



**Pacific
Northwest**
NATIONAL LABORATORY

Nuclear Energy Sensor (NES) Database

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PNNL is operated by Battelle for the U.S. Department of Energy

NE Sensor Database

Purpose: Collect, store, and maintain nuclear power plant sensor technology information so that it can be easily accessed and queried on the web. Provide mechanisms for the user community to suggest additional sensors and needs so that the data available continues to grow.

Initial Content: ORNL/TM-2016 “Assessment of Sensor Technologies for Advanced Reactors”.

- Nuclear energy sensors
- Sensor use cases
- Sensor needs and gaps

NE Sensor Vision

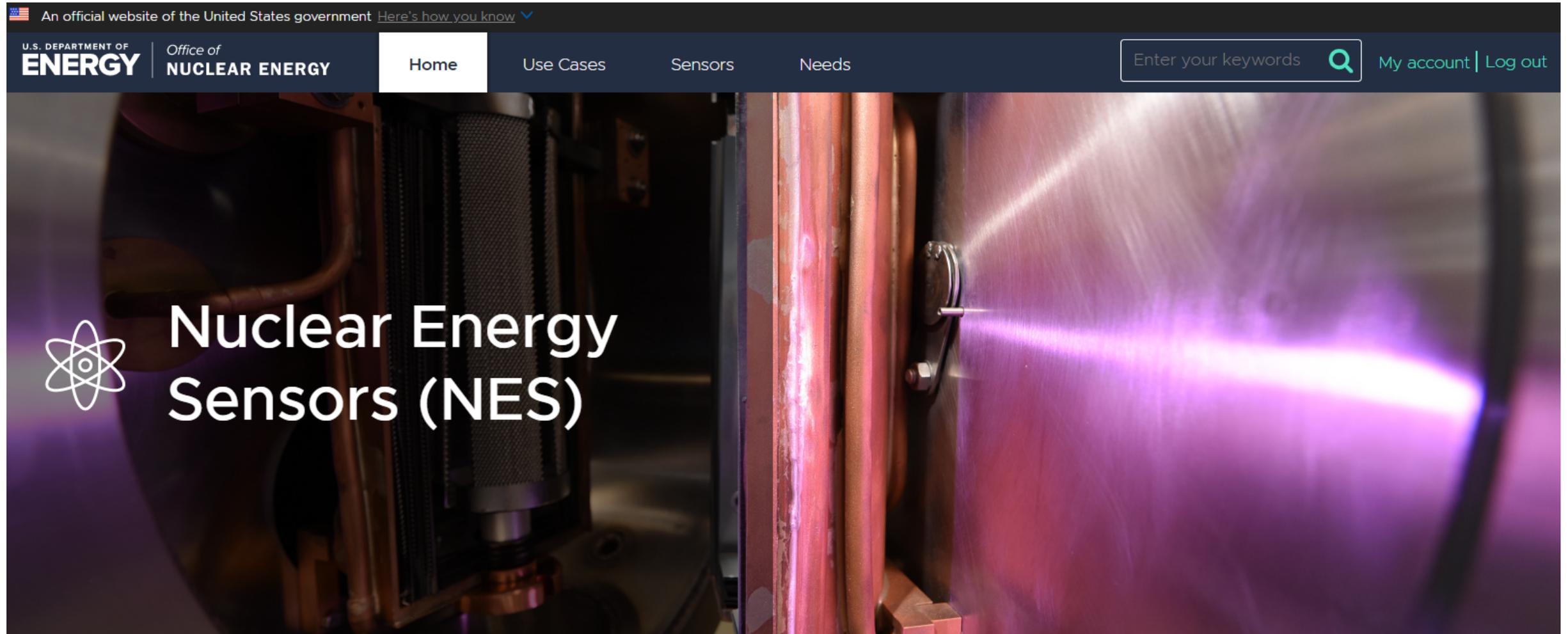
Next Steps:

- Expand the dataset based on input from the user community
- Develop additional search and analytic capabilities
- Develop more advanced visualization functionality

Building a Community:

- Looking for interested subject matter experts to share their expertise:
 - Contribute content for the community
 - Moderate suggested content
 - Network with the community

NE Sensor - Home Page



Sensors for Nuclear Applications at Your Fingertips!

Welcome to the Nuclear Energy Sensors (NES) website! This website provides a searchable sensors technology database for nuclear applications. It provides information on current state of sensors development, availability, use cases, and also helps identify needs and gaps for sensor development.

NE Sensor - Sensors

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Home Use Cases Sensors Needs

Suggest a sensor

SENSOR TYPE

- Thermocouple (7)
- Thermometer (5)
- Unknown/Not declared (4)
- Hygrometer (3)
- Ultrasonic (3)
- [Show more](#)

MEASUREMENT TYPE

- Temperature (15)
- Flow (14)
- Leak Detection (7)
- Neutron Flux (7)
- Moisture (6)
- [Show more](#)

REACTOR TYPE

- High-Temperature Reactor (HTR) (44)
- Sodium Fast Reactor (SFR) (23)
- Molten Salt Reactor (MSR) (6)
- MSR (1)

Sensors

Sensor Type	Sensor Technology	Measurement Type	Applicable Reactor Type(s)	Description
Laser Doppler vibrometry	Laser Doppler vibrometry	Vibration		VIEW DETAILS
Pressure Sensor	Pressure Sensor	Pressure		VIEW DETAILS
Permanent Magnet	Permanent Magnet	Flow		Pro: Rugged, Direct mV output, Nonintrusive; Cons: Heavy, Temperature dependent output, Non-linear in large sizes, Flow turbulence limits response time, Drifts with time VIEW DETAILS
Saddle Coil	Saddle Coil	Flow		Pro: Direct mV output, Nonintrusive; Cons: Large DC power supply and meter size, Temperature dependent output, Non-magnetic pipe only, Non-linear in large sizes, Flow profile dependent, Flow turbulence limits response time VIEW DETAILS

NE Sensor - Sensor Drilldown Functionality

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[Suggest a sensor](#)

SENSOR TYPE

- Core differential pressure (1)
- Gamma thermometer (1)
- Gas circulator differential pressure (1)
- Hot wire anemometry (1)
- Motor power meter (1)
- [Show more](#)

MEASUREMENT TYPE

- Flow (6)

REACTOR TYPE

- High-Temperature Reactor (HTR) (6)

Sensors

Sensor Type	Sensor Technology	Measurement Type	Applicable Reactor Type(s)	Description
Core differential pressure	Core differential pressure	Flow	High-Temperature Reactor (HTR)	VIEW DETAILS
Gas circulator differential pressure	Gas circulator differential pressure	Flow	High-Temperature Reactor (HTR)	VIEW DETAILS
Motor power meter	Motor power meter	Flow	High-Temperature Reactor (HTR)	VIEW DETAILS
Gamma thermometer	Gamma thermometer	Flow	High-Temperature Reactor (HTR)	VIEW DETAILS
Hot wire anemometry	Hot wire anemometry	Flow	High-Temperature Reactor (HTR)	VIEW DETAILS
Projection laser doppler velocimetry	Projection laser doppler velocimetry	Flow	High-Temperature Reactor (HTR)	VIEW DETAILS

NE Sensor - Search Functionality

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MEASUREMENT TYPE

- Flow (5)
- Temperature (5)
- Moisture (2)
- Fuel Element Failure Detection (1)
- Loose Parts Monitoring (1)
- [Show more](#)

SENSOR TYPE

- Hygrometer (2)
- Thermometer (2)
- Acoustic (1)
- Fiber optic (1)
- Fission chamber (1)
- [Show more](#)

REACTOR TYPE

- High-Temperature Reactor (HTR) (27)
- Sodium Fast Reactor (SFR) (14)

Search Content

temperature

Displaying results 1 - 20 of 42

[S70-High-temperature acoustic surveillance microphone/High-temperature acoustic surveillance microphone](#)
... leak of SGs and sodium boiling due to fuel pin failure in core LiNbO3 38 283 138 89 33 S70-High-**temperature** acoustic surveillance microphone/High-**temperature** acoustic surveillance microphone ...

[NG49-S70-High-temperature acoustic surveillance microphone/High-temperature acoustic surveillance microphone](#)
... fuel-pin or components monitoring of nuclear facility in harsh environments Laboratory scale At-**temperature** and pressure activated environment 2 282 152 NG49-S70-High-**temperature** acoustic surveillance microphone/High-**temperature** acoustic surveillance microphone ... In-core fuel-pin or components monitoring of ...

[S67-Fission chamber/High temperature fission chamber](#)
... 56 Compare their performance with high-**temperature** SiC neutron detectors. 19 278 No suitable neutron flux measurement technology is commercially available that functions at **temperatures** above 550 °C. The failure of fission chambers at high **temperatures** is most commonly due to metallic deposits, which arise from evaporation of ...

NE Sensor - Suggest a Sensor Wizard

Suggest a Sensor

Suggest a sensor to be added to this database. Please fill out as much information as possible. One of our subject matter experts may reach out to you with questions or for clarification, if necessary. Please be sure to let us know why you think this sensor should be added, as well.

Thank you.



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* Indicates required field

Contact Information

Full Name <input type="text"/> ? *	Organization <input type="text"/> ?
Email <input type="text"/> ? *	Phone <input type="text"/> ?
Area of Expertise (e.g., Radiation protection, Reactor operation, etc.) <input type="text"/>	

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NES Use Cases

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SENSOR TYPE

- Fission Chamber or Boron Lined Proportional counter (3)
- Thermocouple (3)
- Compensated DC ionization chambers (2)
- Compensated DC ionization chambers and fission chambers (2)
- Strain Gauges (2)
- B10 Lined Proportional counter (1)
- Core differential pressure (1)
- Cross-Correlation of Flow Turbulence (1)
- Electrolytic hygrometer moisture detector (1)
- MMY170 (1)
- Permanent Magnet (1)
- Pulsed Neutron Activation (PNA) (1)
- Rhodium-plated mirror (1)
- Saddle Coil (1)
- Ultrasonic (1)
- Uncompensated ionization chamber (1)
- Unknown/Not declared (1)
- Venturi (1)

REACTOR TYPE

- High-Temperature Reactor (HTR) (14)
- Sodium Fast Reactor (SFR) (2)

Use Cases

Plant	Reactor Type	System Location	Description
Peach Bottom	High-Temperature Reactor (HTR)	Fuel spines	VIEW DETAILS
Peach Bottom	High-Temperature Reactor (HTR)	Fuel element	VIEW DETAILS
Fort Saint Vrain (FSV)	High-Temperature Reactor (HTR)	Other/Multiple locations	VIEW DETAILS
High Temperature Test Reactor (HTR)	High-Temperature Reactor (HTR)		VIEW DETAILS
MSRE			VIEW DETAILS
Fort Saint Vrain (FSV)	High-Temperature Reactor (HTR)	Reactor vessel	VIEW DETAILS
Peach Bottom	High-Temperature Reactor (HTR)	Inlet/Outlet of steam generator	VIEW DETAILS

NE Sensor – Needs & Gaps

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Identify a need

REACTOR TYPE

High-Temperature Reactor (HTR) (27)

Sodium Fast Reactor (SFR) (16)

TRL

1 (2)

2 (10)

3 (6)

4 (1)

Needs & Gaps

TRL	Reactor Type	Description	
2	High-Temperature Reactor (HTR), Sodium Fast Reactor (SFR)	Conventional sensors such as fission chambers quickly burn out the harsh in-core environment; fission chambers used for reactivity and power monitoring could not be operated in the core environment, and required cooled thimbles in the radial shield	VIEW DETAILS
	High-Temperature Reactor (HTR)	Capacitive shift-type hygrometers are moderately sensitive to pressure and temperature changes, necessitating a controlled sample environment, and are generally insensitive to combustion gases	VIEW DETAILS
2	High-Temperature Reactor (HTR), Sodium Fast Reactor (SFR)	Cabling is difficult to replace and maintain in-vessel; Increased sensor density in-vessel increases need for penetrations. Accuracy - Low power (<1 mW?) reliable (Low error rates) Needed for temperature and neutron flux measurements Neutron flux ranges: Lower Limit: 10, Upper Limit: 1E13 n/cm ² sec	VIEW DETAILS

NE Sensor – Suggest a Need Wizard

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✓ You have already submitted this webform. [View your previous submission.](#)

Identify a Need or Gap

Please let us know about any need or gap in sensor technology you've identified, along with any steps you may suggest to resolve it.

Thank you.



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* Indicates required field

Contact Information

Full Name *

Organization

Email *

Phone

Area of Expertise

(e.g., Radiation protection, Reactor operation, etc.)

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d3e794

Your email address
tim.downing@pnl.gov

Subject *

Message *

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Create new account

Email address *

A valid email address. All emails from the system will be sent to this address. The email address is not made public and will only be used if you wish to receive a new password or wish to receive certain news or notifications by email.

Username *

Several special characters are allowed, including space, period (.), hyphen (-), apostrophe ('), underscore (_), and the @ sign.

Full Name

Institution

Position

Picture

No file chosen



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Thank you