NEXT

MSRR Introduction for

Virtual event on the NEXT molten salt research reactor

ANS Events

The ANS Chicago Local Section invites ANS members to attend a special virtual event on "The NEXT Molten Salt Research Reactor at Abilene Christian University" on Tuesday, March 7, at 8 p.m. ET. The presenter will be Rusty Towell, the founding director for ACU's premier research project called NEXT (Nuclear Energy eXperimental Testing). The event is open to all

by

Dr. Rusty Towell NEXT Lab Director

March 7, 2023

Natura Resources
SUSTAINABLE ENERGY

ACU
ABILENE CHRISTIAN UNIVERSITY

Abilene Christian University

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Nuclear Energy eXperimental Testing

- ACU's mission is to educate students for Christian service and leadership throughout the world.
- Main Campus in Abilene, Texas population 123,000
- Fall **2022 marks the fifth consecutive year** for a record number of students enrolling at ACU: 5,731 students.

ABILENE CHRISTIAN UNIVERSITY

TOP 50 NATIONALLY
IN UNDERGRADUATE TEACHING AND RESEARCH

BEST COLLEGES U.S.News & WORLD REPORT
UNDERGRADUATE TEACHING 2022-2023

BEST COLLEGES U.S.News & WORLD REPORT
UNDERGRADUATE RESEARCH / CREATIVE PROJECTS 2022-2023

BEST COLLEGES U.S.News & WORLD REPORT
SERVICE LEARNING 2022-2023

BEST COLLEGES U.S.News & WORLD REPORT
FIRST-YEAR EXPERIENCES 2022-2023

BEST COLLEGES U.S.News & WORLD REPORT
LEARNING COMMUNITIES 2022-2023

BEST COLLEGES U.S.News & WORLD REPORT
SENIOR CAPSTONE 2022-2023

BEST COLLEGES U.S.News & WORLD REPORT
STUDY ABROAD 2022-2023

BEST COLLEGES U.S.News & WORLD REPORT
NURSING (BSN) PROGRAMS 2022-2023

Nuclear Energy eXperimental Testing Lab

Finding global solutions to the world's critical needs

May 24, 2021

1 in 2 Need Energy

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Solution: Inexpensive, Clean, Safe, Available Electricity

Energy Usage and Standard of Living

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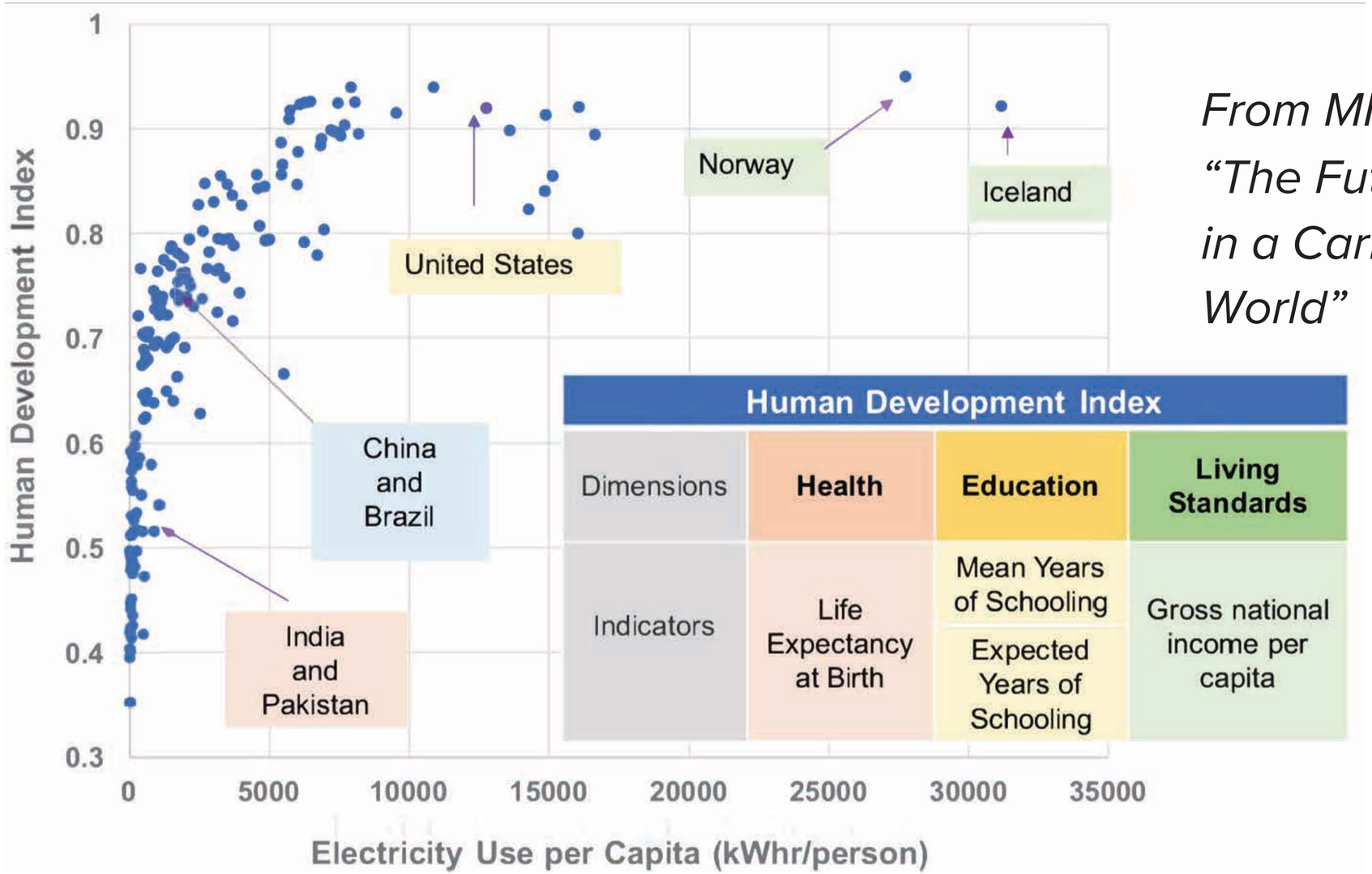
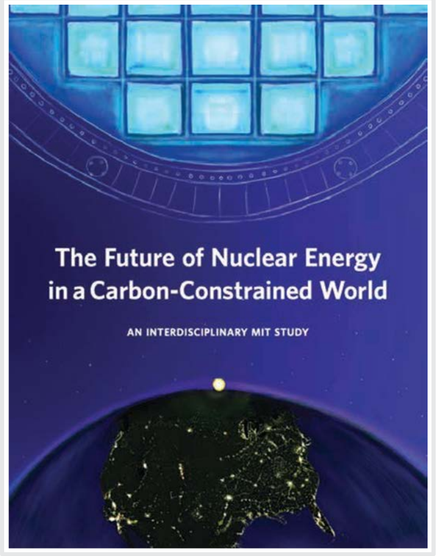
Nuclear Energy eXperimental Testing



From MIT's 2018 study, "The Future of Nuclear Energy in a Carbon-Constrained World"



Cure for Cancer

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NEWSLETTER MEDICAL NEWS TODAY LOG IN

'1 in 2 people will develop cancer in their lifetime'

By Honor Whiteman | Published Wednesday 4 February 2015

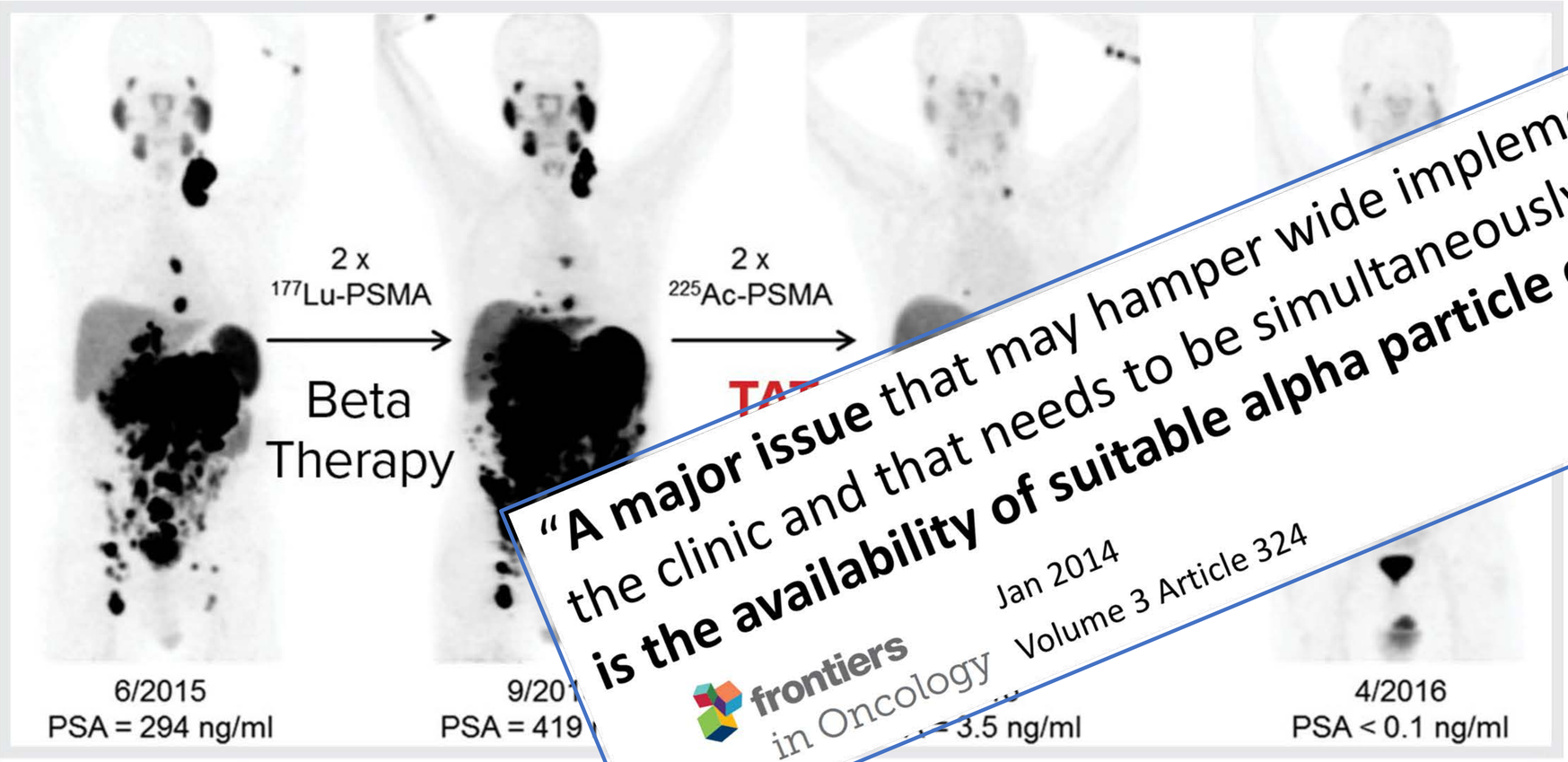
In the US, 1 in 2 women and 1 in 3 men will develop cancer in their lifetime. Now, a similar rate has been reported in the UK, with a new study published in the *British Journal of Cancer* claiming 1 in 2 men and women will be diagnosed with the disease at some point in their lives.

"From this, we can now forecast that a child born today has a 1 in 2 chance of developing cancer at some point in their lives."

Solution:

Targeted Alpha (α)-particle Therapy (TAT)

Targeted Alpha Therapy



"**A major issue** that may hamper wide implementation in the clinic and that needs to be simultaneously addressed **is the availability of suitable alpha particle emitters**"

frontiers in Oncology Jan 2014 Volume 3 Article 324

effective
specific
bs" to
cells

The Journal of NUCLEAR MEDICINE

68Ga-PSMA-11 PET/CT scans of patient B. In comparison to initial tumor spread (A), restaging after 2 cycles of β-emitting 177Lu-PSMA-617 presented progression (B). Clemens Kratochwil et al. J Nucl Med 2016;57:1941-1944

1 in 3 Need Water

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Humanitarian Focus

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1 in 2 do not have access to the **energy** needed to lift them out of poverty

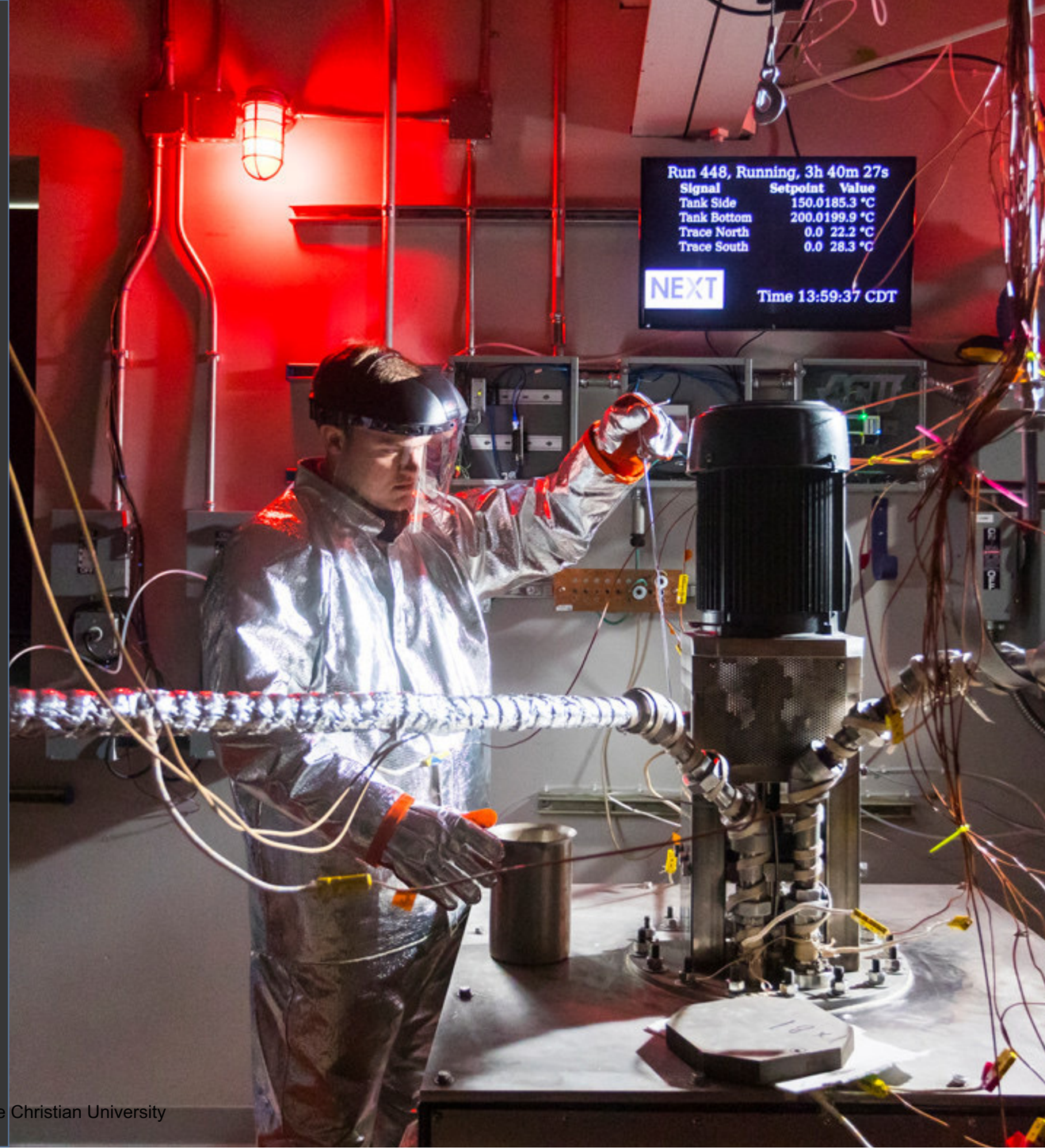
1 in 2 will develop **cancer**

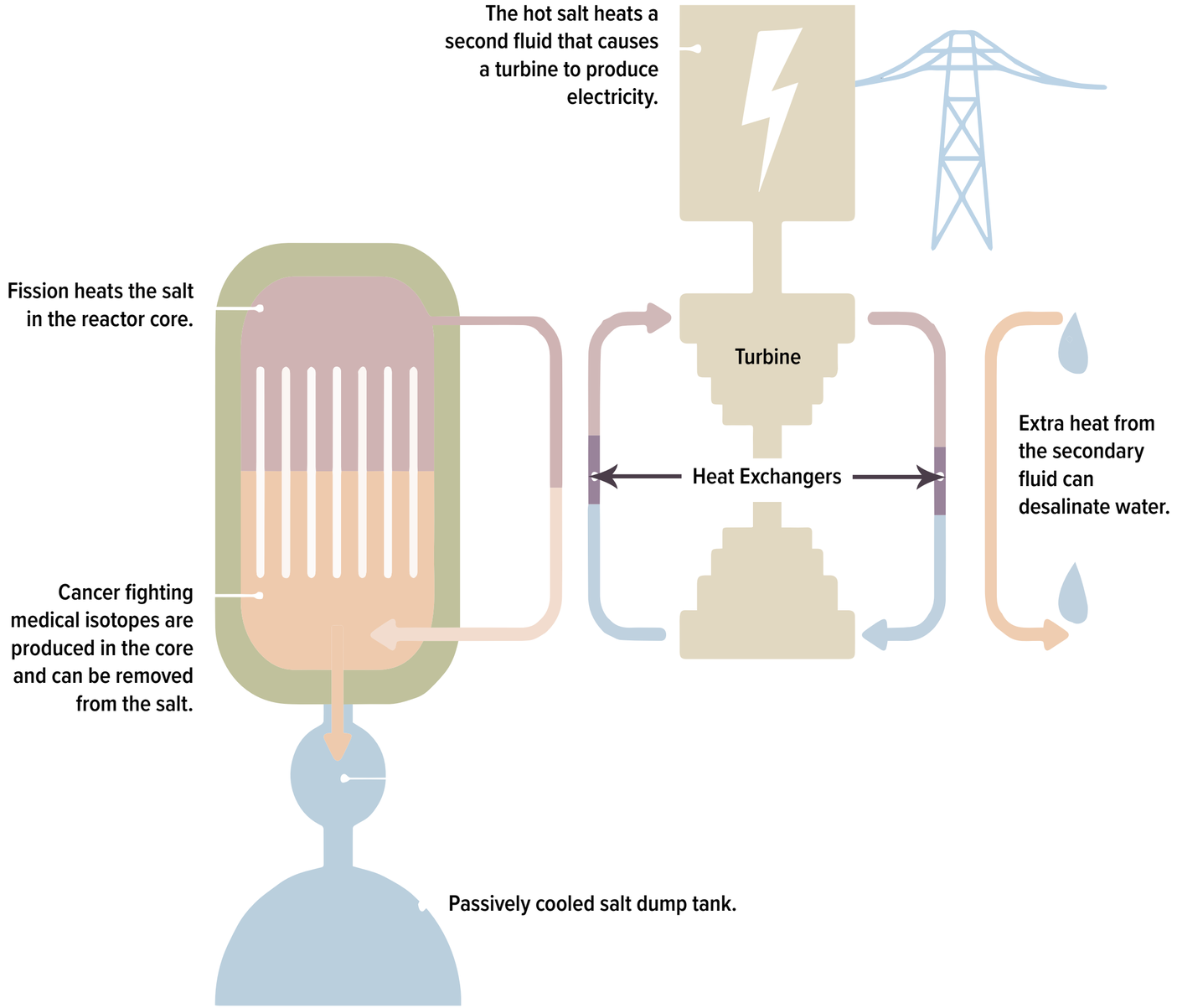
1 in 3 do not have access to clean drinking **water**

*"**Nuclear energy is indispensable for** achieving global sustainable development and has a crucial role in decarbonizing the energy sector, as well as **eliminating poverty, ending hunger, providing clean water, affordable energy,** economic growth, and industry innovation."* - United Nations Economic Commission for Europe (UNECE) Expert Group on Resource Management (EGRM)

Molten Salt Reactors (MSRs) provide answers to critical global needs

The mission of ACU's NEXT Lab is to provide global solutions to the world's need for energy, water and medical isotopes by advancing the technology of molten salt reactors while educating future leaders in nuclear science and engineering.





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Molten Salt Reactor

- Safe
- Clean
- Efficient
- Multi-functional
- Scalable
- Carbon-free
- Reliable
- Can use SNF

Key Requirement 1: Molten Salt Coolant

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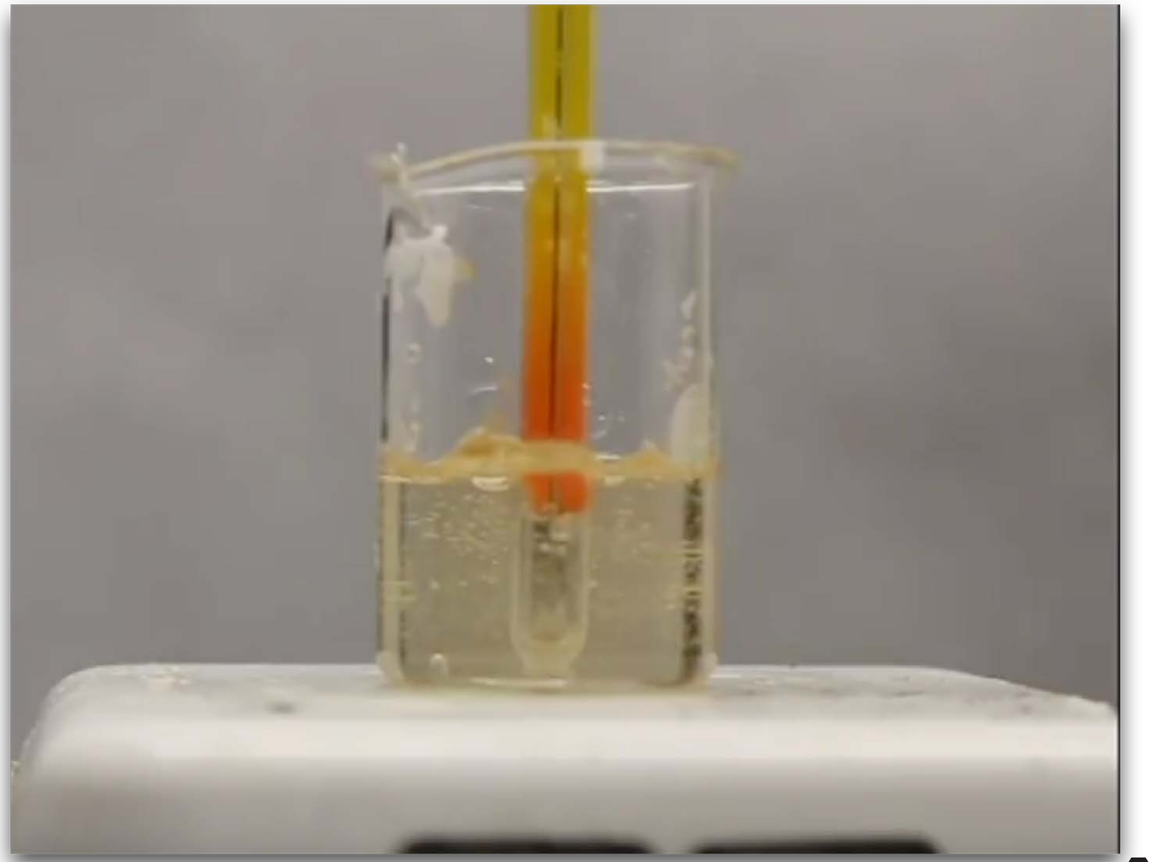
Nuclear Energy eXperimental Testing



Key Requirement 1: Molten Salt Coolant

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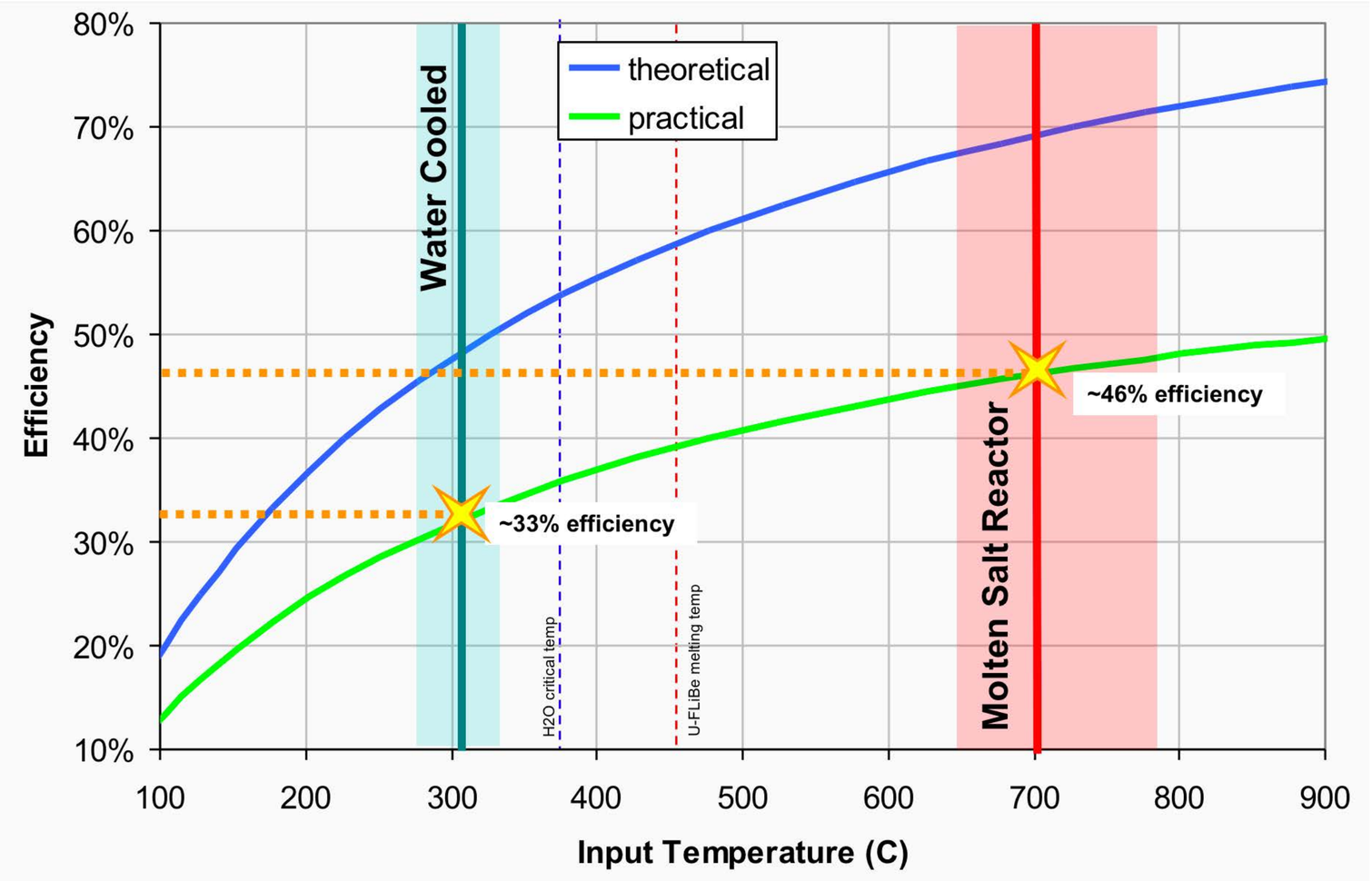
- High Temperature:
  - Improved efficiency
  - Industrial heat
- Safe – Low Pressure
  - No phase transition to a vapor
  - Walk-away-safe
- Enables …



Key Requirement 2: Liquid Fuel

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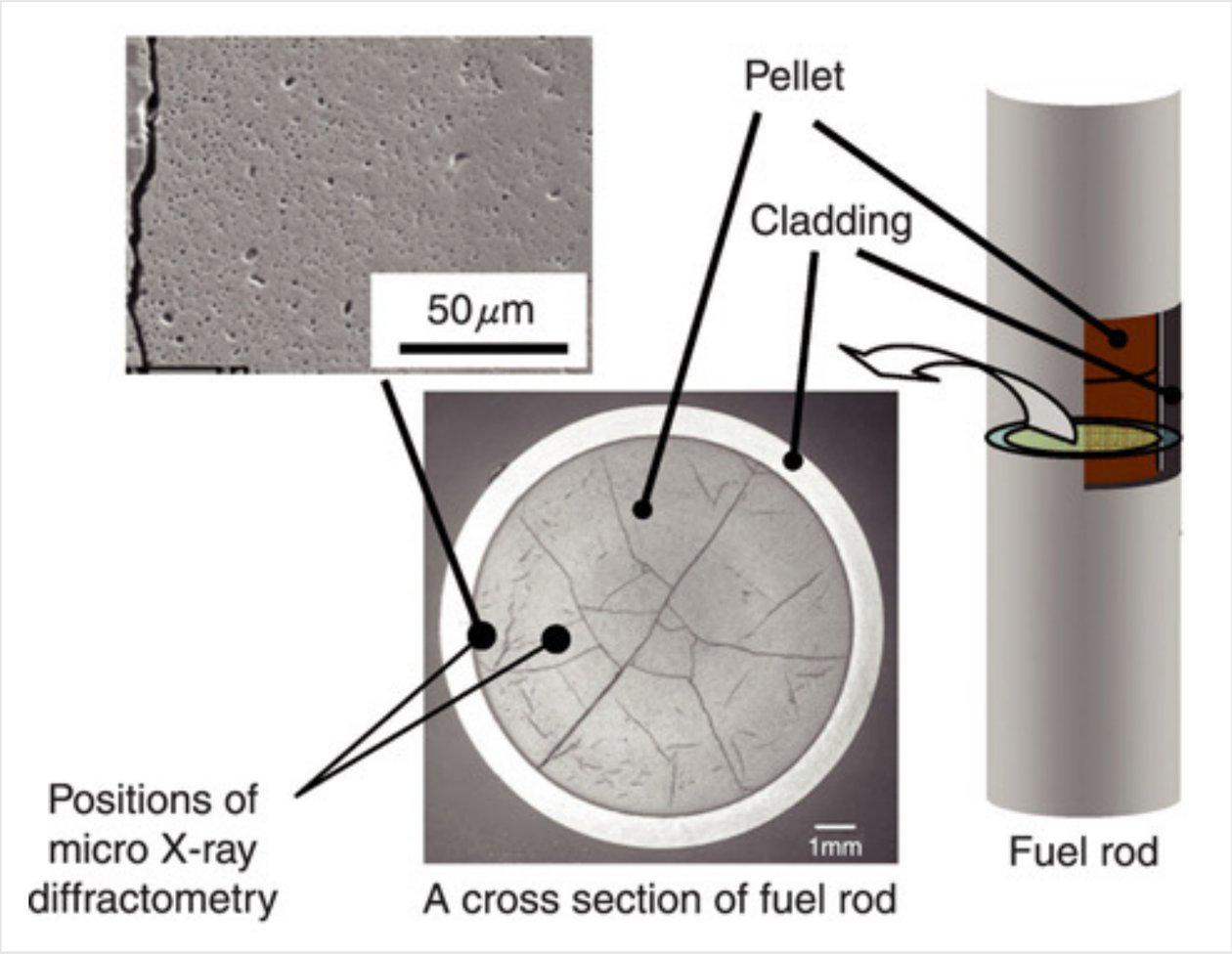
Old Solid Fuel Technology



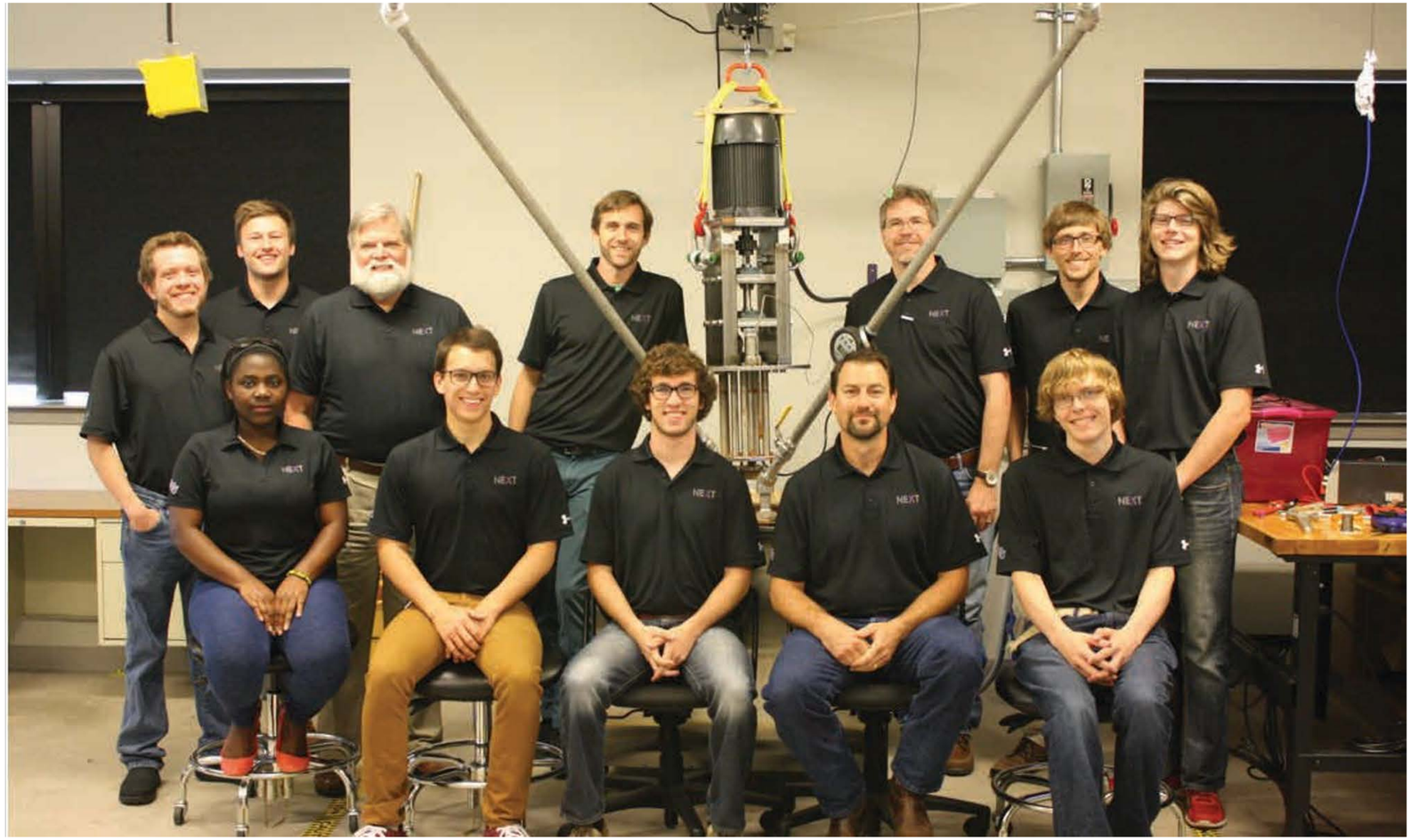
Advantages of Liquid Fuel

- Increased fuel utilization
- Decreased waste
- Access to medical isotopes
- Can not melt down

NEXT Team (2017)

NEXT
Nuclear Energy eXperimental Testing

- 5 faculty/staff members
- 7 students
- 2 lab rooms
- Advisory Board



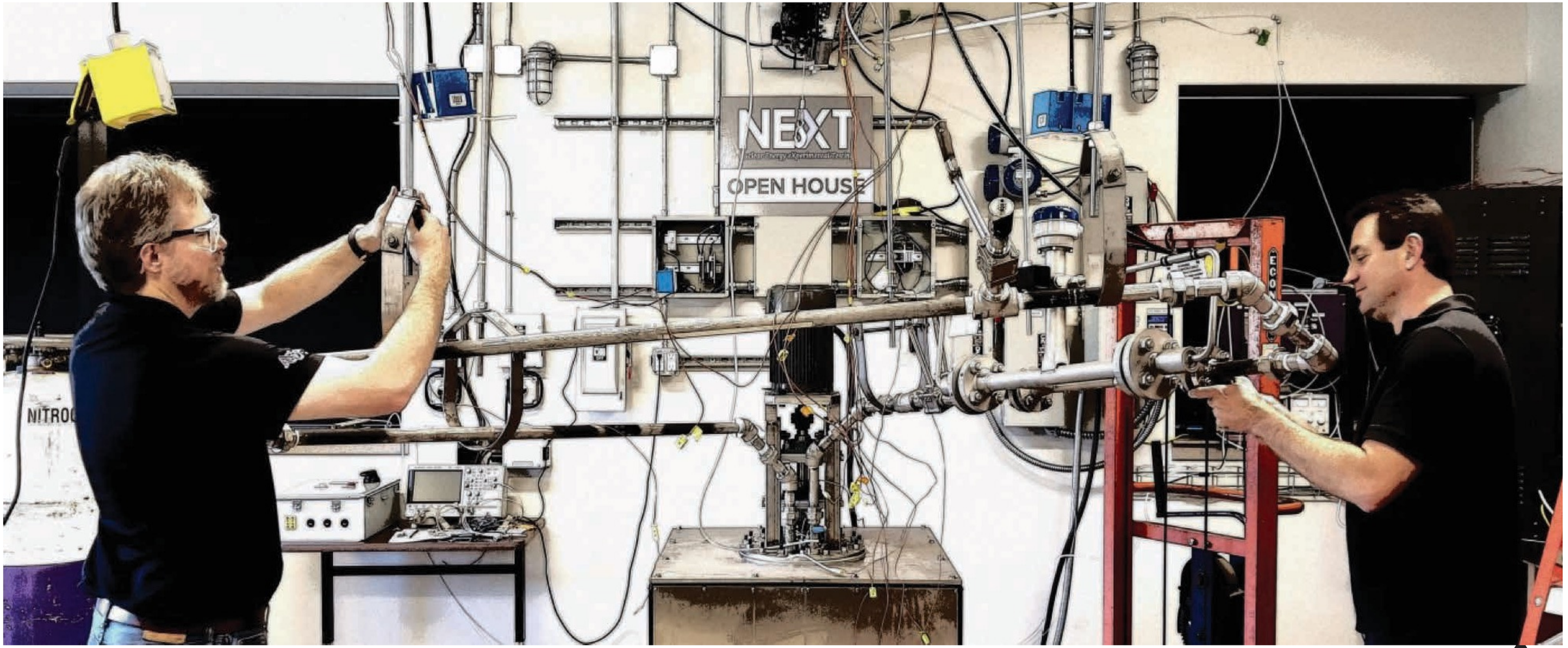
NEXT Team (2018)

NEXT
Nuclear Energy eXperimental Testing

- ACU
  - 10 faculty and staff members
  - 17 students currently involved 5 lab rooms
  - Advisory Board
  - Lab Oversight Committee
- Building larger collaborations
  - Collaborating on VTR at INL
  - Collaboration discussions with others

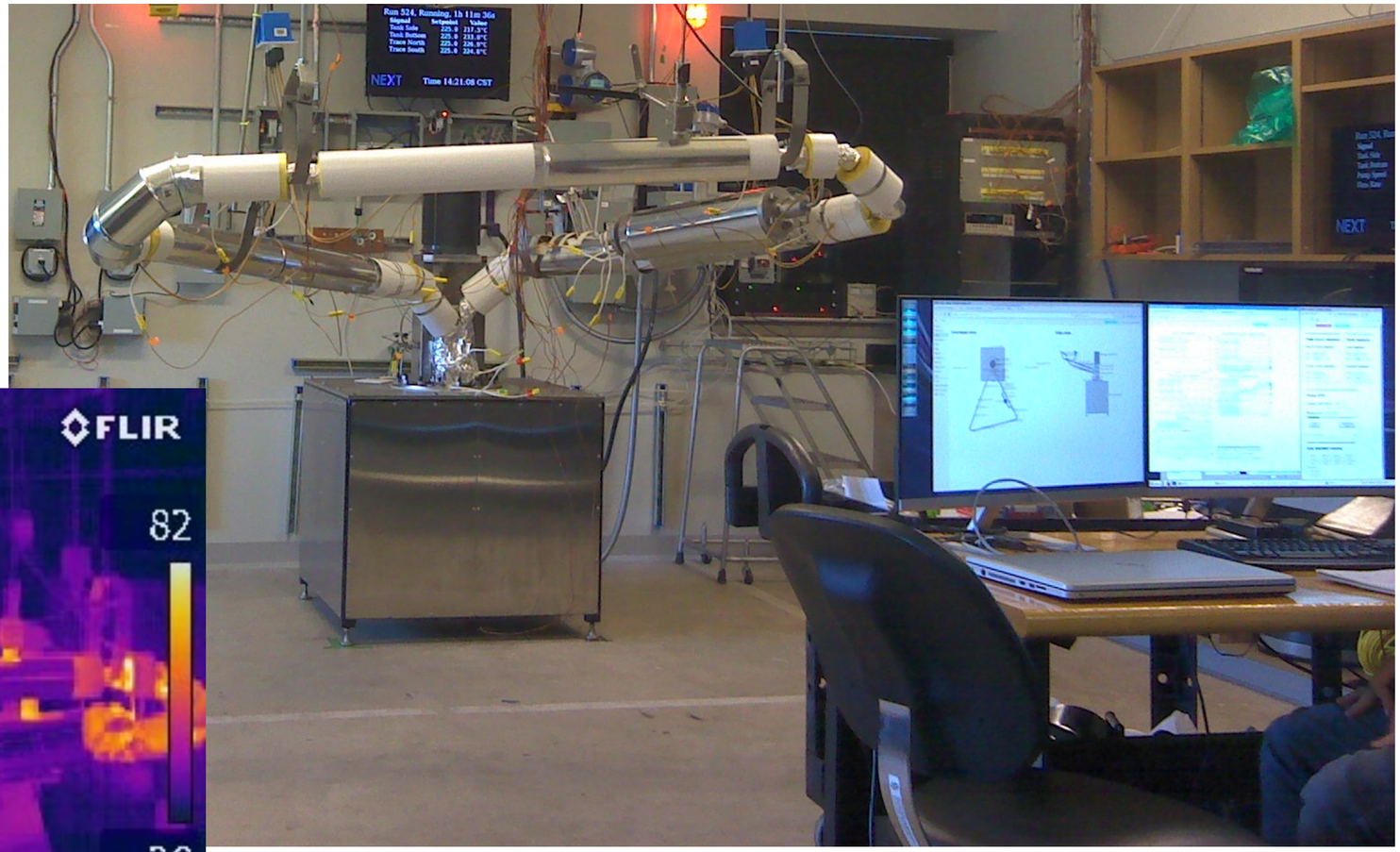
Molten Salt Test Loop

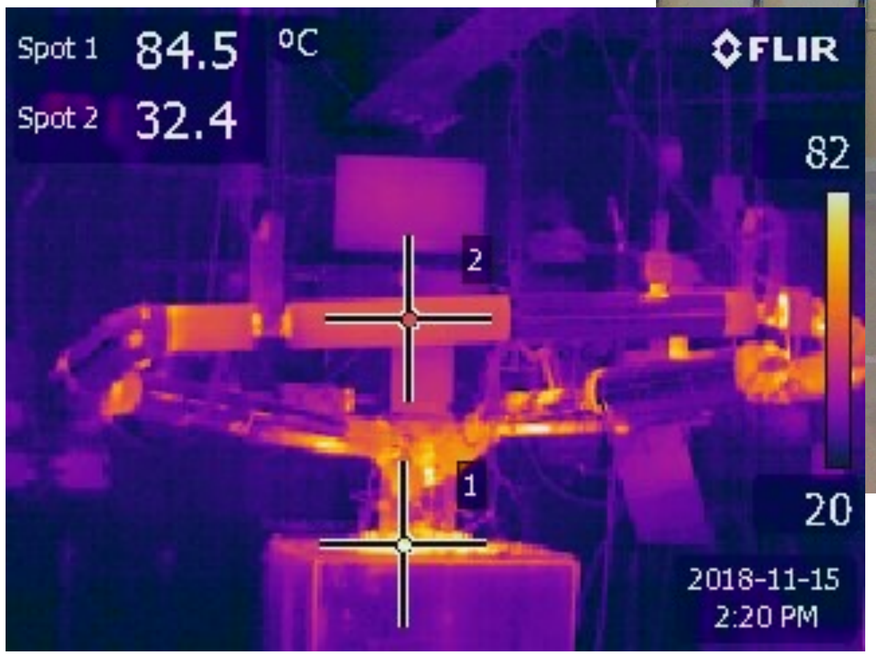
NEXT
Nuclear Energy eXperimental Testing



Molten Salt Test Loop

NEXT
Nuclear Energy eXperimental Testing





2018 Campus Visit

DOE visits NEXT

- Principal Deputy Assistant Secretary for Nuclear Energy Edward McGinnis
- Extremely impressed with our Vision and Work
- Wanted more details about our Plan
- Follow up visit to DC in January

2019 DC Visit

NEXT visits DOE

- Presented a plan to build a Molten Salt Research Reactor in 5 years.
- Asked DOE for fuel (500 kg HALEU), salt (FLiBe), and licensing support
- DOE was excited to help and has committed their support in writing.

Natura Resources

SUSTAINABLE ENERGY

Natura Resources, LLC is committed to answering the world's increased demand for **reliable energy**, **medical isotopes**, and **clean water**, by developing commercially deployable molten salt reactors (MSRs)

NEXTRA

Nuclear Energy eXperimental Testing Research Alliance

Faculty & Staff

Molten Salt Research Reactor is Simplified MSRE

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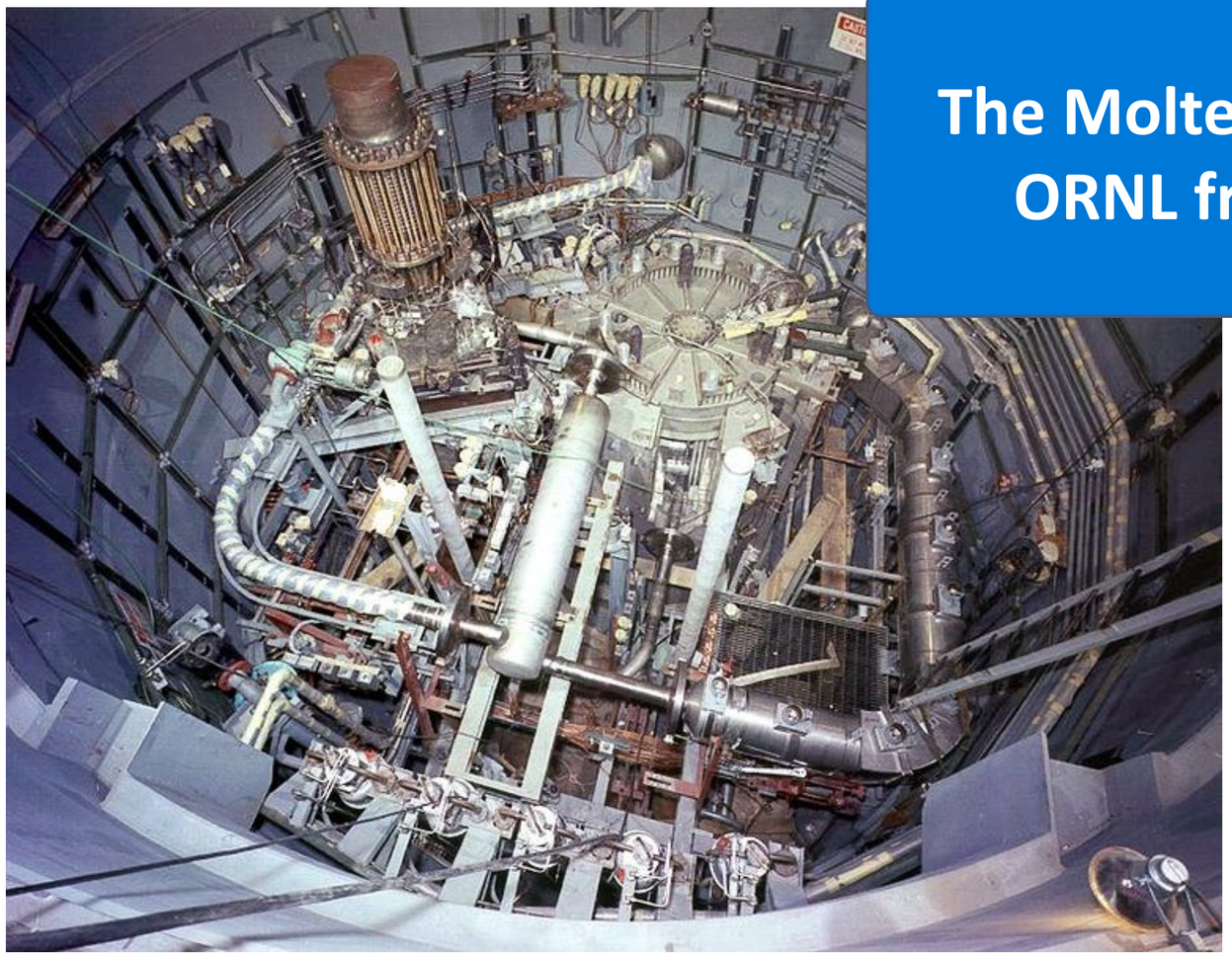
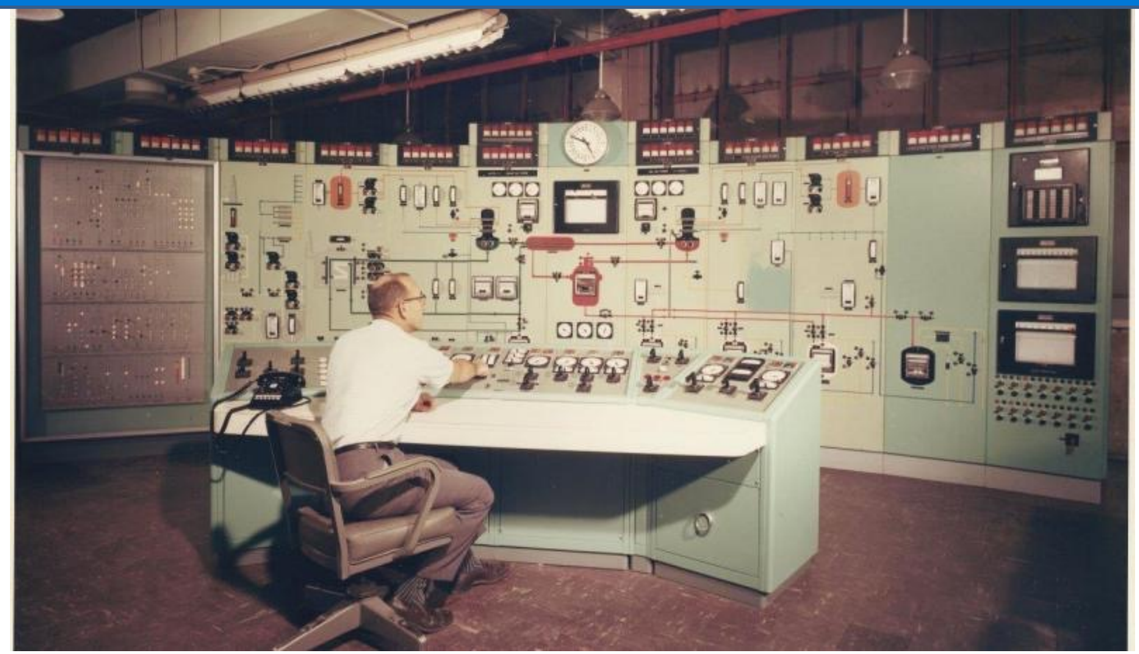
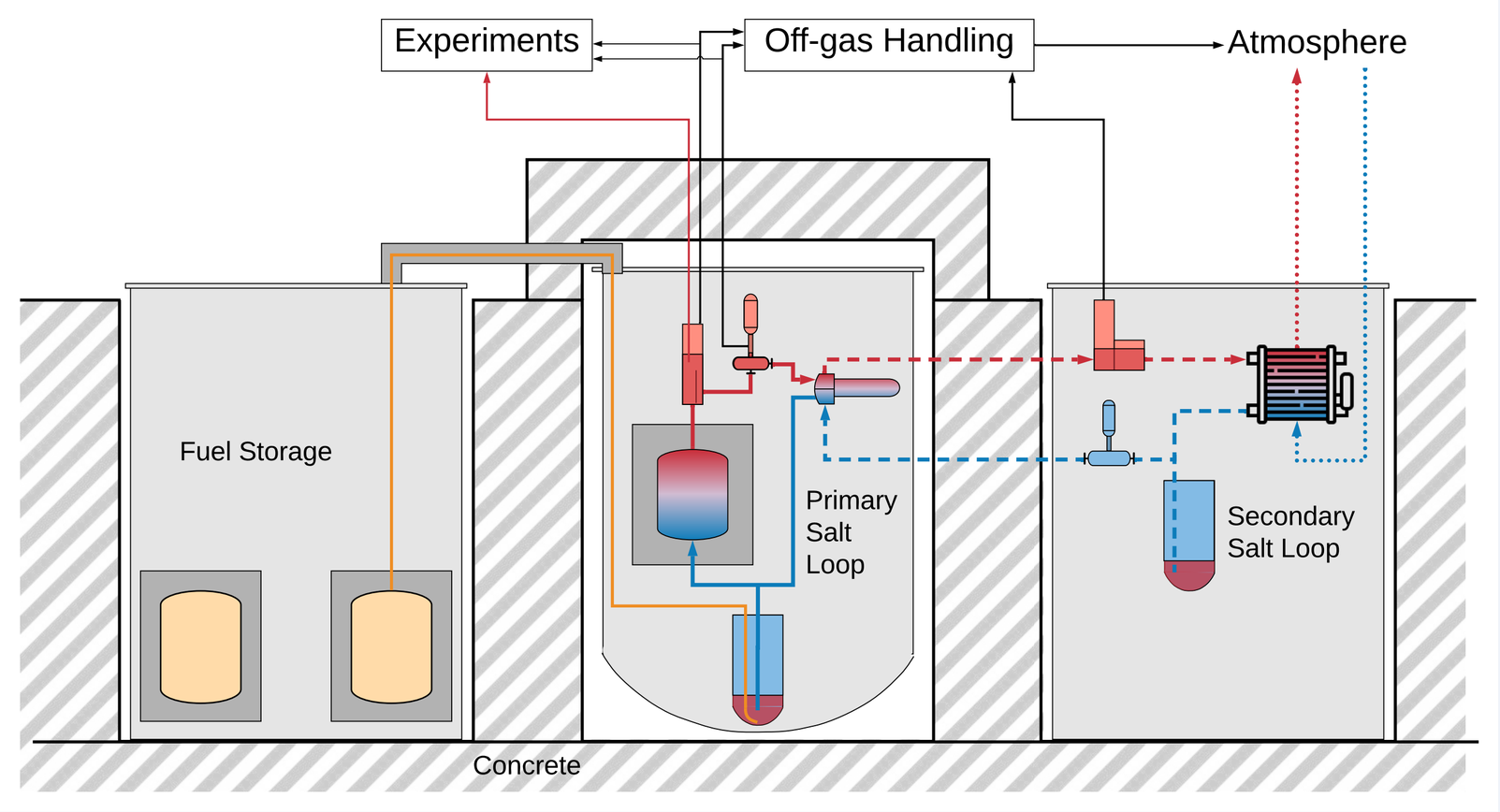
Nuclear Energy eXperimental Testing



The Molten Salt Reactor Experiment operated at ORNL from 1965-1969 on U-235 and U-233.





MSRE: shared concepts

- UF_4 LiF-BeF_2 fuel
- Loop design
- Graphite moderator
- Drain tank
- Trench-based radiation protection
- 5-years of full-power operation

MSRR: simplified concepts

- 19.75% instead of 33% ^{235}U
- 1 MWth instead of 8-10 MWth
- SS-316 instead of Hastelloy-N
- No freeze valve
- Utilizing 50 years of technology advancement

Natura Resources SUSTAINABLE ENERGY

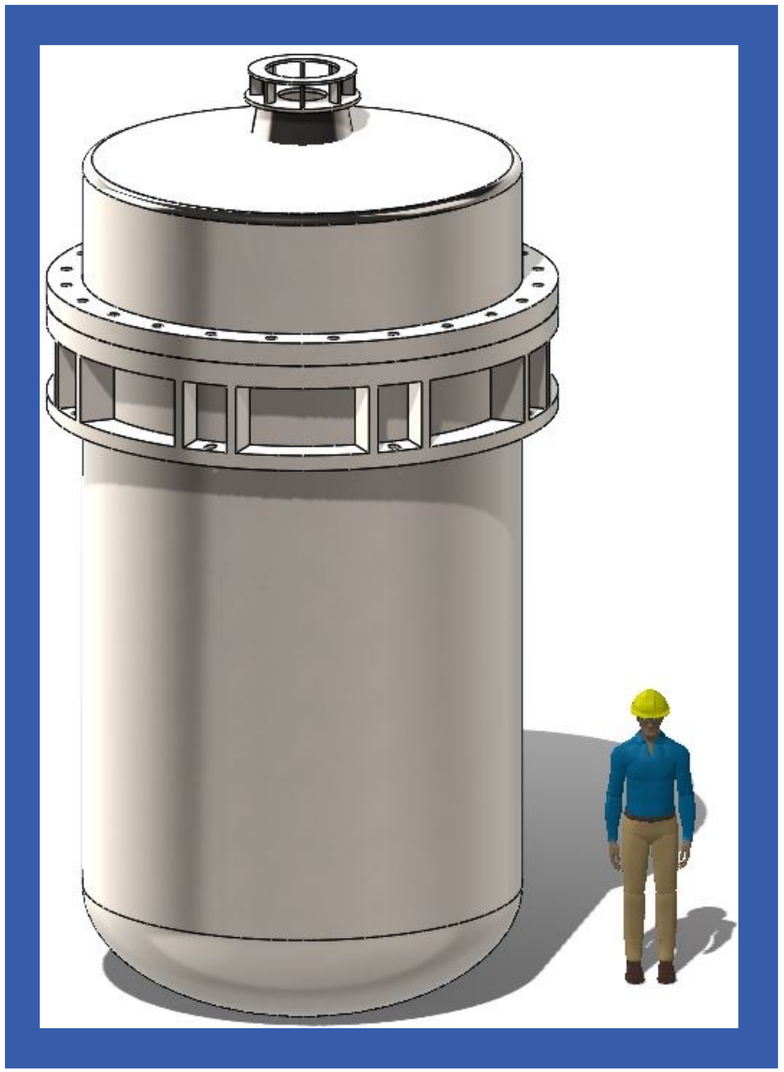
ACU ABILENE CHRISTIAN UNIVERSITY

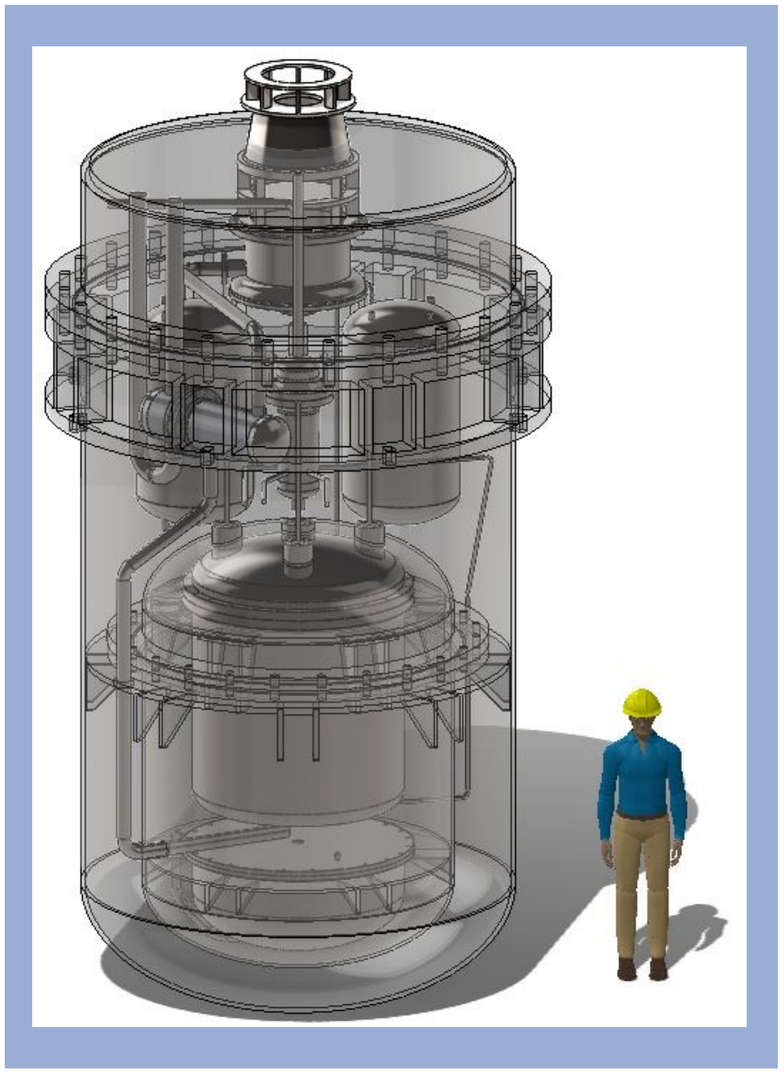
Georgia Tech

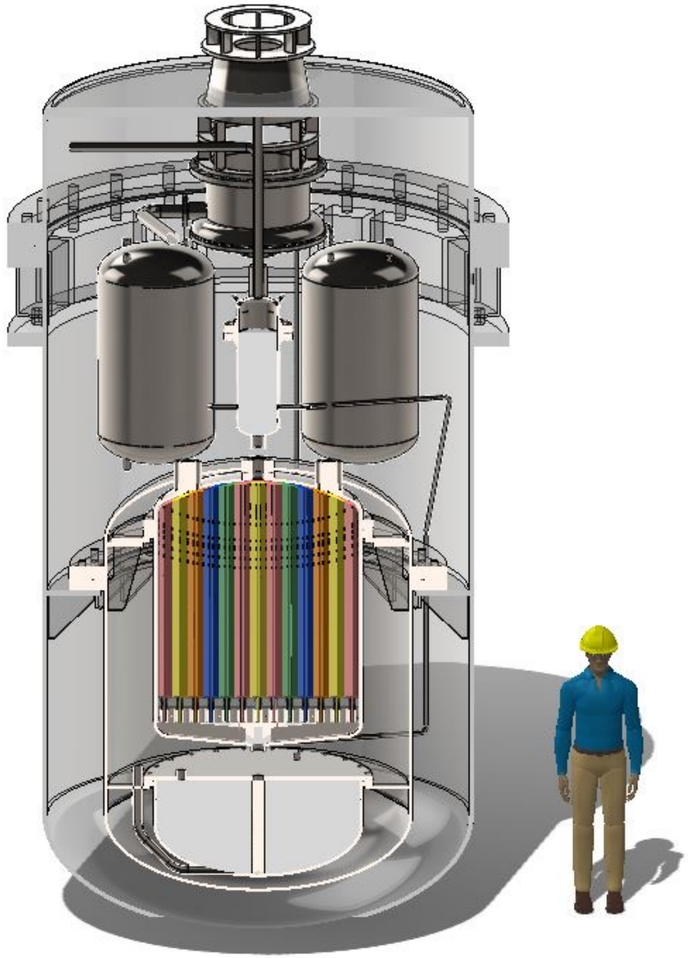
TEXAS A&M UNIVERSITY

TEXAS The University of Texas at Austin

MSRR REACTOR ENCLOSURE







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Molten Salt Research Reactor installed

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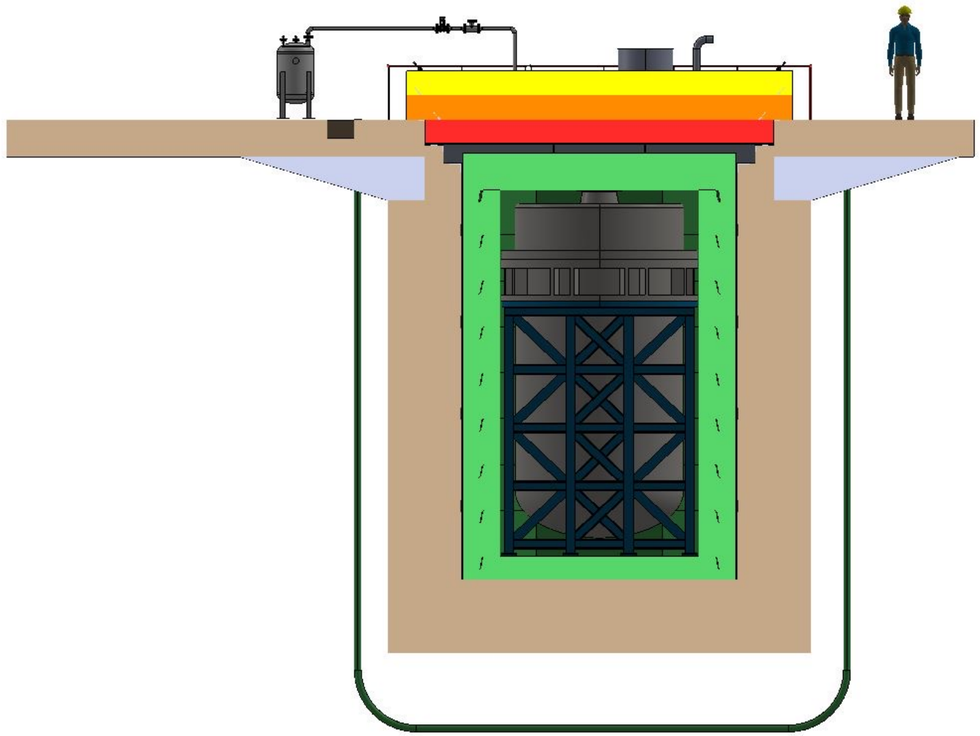
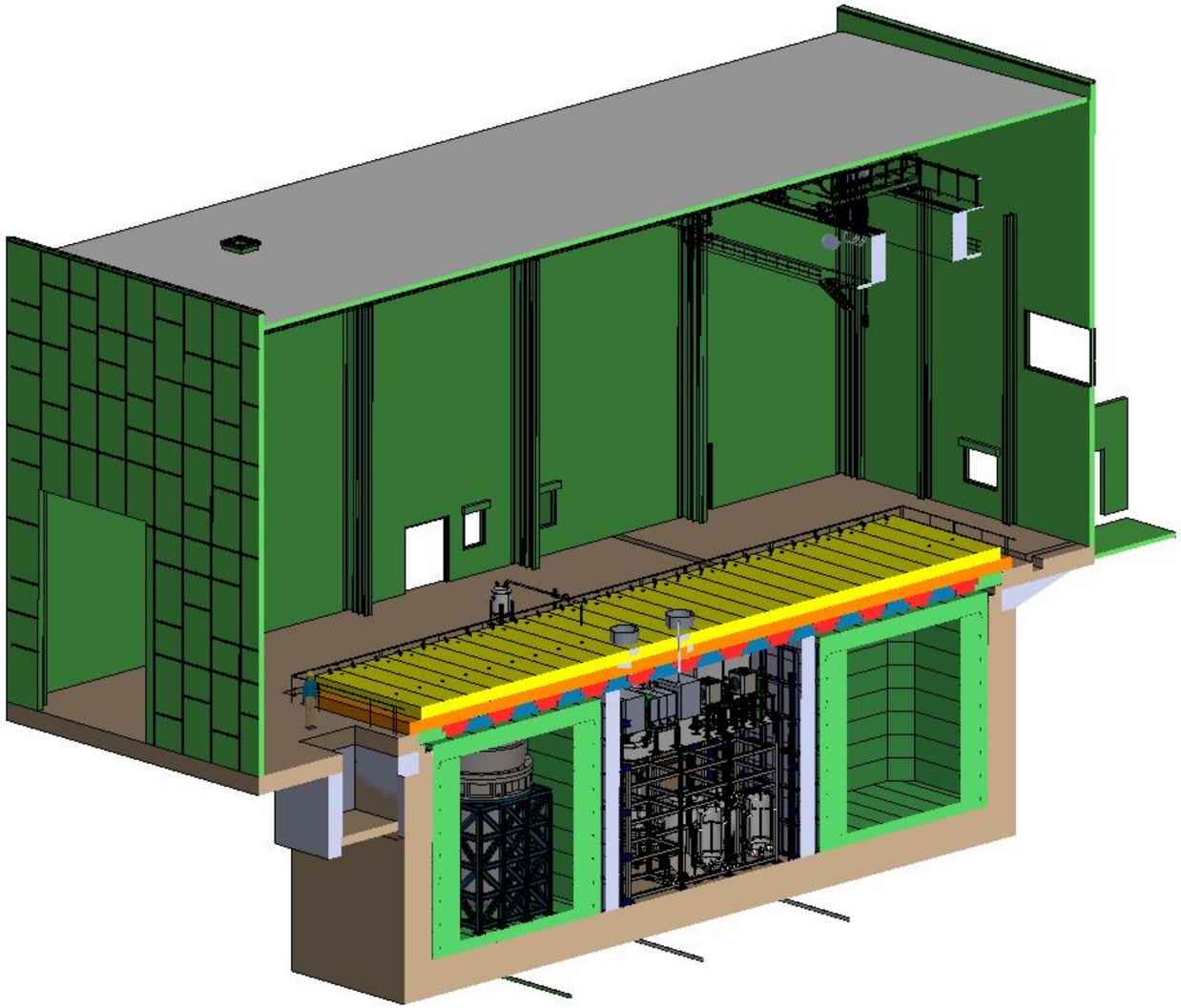




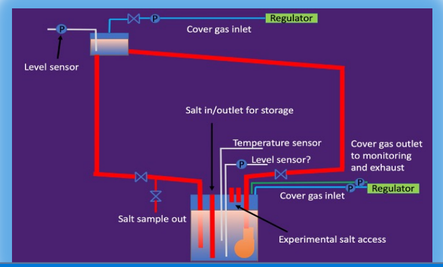
Summer 2022 NEXT Team

NEXT Lab Research Projects

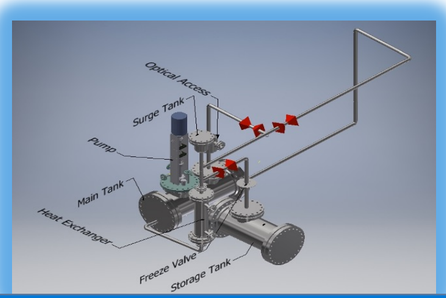
NEXT
gy eXperimental Testing

Molten Salt Test Loop

Isoto



Fluoride Molten Salt Test Loop



Molten Salt Test System

ELSEVIER

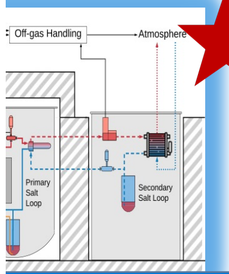
Annals of Nuclear Energy

Volume 186, 15 June 2023, 109772

A molten salt test loop for component and instrumentation testing

T.L. Head, Allison M. Berry, Keaton J. Brewster, Robert L. Brown, Hailey N. Burden, Reuben Byrd, Timothy Doty, Jess Dowdy, Kameron A. Hill, R.A. Jinkerson, Timothy J. Kennedy, Ronald C. Laehn, Dakotah Martinez, Samuel L. Mulder, Charles Onstead, Kim L. Pamplin, Dylan C. Pfeifer, Michael B. Ranger, Aaron D. Robison, Nathaniel T. Rowlands…T.S. Watson

Test System



search Reactor

Chemical Analysis System

Molten Salt Filters

✪Patented Technology

✯Patent Pending

https://doi.org/10.1016/j.anucene.2023.109772

University Research Reactors

Four universities team up to design molten salt research reactor

Fri, Aug 21, 2020, 12:11PM | Nuclear News

Abilene Christian University (ACU) is leading a consortium called NEXTRA—the Nuclear Energy ... Testing Research Alliance—with the Georgia Institute of Technology, Texas A&M ...

U of Illinois plans to integrate ... microreactor

Abilene Christian's NEXT Lab applies for MSRR construction permit

Thu, Aug 18, 2022, 3:04PM | ANS Nuclear Cafe

The Nuclear E... University in T... Regulatory Co...

Abilene Christian's NEXT Lab reaches milestone in molten salt reactor research

Mon, Nov 14, 2022, 7:02AM | Nuclear News

The Nuclear Energy eXperimental Testing (NEXT) Laboratory at Abilene Christian University in Texas created quite a bit of buzz within the nuclear community in August when it submitted the...

...Sale Nuclear Corporation (USNC), and Global First ... have embarked on a new partnership to study the feasibility of deploying a USNC Micro Modular Reactor...

Science and Engineering Research Center

- 28,000 ft^2 facility
  - 6, 000 ft^2 Research Bay
  - Specialty Research Labs
  - Offices
- Design completed by Parkhill
- Linbeck construction company
- Design Completed: 2021
- Begin Construction: 2022
- Completed: 2023

Status Summary

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Nuclear Energy eXperimental Testing

The Natura Resources sponsored Research Alliance is leading the way in MSR development and deployment.

1. ACU is building the SERC to house the MSRR.
2. ACU has submitted the construction permit to the NRC.
3. The NRC accepted our CP and agreed to an 18-month review.

We are the only project with accepted CP and construction

NEXTRA
Nuclear Energy eXperimental Testing Research Alliance

Natura Resources
SUSTAINABLE ENERGY

ACU

Natura Resources
SUSTAINABLE ENERGY

THANK YOU

acunextlab.org

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Nuclear Energy eXperimental Testing

Develop Abilene
Development Corporation of Abilene

U.S. DEPARTMENT OF ENERGY

Excelsior