S. and Canadian regulators. So we'll talk about our nuclear test reactor. That's the NTR. We've started to really design that already, and that's a big focus for us in the year 2023.

A number of the things we've done in the past, too, is really integrated manufacturing demonstrations, so not just testing but also how do we scale up and validate the supply chain and the capabilities to meet our design parameters that we're putting in in terms of the materials, material properties, impurities, and just be able to meet the challenging configurations that we have with this reactor design.

Again, a lot of -- I mentioned before, a lot of separate effects tests in terms of materials, material interactions. We are operating a high temperature, so that does -- that drives a lot of the testing that we've been doing in addition to that material interaction.

And, again, as we look at '24, we have some criticality testing planned, as well as irradiation testing ongoing again in the future, and then we always continue to challenge ourselves in terms of that manufacturing, assembly, design for value, all those different attributes to make sure that we're achieving our market and product requirements.

And then, again --

MEMBER MARCH-LEUBA: Criticality testing is going to be prototypical or just collecting data to evaluate your method?

MR. HALACKNA: Sorry. Can you repeat --

MEMBER MARCH-LEUBA: Criticality testing, is it going to be a prototypical geometry or just going to collect data to evaluate your method?

MR. HALACKNA: So, do you want to take that?

MR. SCHOEDEL: Yeah. So I think you'll see when we get into the closed portion of the discussion we're going to have a lot of discussion around testing, overall test program, including criticality testing.

Ultimately, the testing that we're doing, whether you call it single effects or integral-type tests, are all going to end up supporting in some fashion, you know, V&V of our analysis code suite and ultimately support our licensing case.

Yeah. This is Anthony Schoedel with Westinghouse licensing.

MR. HALACKNA: All right. Joe Halackna, Westinghouse. So just on the bottom of the slide there you can see our licensing timelines as well, so we're currently in the -- again, the preapplication, prelicensing phase. We'll get into some of our future submittals that we're planning there in the topicals in later slides.

And, again, from there we'll plan to eventually, in 2024, submit our design license application and move through in the '25 to '27 timeline our design certification.

In parallel, we have initiated various discussions. We'll talk about vendor design review with the Canadian Nuclear Safety Commission as well as some joint reviews between the NRC and the CNSC as well.

Go to the next slide.

I mentioned the test reactor. It is a 3 megawatt thermal reactor, so that's one-fifth power scale. In our design, we refer to it as a unit cell. We also think of it as a fuel assembly.

Basically, it's the same design in that terms, but a lot less fuel assemblies or unit cells are in the designs with much lower power, not -- shorter axial length for the core, so enough of the design that we can validate our key attributes and our key performance and safety of the plant, but it's not a full-scale reactor.

But we're targeting this to achieve a lot of the integrated safety analysis that we really need for the plant, and really use that as part of our design certification process to close out any of the testing that we need from our PIRTs and our other safety analysis needs.

MEMBER REMPE: So it looks like you're putting this in the EBR-I -- or, excuse me, II containment, right? That looks like an Idaho picture. It doesn't require any interactions with the NRC, but I would hope that they are cognizant and this activity is well coordinated, so you can address things that would come up in the future. Could you talk about that interaction a bit?

MR. SCHOEDEL: Mm-hmm. So this is Anthony Schoedel, Westinghouse licensing. So spot on, yes.

So this is being -- it's intended to go into EBR-II dome at INL with DOE authorization as part of that process.

As part of the DOE authorization process and the development of those application documents, we're engaging with DOE and INL team and NRIC team to make sure that there is, you know, access, availability for both U.S. NRC and CNSC in Canada to be apprised of what's going on with that test facility and making sure also through our integrated test plan that we're capturing through preapplication engagements, you know, that this test amongst the suite of the rest of our tests are going to accomplish the full gamut of what's needed for licensing for eVinci micro reactor in both countries.

So, yes, the allowance is there and that coordination has been going on.

MEMBER REMPE: Thank you.

MEMBER PETTI: Just a question, smaller one. Will you have the capability to measure the radioactive contents of the gas, the air?

MR. HALACKNA: So this is Joe Halackna. So we'll -- I think we'll get into --

MEMBER PETTI: The helium that's in the

MR. HALACKNA: Within the core or within the --

MEMBER PETTI: The core.

MR. HALACKNA: -- EBR-II dome?

MEMBER PETTI: No. Within the core.

MR. HALACKNA: Okay.

MEMBER PETTI: The helium. I'm just talking about the fuel, okay? HEI program, the EPRI topical, fuel never went beyond two years of radiation. You know, eight years is a long time. you're running it at a derated power relative to that.

You know, my personal opinion is that it's probably going to survive. The problem is, there's no data behind that. That's just sort of an educated guess. And there's enough bad data historically that could scare people who don't, you know, appreciate the full landscape of TRISO fuel. And so one way to do that is if you monitor the content of the helium, if you feel particles, you'll know. You'll see increases in noble gases.

And it's not a difficult thing, but it's just something that if you have it, it provides some assurance.

MR. HALACKNA: Yeah. So I think we understand the comment in particular, and I think in a closed session we'll have some slides that address that question. Yeah.

MR. SCHOEDEL: This is Anthony Schoedel with Westinghouse licensing. So this slide -- Joe has done a good job at explaining, you know, what are some of the different aspects of eVinci micro reactor and maybe what's new and novel about it. This slide is a great representation of maybe the full picture or, you know, beginning to end on what is -- what's new with eVinci, particularly around how it's deployed, right, and how is it brought to market and operating, right?

So you kind of work these in order, you know, left to right, one through eight. But starting with item 1 there, that's the test reactor that we were just discussing, really. So what we're trying to show here on this slide is you pick up with what we would consider our pinnacle or the final integrated nuclear test for eVinci micro reactor that supports the design certification. Right?

So when we say, in step 2, eVinci licensing approval, what we're really talking about there is, you know, we have submitted a design certification application under Part 52, and we're going to close out any analysis, testing, and V&V ultimately to complete that application and get certification.

That transitions, then, into the dotted line or the dotted box area where we really focus on, how is eVinci manufactured and delivered and brought into -- brought into fruition, right?

So Joe has talked about, you know, this is going to be assembled, manufactured, fueled, and then transported to the operating site. So you see that in items 3, 4. Primarily, you can transport this via rail, barge, or truck.

It will operate, then, for a period of, you know, the design lifetime. We'll say eight years of effective full power lifetime, with remote monitoring capability. I would like to differentiate that that's remote monitoring and not remote operation or control, right? So it's remote monitoring capability.

And then, finally, on the back end is, you know, we -- we're not going to deal with onsite handling of spent fuel. We're not going to do onsite refueling as part of this vision and the strategy. It's going to be taken away in the transportation canister that Joe talked on earlier. That canister would be designed for the limiting case, being the spent case after operation, and then it's taken back to an interim storage facility where it would -- it would reside until deep geologic disposal is available.

So that's soup to nuts how eVinci is tested, made, and delivered. So any questions on this before the next slide?

MEMBER HALNON: Yeah. You mentioned and emphasized remote monitoring, remote operation. Joe, you mentioned autonomous operation. I assume that in closed session we're going to get -- talk about the difference between those two and the nuclear battery versus the nuclear reactor.

MR. HALACKNA: Yeah. And those are two separate systems in that sense, too.

MEMBER HALNON: Yeah. So let's not -- I want to make sure we understand the role of the operator on this thing.

MEMBER PETTI: So just a question on the defueling. If you -- how long is the coil again, axially?

MR. HALACKNA: Approximately 10 feet.

MEMBER PETTI: The defueling machine is not something to overlook. Okay? You know, the one that we use in Fort St. Vrain is long gone. That was on top vertical. Horizontal defueling is going to be a challenge.

MR. HALACKNA: So Joe Halackna, Westinghouse. I'll just say that is one of the things we have already been working on is cooling associated with all of this deployment model. We have several demonstrations underway to demonstrate that exact process.

MR. SCHOEDEL: Thanks. Anthony Schoedel with Westinghouse. So we've talked a number of times here in the discussion about the preapplication engagement. So a lot of thanks to Mr. Wentzel and NRR, NMSS, over the past year plus. We're supporting a volume of White Papers that -- in the Westinghouse design and engineering and licensing team have put together referencing the White Paper that Mr. Wentzel talked about at his opening remarks, and the value of preapplication engagement really as we go through design development, and in the early stages of licensing this new -- this new micro reactor technology.

So you see here, you know, that we listed the 24 that have been submitted between 2021 and 2022. Those are available, you know, for NRC staff and through ADAMS. We've had a number of dialogues with them on, you know, I'll call it like post-submittal discussions where we've solicited, you know, observations and feedback, making sure we clearly understand, you know, where we need to, you know, continue to progress in some of -- some of the more challenging issues on the eVinci deployment.

And that's being taken back and funneled into our design organization and making sure that the feedback and the observations are being captured and informing the design development to set up a smooth and streamlined license application process, like Mr. Wentzel indicated, from the staff's White Paper.

You can see there is more coming in 2023, and these White Papers then are a stepping stone to more formal submittals, topical reports, coming in 2023 and beyond, and then setting up the design cert application, like Joe said, end of '24, early 2025.

So we'll have some more discussion specifically around topical reports and some of the other licensing strategy in the closed session of the discussion, but I just wanted to highlight the good engagements and the robustness of the preapplication from this Westinghouse team to date.

MEMBER MARCH-LEUBA: I wanted to make a comment, not a question, about -- I like that number 30, cybersecurity, that you are thinking about it before you start, because if you follow the news, I mean, if -- what I get in -- you had to scale to this because you didn't know enough. You're talking about more monitoring, autonomous operation. Cybersecurity is number one.

MEMBER HALNON: So, you guys, this is great. You've got a lot of good information there. If we wanted to look at those, would they reflect a revision to the NRC comments you have had during your interaction, or is that going to be reflected in the topical reports down the road?

MR. SCHOEDEL: Yes. So Anthony Schoedel, Westinghouse licensing. So these are the submittals themselves. They will not reflect any revision from NRC comments and feedback. The reflection of that is going to go directly into either the follow-on topical reports themselves or directly into the license applications.

MEMBER HALNON: Okay. So if we wanted to get like the picture of number 15, EPZ Sizing Methodology -- no specific reason why I chose that -- but is there a record of the NRC comments back and forth between you all? Is it, you know --

MR. SCHOEDEL: Yes. Great question. Anthony Schoedel, Westinghouse licensing. So that -- there is a record. Westinghouse has a preapplication docket with NRC, and that's available on NRC's website.

And every paper that Westinghouse has submitted and the NRC written feedback provided back to Westinghouse is available with an added succession number.

Largely, the contents are proprietary, so the links will take you to, you know, those statements. But they are available on ADAMS.

MEMBER HALNON: All right. So if we have a specific issue with one of them, we can certainly run that around pretty easily. All right. Thank you.

MR. SHAQQO: Greg, we have them all uploaded on SharePoint.

MEMBER HALNON: All the record is? Both the White Paper and the NRC comments?

MR. SHAQQO: Yes.

MEMBER HALNON: Okay. Good.

MR. SHAQQO: Thanks to Donna.

MEMBER HALNON: Thank you.

MEMBER BROWN: Can you go back to your slide 11?

MR. SCHOEDEL: Yes.

MEMBER BROWN: Next previous one, the one on NTR. Yeah. The one before that, excuse me. Yeah.

Looking at that last block it says design fully received, regulatory licensing approval. Is that for installing in some remote mining location or is that the NTR design? I mean, that's '27, so that's three and a half years from now, or four years.

MR. SCHOEDEL: Yeah. So Anthony Schoedel, Westinghouse licensing. That's primarily referring to the design certification application.

MEMBER BROWN: So installing -- it's commercial unit delivery and operation --

MR. SCHOEDEL: Right. That's --

MEMBER BROWN: It would be pretty helpful if I had my mic on. I apologize for that.

MR. SCHOEDEL: So that would be covered by the plusses you indicated, but the initial -- the initial approval here would be the design cert application. So it sets up the rest of the dotted line deployment model licensing activities.

MEMBER BROWN: So that's done in '27 or so.

MR. SCHOEDEL: Right. The vision is starting to submit the design cert application in the end of '24, early '25 timeframe, like we've discussed. And then there is a -- you know, a multi-year review period there consistent with what Mr. Wentzel said in his remarks, and that all builds off of the White Paper engagement, the topical reports that we're going to talk to in the closed session, too, a bit, and you're taking the feedback, you're making sure that the license application builds off of this engagement.

MEMBER BROWN: Okay. Thank you. Just trying to connect the dots between the words and the box. That's all.

MEMBER MARCH-LEUBA: Yeah. But doing some advertising here. As opposed to light water -- larger light water reactors, you would expect construction of one such facility to be in months, not weeks, timeframe, right?

MR. SCHOEDEL: Correct.

MEMBER BALLINGER: I tried to go through all of these documents, and there are so many of them I'm sure I missed some. Probably missed a lot. But if you ship one of these things up to Timmons, who owns the license, the customer or you?

MR. SCHOEDEL: Anthony Schoedel with Westinghouse licensing. So I think that's something that we will be giving some more detail when we get into the closed session. But there is going to be handshakes and license transfers as part of the deployment model.

MR. HALACKNA: Yeah. So Joe Halackna, Westinghouse. So, again, to really deliver this technology right, you need partners. We couldn't do this simply by ourselves, whether it's the NTR delivering out at Idaho National Lab.

We do have some early adopters that we're working with, including Penn State and Saskatchewan Research Council, design partners, highly leveraged, again, our partner, Brayton Energy, in terms of delivering this power conversion system, which is, obviously, different than a lot of the light water reactor technologies on secondary side there.

And, again, all of the national labs that have contributed to a number of the different materials, heat pipes, fuel, all of the different things that would have made up this micro reactor, and, again, a lot of the material that development for our high temperature regime that we're operating in.

So you can see a number of our partners on the screen there that we've been very successful in working with in order to deliver this very important technology and product.

MEMBER BALLINGER: Have you actually visited Brayton Energy?

MR. HALACKNA: Yes.

MEMBER BALLINGER: Okay.

MR. HALACKNA: Yes. Sorry?

MEMBER BALLINGER: The seafood is nice.

MR. HALACKNA: All right. Yeah. So I think we just want to close out with saying, again, thank you. This is -- for the opportunity today to present the work we've been doing in the preapplication phase with the NRC.

We've had -- it has been a great opportunity to collaborate and work with them at this phase of where we are, and we look forward to, again, progressing this design, and ultimately working through the licensing process.

Anthony, any --

MR. SCHOEDEL: No. Just, again, thank you to Mr. Chairman, to the ACRS Committee here for taking the time today, and thank you to NRC for the dialogue.

CHAIR KIRCHNER: Okay. Well, thank you, Joseph and Anthony. And thanks for your comments.

Members, further questions for this session?

To our members out there, Vesna and Vicki, and our consultants?

MEMBER DIMITRIJEVIC: Hi. Yes, Walt. This is Vesna. In this -- the White Paper schedule that is -- the four or five of them coming in March, I just want to check with Chris, will they be made available for us immediately when they receive them in March?

MR. BROWN: I'm going to ask Donna to comment on that. Donna Williams.

MS. WILLIAMS: Yes. We can certainly share the incoming White Papers and then our feedback once it's issued.

MEMBER DIMITRIJEVIC: All right. Thank you.

So just what are coming on the PRA, you know, programs and schedules, so I'm looking forward to see that.

CHAIR KIRCHNER: Thank you, Vesna.

Others?

If we have no further comments, then we need to turn to the public. And at this time, if there are any members on the line or in the room here who wish to make a comment, please identify yourself, and affiliation if appropriate, and please make your comment.

Using a long pause of 15 seconds, but I'm not hearing anyone out there wishing to make a comment.

Okay. With that, we will close this open session and return on a closed Teams link. We will take time for Chris, our Designated Federal Official, and NRC staff -- I think Donna Crawford -- to help with

Westinghouse's assistance -- I think that's you, Anthony -- to check who is on the closed session.

So we will -- to allow time to do that, I think we should take a 15-minute break, and we will return at --

MEMBER BROWN: 2:10.

CHAIR KIRCHNER: No, that's not enough.

MEMBER BROWN: 3:10.

CHAIR KIRCHNER: No. Let us return at 2:20 Eastern Time.

Thank you for all that help. We will reconvene at 2:20. Thank you.

(Whereupon, the above-entitled matter went off the record at 1:55 p.m.)

WAAP-12580, Revision 0
"eVinci Microreactor Overview – Non-Proprietary Open Presentation"
(Non-Proprietary)

Westinghouse Electric Company
1000 Westinghouse Drive
Cranberry Township, PA 16066

eVinci™ Microreactor

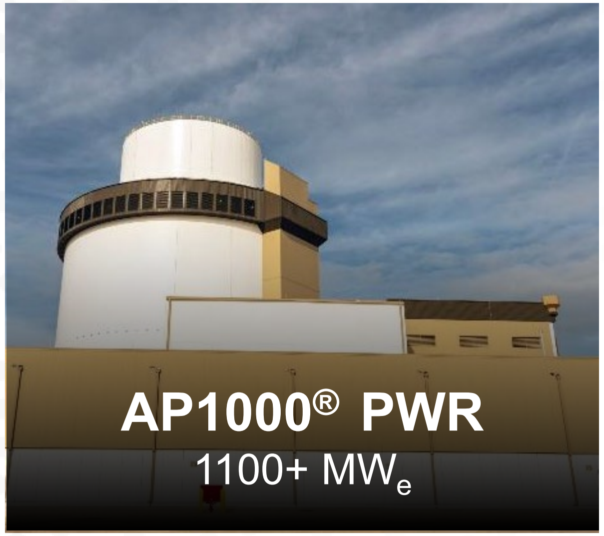
The eVinci microreactor is a next-generation energy source for delivering clean & reliable energy for the 21st century

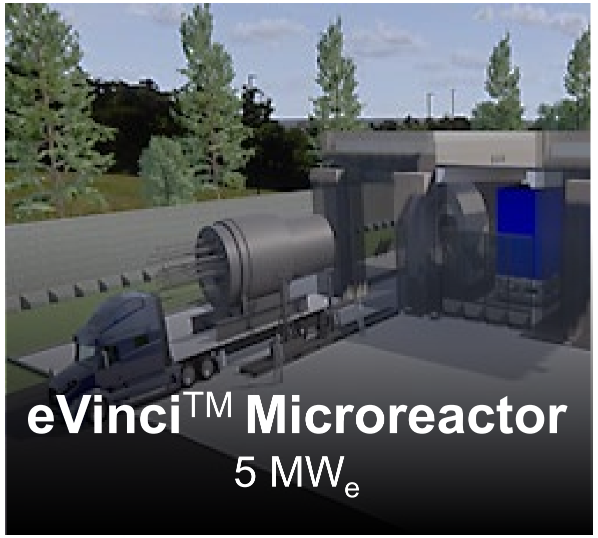
Design & Development Program

Joseph Halackna, Deputy Director
Alex Harkness, Chief Engineer
Anthony Schoedel, Advanced Reactor Licensing Manager

Shaping Today’s and Tomorrow’s Energy

A Portfolio of Innovative Solutions





Our reactors can also deliver these beyond-electricity benefits:

Long-Duration Energy Storage

Hydrogen Generation and Process Heat

Radioisotope Production

Fuel Cycle Closure

Complementary Clean Energy Products to Serve the Needs of Diverse Global Customers

Agenda
February 28, 2023

- New Nuclear Market & Applications
- Heat Pipes & eVinci Microreactor
- Development History
- Deployment Vision
- Design Attributes
- Transportable Nuclear Battery
- Technology Timeline
- Nuclear Test Reactor for eVinci Microreactor
- Deployment Model with Current Regulations
- Current Status on Pre-licensing with US NRC

Simplicity is the ultimate sophistication.

– Leonardo da Vinci

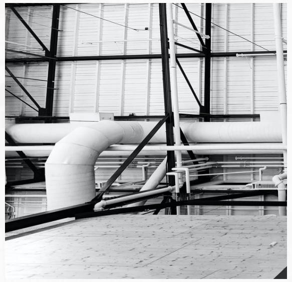
Westinghouse

The Market and Applications for New Nuclear

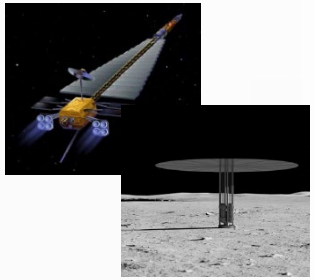
Clean, Carbon-Free Energy Solutions and Energy Security are Driving New Nuclear Demand

Remote Mining Operations

Industrial Process Heat



District Heating



Space

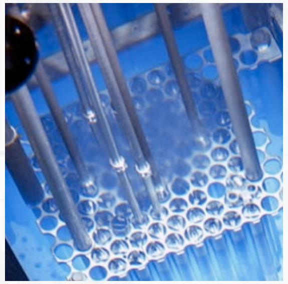
Remote Communities

Hydrogen Generation

Maritime

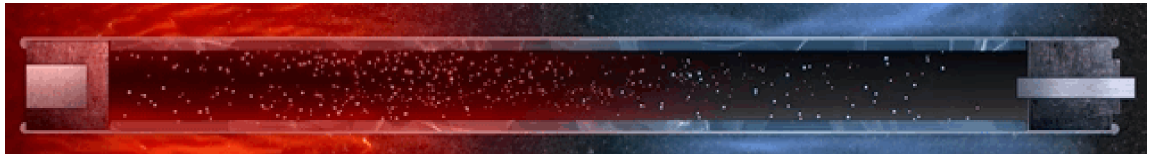
Critical Infrastructure Installations

Disaster Relief



Research Reactors

Westinghouse



Heat Pipes:
An Innovative, Elegant Game Changer

Heat pipe technology shouldn't be new to you. Chances are you've carried "heat pipes" around with you for years as heat-spread devices in your mobile phone or other electronics.

Heat pipe technology has been applied for the past 50 to 60 years with millions of operating hours in industries that need passive and simple designs. Westinghouse engineers have taken that concept and applied it to nuclear energy.

What does that mean?

Heat pipes enable high-temperature, passive-heat transfer, eliminating the complexity of a forced-flow reactor coolant system, so no pumps or valves needed. Operated by capillary forces, heat pipes eliminate the need for high-pressure operation.

Few moving parts and low pressures make heat pipe systems highly reliable while requiring very little maintenance.

In the end, **that's the game-changer**.

eVinci Microreactor:
The Real Nuclear Battery

Batteries — as we all know them — are pretty simple devices, requiring no moving parts to discharge their energy, powering a multitude of everyday devices for various lengths of time.

What if we applied that concept to nuclear energy?

That's what Westinghouse has achieved with the eVinci microreactor: a nuclear battery.

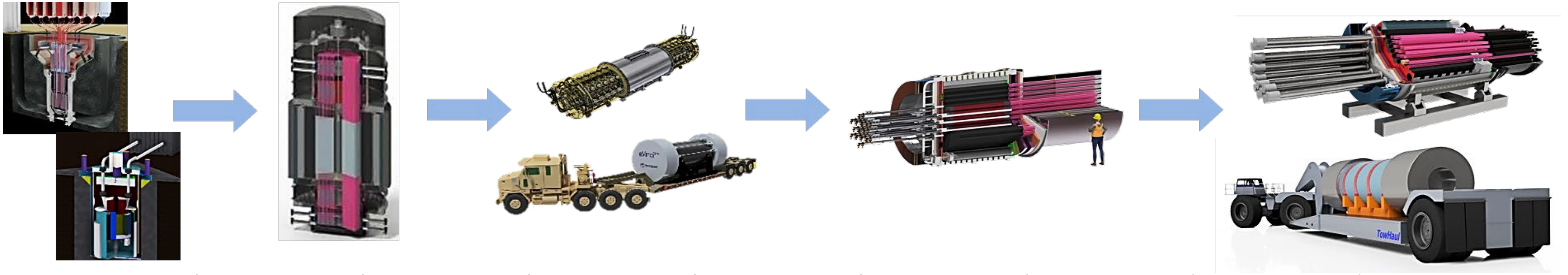
Like a battery, the eVinci microreactor has a simple design with no moving parts or pumps for coolant. Like a battery, the eVinci microreactor can supply its power 24/7/365. But unlike most batteries we know, the eVinci microreactor can do this without recharging (refueling) for eight years or more.

The game has changed.

eVinci Microreactor – Developed from Decades of Research

Background & development to date

- **1980s** to **2000 –** heat pipe reactors developed for space due to simplicity, small size & passive cooling
- **2000** to **2015** – national laboratory led materials and reactor design development research
- **2015** – Westinghouse began development of heat pipe & microreactor concepts
- **2018** – DOE/NASA demonstration of 5kW heat pipe reactor (KRUSTY) & technology commercialization fund initiated between Westinghouse & LANL
- **2020** – completed construction of eVinci test facility & manufactured first sodium heat pipe
- **2021** – electrical demonstration of heat pipe core assembly at operating temperature
- **2022** – material compatibility testing & conceptual design completed; technical white papers & first topical reports delivered to US NRC; produced first heat pipe for design of Nuclear Test Reactor (NTR)



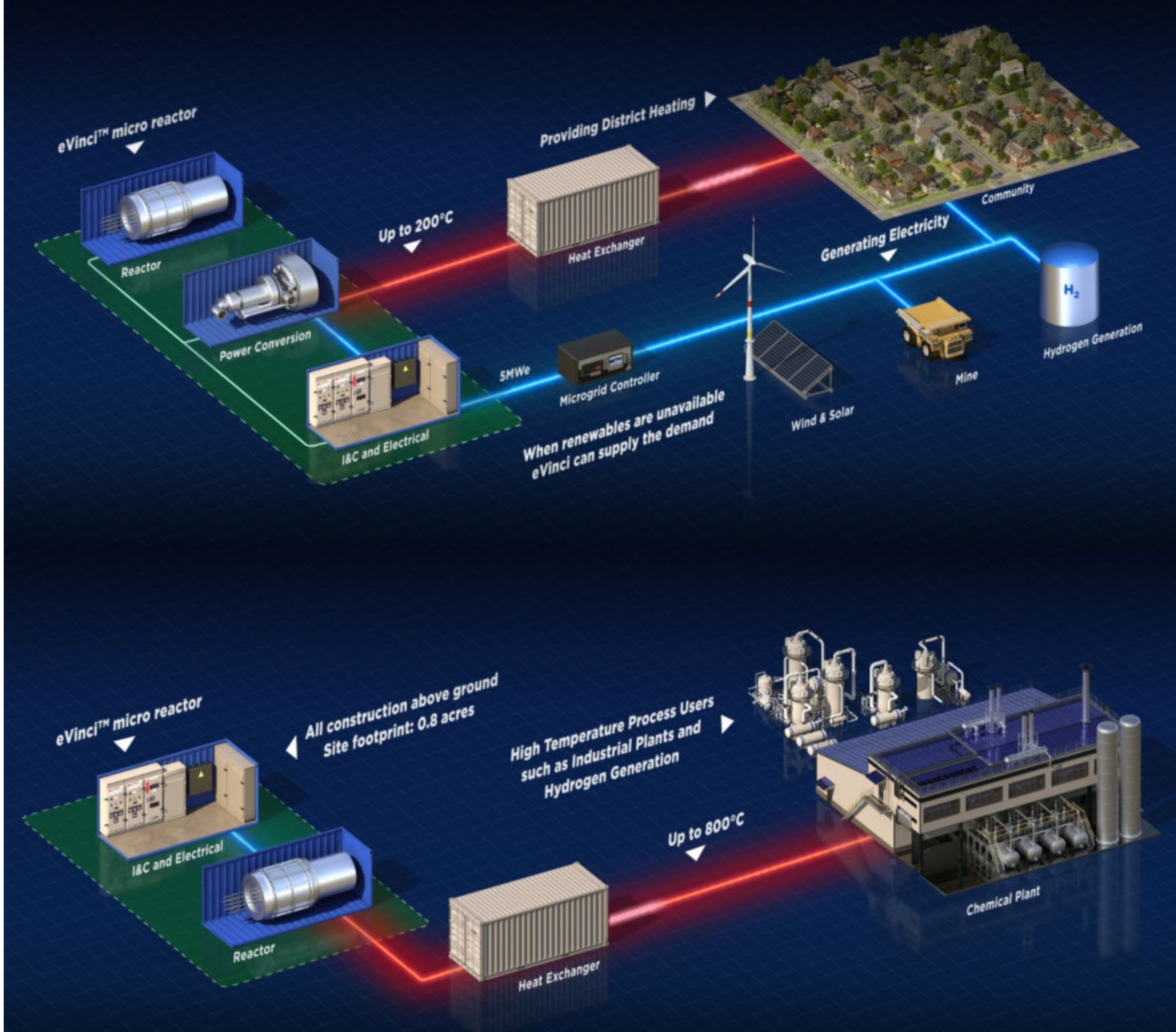
2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023

Westinghouse

Deployment Vision

Nuclear battery designed for safe and reliable electricity and heat

- 15 MWt reactor with 8+ year refuel cycle
- Effective cogeneration nuclear battery
- Transportable for ease of installation & elimination of spent fuel storage on site
- Cost-competitive plant lifecycle
- Minimal onsite personnel for O&M
- Mature technology, manufacturing, and regulatory readiness
- High speed load following capability
- Versatile and flexible open-air Brayton power conversion
- No onsite cooling water required



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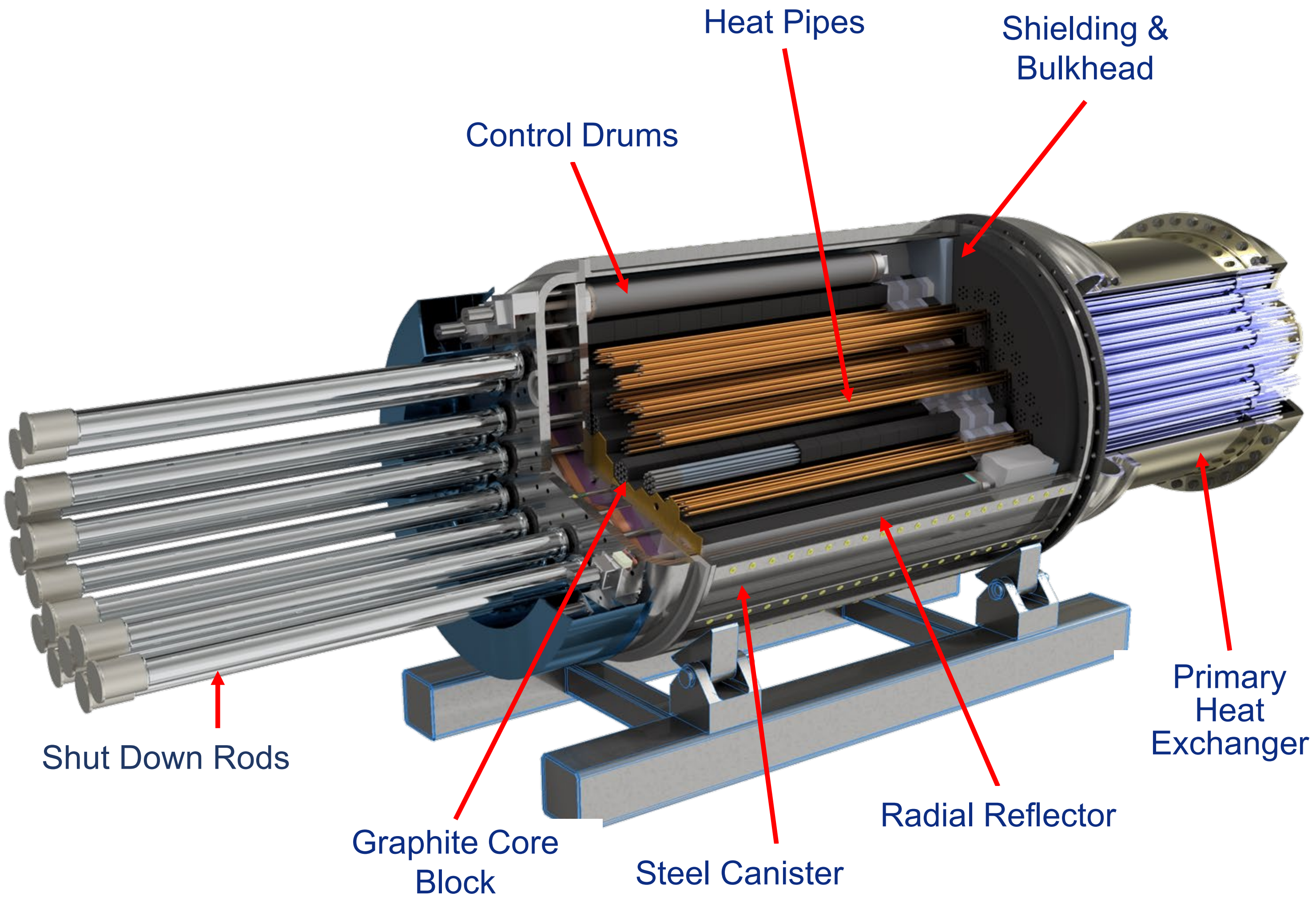
The eVinci Microreactor

Safety through passive heat pipe technology, enabling a very low-pressure reactor

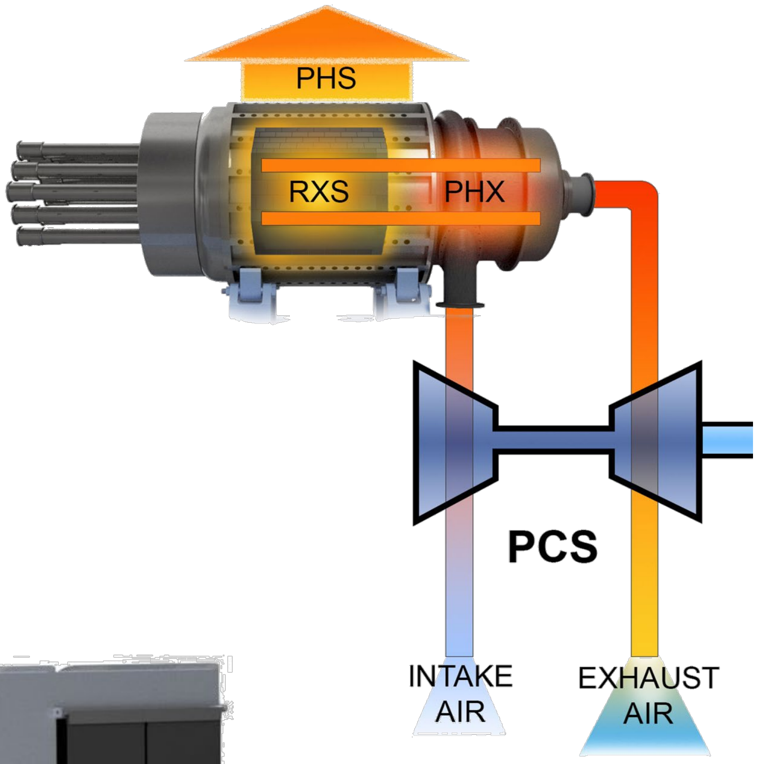
Parameter	eVinci
Power	15 MWt
Fuel Cycle	8 years
Fuel (Enrichment)	TRISO (19.75%)
Coolant	Heat Pipes
Reactor Pressure	~1 atm
Moderator	Graphite
Power Conversion	Open-Air Brayton
Efficiency	34%
Decay Heat Removal	Radial Conduction

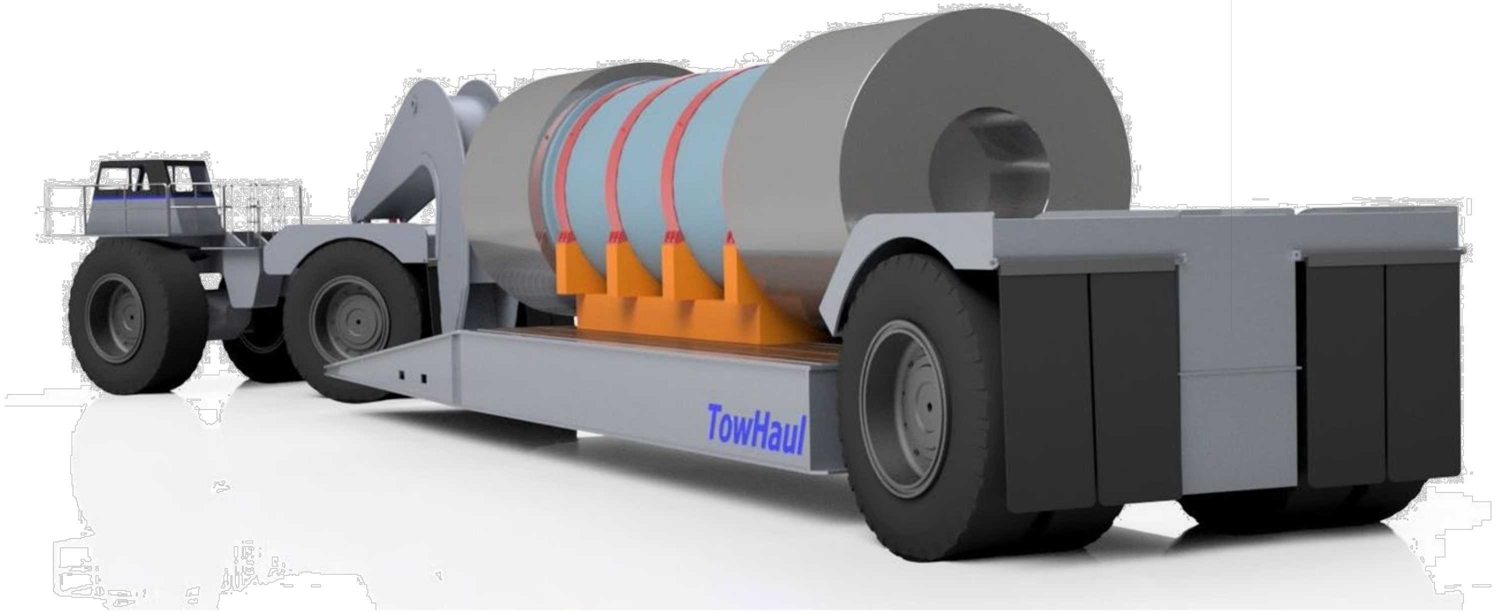


Designed for Simplicity, Flexibility & Transportability

The eVinci microreactor is a transportable nuclear battery with a simple design architecture enabled by passive, low pressure heat pipes

- Fuel load before transport
- Transported off-site for storage & decommissioning
- Flexibly deployed



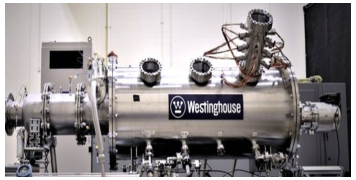


eVinci Microreactor – Technology Development & Timeline

Leading the way in advanced reactor development and commercialization

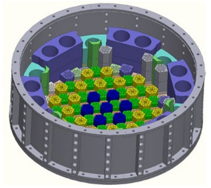
Technology Development and Manufacturing

2021-2022



- Conceptual design complete
- Electrical demonstration unit operational
- Initiated licensing engagement with US and Canadian regulators

2023

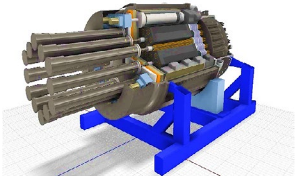


- NTR design for procurement
- Integrated manufacturing demonstrations and prototyping
- Separate effect and component testing

2024

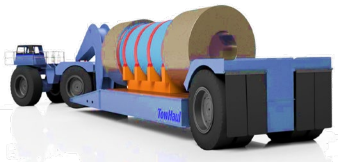
- NTR component fabrication
- Criticality, transient and irradiation testing
- Design for value, manufacturing & assembly

2025-2026



- NTR assembly and operation
- Analysis code validation
- Initiate eVinci Unit 1 manufacturing
- 5 MWe non-nuclear power conversion test

2027+



- Design complete
- Receive regulatory licensing approvals
- Commercial unit delivery and operation

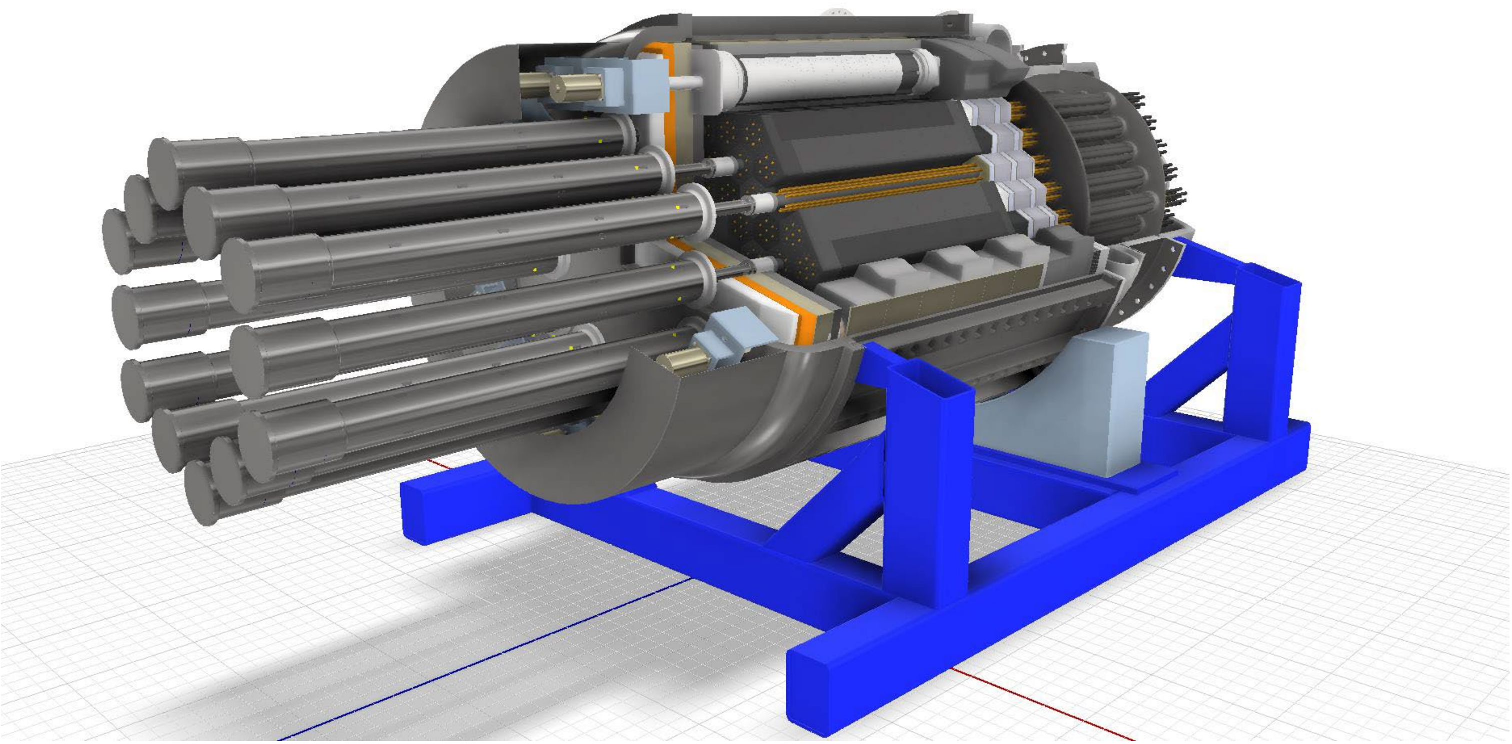
Licensing

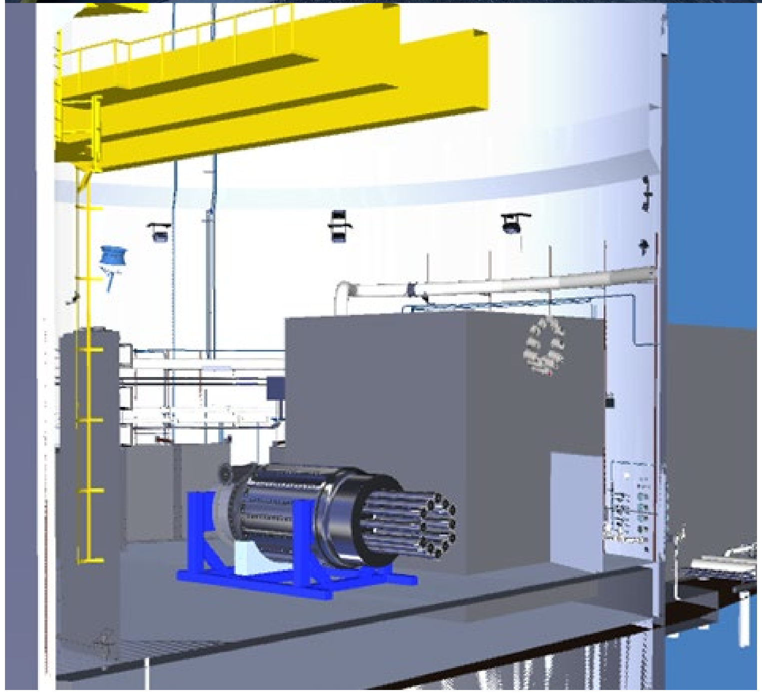
- **US NRC pre-licensing engagement** *(Technical papers & Topical report submittals)*
- **Prepare & submit design license to NRC**
- **NRC review & approve design certification**
- **Canadian Nuclear Safety Commission (CNSC) vendor design review**
- **Other countries' licensing activities**

Westinghouse

Nuclear Test Reactor for the eVinci Microreactor

- 3 MWt Reactor System
- Reactor system, reactivity control systems, heat exchanger, and targeted I&C



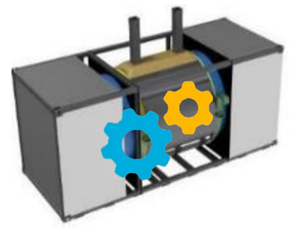


A New Deployment Model Within Current Regulations

1

Test reactor for safety feature performance demonstration

Test reactor – testing, data collection and analysis



2

eVinci licensing approval

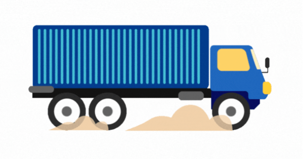
eVinci Microreactor Deployment

3

Assemble in factory

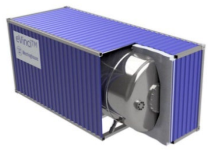
4

Transport to site

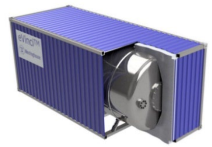


5

Install and operate at site



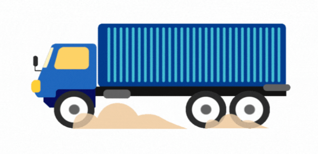
Primary reactor



Replacement reactor

6

Transport away from site



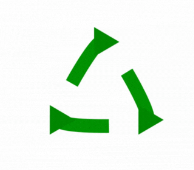
Depleted reactor

Remote monitoring station

Limited site staff with remote monitoring

7

Refuel/refurbish



or decommission

8

Fuel storage facility

Licensing Progress with US NRC

Current Status: https://www.nrc.gov/reactors/new-reactors/advanced/licensing-activities/pre-application-activities/evinci.html

#	Topic	Submittal Wave	#	Topic	Submittal Wave	#	Topic	Submittal Wave
1	Facility Level Design Description	Submitted - 1	13	Advanced Logic System®(ALS) v2	Submitted - 3	25	Inservice Inspection Program/Inservice Testing Program	5 (March 23)
2	Principal Design Criteria	Submitted - 1	14	Component Qualification	Submitted- 3	26	Post-Accident Monitoring System	5 (March 23)
3	Safety and Accident Analysis Methodologies	Submitted - 1	15	EPZ Sizing Methodology	Submitted - 3	27	Equipment Qualification	5 (March 23)
4	LMP Implementation	Submitted - 1	16	Physical Security	Submitted - 3	28	PRA Program Strategy	5 (March 23)
5	Regulatory Analysis	Submitted - 2	17	Heat Pipe Design, Qualification, and Testing	Submitted - 3	29	Fire Protection	5 (March 23)
6	Deployment Model	Submitted - 2	18	Nuclear Design	Submitted - 3	30	Cyber Security	5 (March 23)
7	Safeguards Information Plan	Submitted - 2	19	U.S Transportation Strategy	Submitted - 3	31	Radiation Protection and Contamination Methodology	6 (Q2 23)
8	Test and Analysis Process	Submitted - 2	20	Phenomena Identification and Ranking Table (PIRT)	Submitted - 4			
9	Functional Containment and Mechanistic Source Term	Submitted - 2	21	Integral Effects and Transient Testing	Submitted - 4			
10	Composite Material Qualification and Testing	Submitted - 2	22	Refueling and Decommissioning	Submitted - 4			
11	Fuel Qualification and Testing	Submitted - 3	23	Seismic Methodology	Submitted - 4			
12	Code Qualification	Submitted - 3	24	Operations and Remote Monitoring	Submitted - 4			

Partnerships and Customers

Early Adopters

- Penn State University - developing research reactor project
- Saskatchewan Research Council - developing commercial reactor project

Key Design and Development Partnerships

- Brayton Energy – Power conversion system design
- Aerojet Rocketdyne – Fission Surface Power
- LANL, INL PNNL and ORNL
- Penn State University – R&D support
- MIT – Material irradiation testing

Thank You!

www.westinghousenuclear.com

See our Navigator for more information on the eVinci microreactor and all Westinghouse technology

https://navigator-voyantstudios.com/

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

NRC Staff Pre-application Interactions on the eVinci Advanced Reactor

Presentation to the Advisory Committee on Reactor Safeguards

eVinci Subcommittee

February 28, 2023

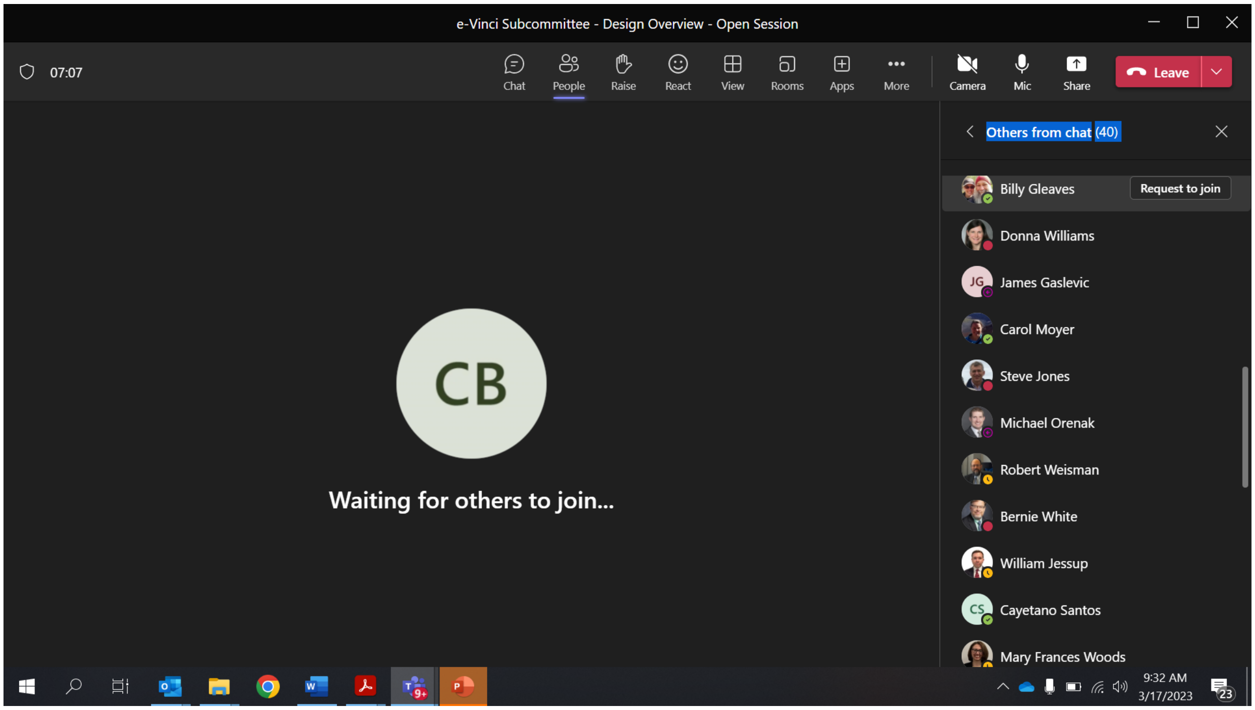
Donna Williams, Senior Project Manager

Advanced Reactor Licensing Branch 1

Office of Nuclear Reactor Regulation, US NRC

Background on Pre-application Interactions

- NRC draft white paper “Pre-application engagement to Optimize Advanced Reactor Application Reviews” ML21145A106
  - NRC staff proposed a set of pre-application activities that, if fully executed, will enable staff to offer more predictable and shorter schedules and other benefits
- Staff reviewed 24 white papers, and plan to review 7 more white papers and 15 topical reports
- eVinci deployment model introduces policy issues that are under evaluation by the staff.


e-Vinci Subcommittee - Design Overview - Open Session
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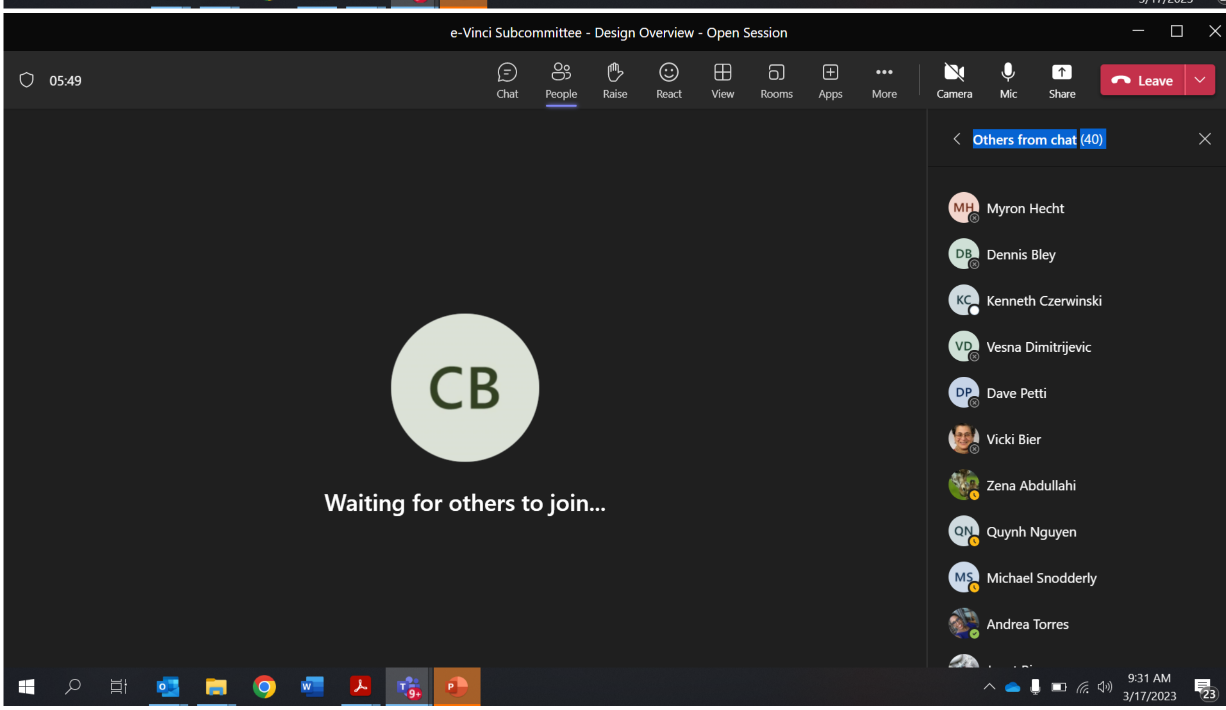
Chat
People
Raise
React
View
Rooms
Apps
More
Camera
Mic
Share
Leave
Others from chat (40)
Billy Gleaves
Request to join
Donna Williams
James Gaslevic
Carol Moyer
Steve Jones
Michael Orenak
Robert Weisman
Bernie White
William Jessup
Cayetano Santos
Mary Frances Woods
CB
Waiting for others to join...
9:32 AM
3/17/2023


e-Vinci Subcommittee - Design Overview - Open Session
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Chat
People
Raise
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Rooms
Apps
More
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Share
Leave
Others from chat (40)
Myron Hecht
Dennis Bley
Kenneth Czerwinski
Vesna Dimitrijevic
Dave Petti
Vicki Bier
Zena Abdullahi
Quynh Nguyen
Michael Snodderly
Andrea Torres
CB
Waiting for others to join...
9:31 AM
3/17/2023