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Nuclear Energy Sensors Database Website

Advanced Sensors and Instrumentation Annual Webinar

October 29, 2020

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Pacific Northwest National Laboratory

Project Overview

- Goal and Objective:
  - Collect, store, and maintain nuclear energy sensor 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/gaps.
  - Adapt to new data requirements as needed.
- Participants 2020
  - Software (PNNL): Tim Downing, Shan Osborn, Tyler Willis, Claudia Hilderbrand, Jeanne Morgan, Isaac Jo, Corey Jenkins
  - Data: Yogi Dayal (INL), David Wootan (PNNL)
- Schedule
  - Version 2.2 deployed. Ongoing operational support, data loading, and development as needed.

Summary of accomplishments

FY20 Deliverables

- Version 2.0 (October 2019)
  - Baseline functional requirements for website met
  - Home page, Sensors page, Use Case page, Needs/Gaps page, Search Page, etc.
  - Initial data load based on ORNL/TM-2016/337 R1 “Assessment of Sensor Technologies for Advanced Reactors”

- Version 2.1 (March 2020)
  - New User Forum
  - Improved wizard for suggesting sensors and needs
  - Miscellaneous fixes/improvements

Summary of accomplishments

FY20 Deliverables (Continued)

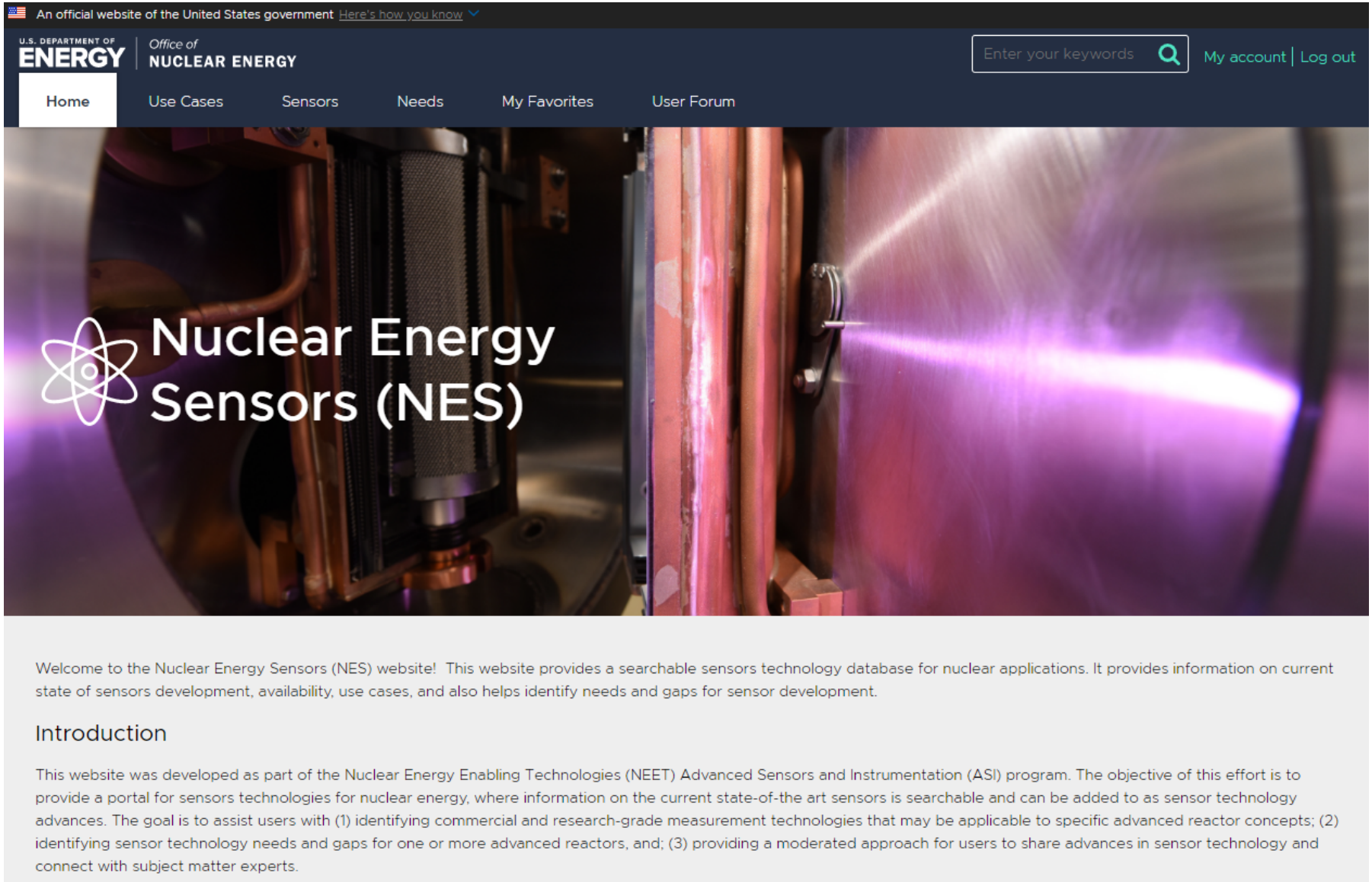
- Version 2.2 (September 2020)
  - Significant expansion of data fields defined to capture NE sensor data
  - Ongoing loading of newly created data content
  - Site wide improvements to “look and feel” based on User Experience (UX) designs
  - Added User Favorites
  - Miscellaneous fixes/improvements

Technology Impact

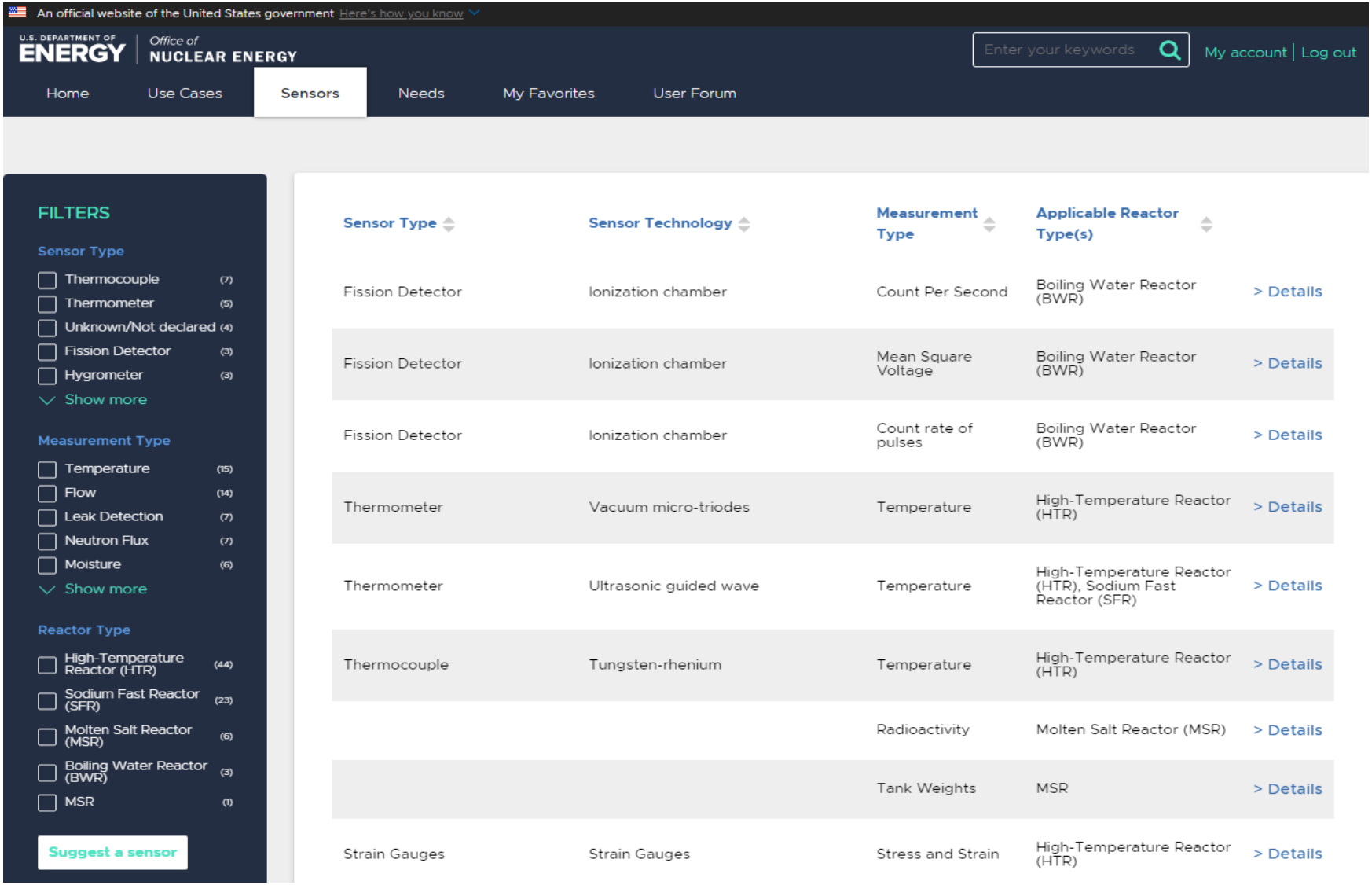
Nuclear Energy Sensor Website Impacts

- Provides one “go to” searchable database for government, universities, and industry on current sensor technology.
- Provides a database for sensor gaps that need to be filled, including community voting on priority.
- Can be used to build a community via the User Forum and ability to suggest sensors and needs.
- Can be used as a tool for stakeholders in designing and building new nuclear designs and facilities.

Accomplishments – Website Tour – Home Screen



Accomplishments – Website Tour - Sensors



Accomplishments – Website Tour – Sensor Detail

An official website of the United States government Here's how you know

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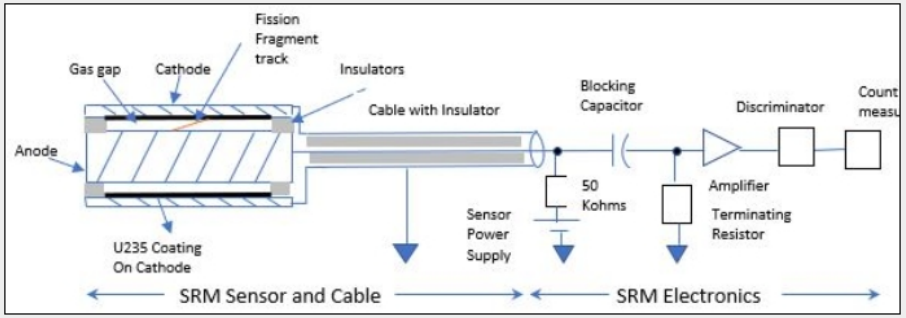
Enter your keywords | My account | Log out

Home | Use Cases | Sensors | Needs | My Favorites | User Forum

Startup Range Monitor (SRM)



BENEFITS

Measurement of neutron flux during reactor startup, and assuring flux stays under safe limits.

Needs and Gaps | Use Case(s) | Operating Environment

Assessed Priority	Accuracy	
Low	No significant changes needed for BWR application. For other applications the acuracy at high count rates (>1E6 CPS) can be improved, if needed, by shortening the pulse width by adding a few percent nitrogen to fill gas which increases ion mobility.	View Details

DETAILS

Description
Count rate increases linearly with neutron flux.

Measurement Type
Count rate of pulses

Applicable Reactor Types
Boiling Water Reactor (BWR)

Manufacturer
General Electric / Reuter-Stokes

Manufacturer Part Number
GE 175A8239

Detector Element Design
Concentric cylindrical Anode/Cathode design; Sensitive length 1 in ; External material 304 SS; Overall length 1.62 in and diam 0.265 in; Anode to Cathode Gas gap 0.0195 in. Fill gas Argon pressure 1110 cm Hg; U235 fission coating (~ 1 mg/cm^2) on Titanium cathode.

Detection Sensitivity
Neutron Sensitivity 6E-3 +/- 20% (CPS/BWR nv); Operating Voltage 350 Volts

Sensitivity to Background
Background noise above discriminator setting is 1 cps at shutdown due to gammas and electronic noise. Background noise becomes negligable as power increases.

Accomplishments – Website Tour – Sensor Detail

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Response time
Response time at shutdown ~10 sec for enough statistical counts; Response time much faster as flux and power is increased and count rate increases.

Measurement Range
1E3 to 1E9 BWR nv; Startup to 1E-3% Reactor Power

Service Life Expectancy
7 Years

Degradation Mechanism(s)
No significant sensitivity decrease because of relative small residence time in the reactor at startup power conditions.

10-year Availability Forecast
SRM is available, but can be replaced with newly developed Wide-Range Monitor (WRM) which combines the functionality of both SRM and IRM.

References
GE and Reuter-Stokes manuals

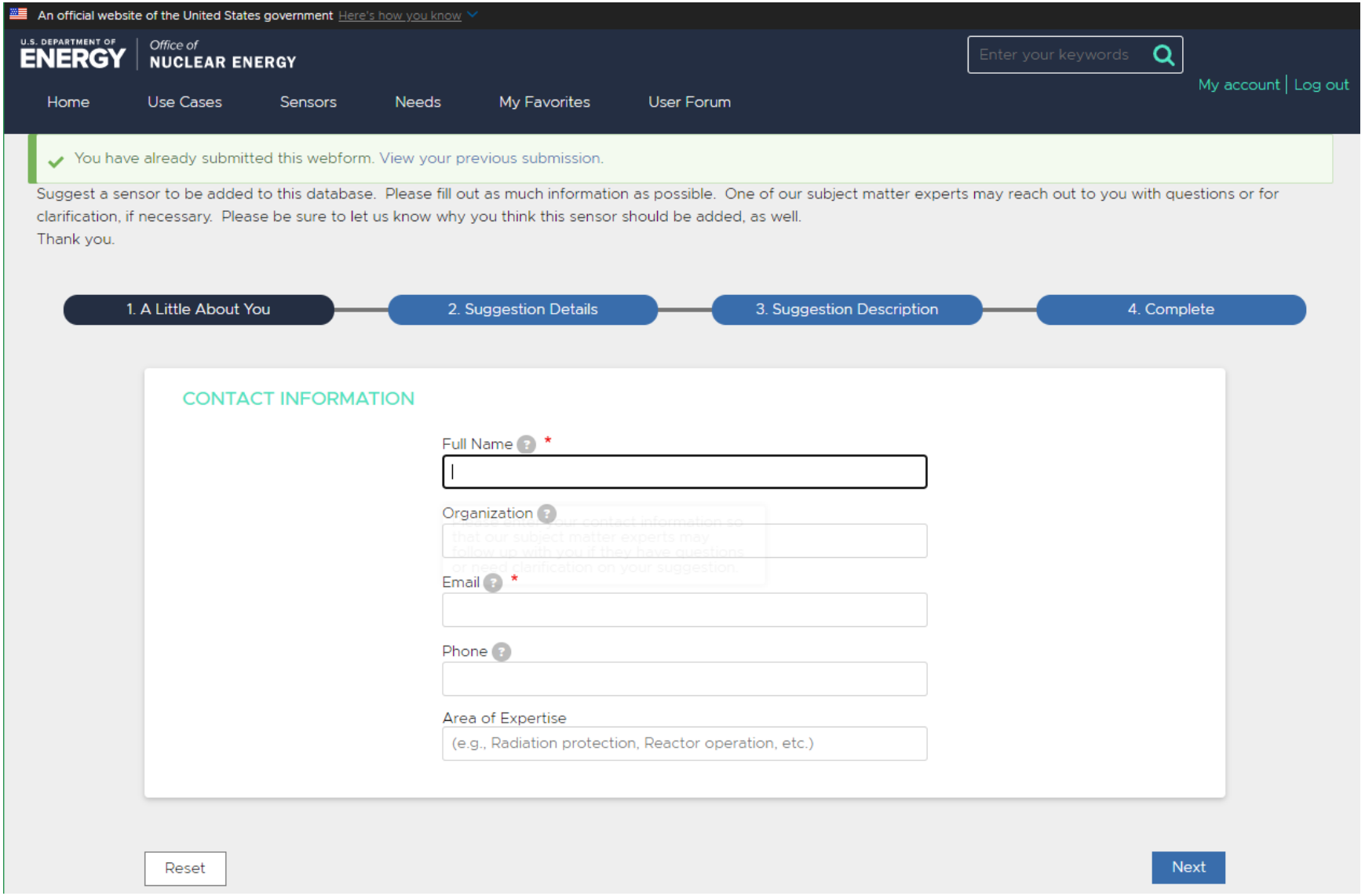
Available Alternatives
WRM

Modularity (Replaceability)
Replaceable

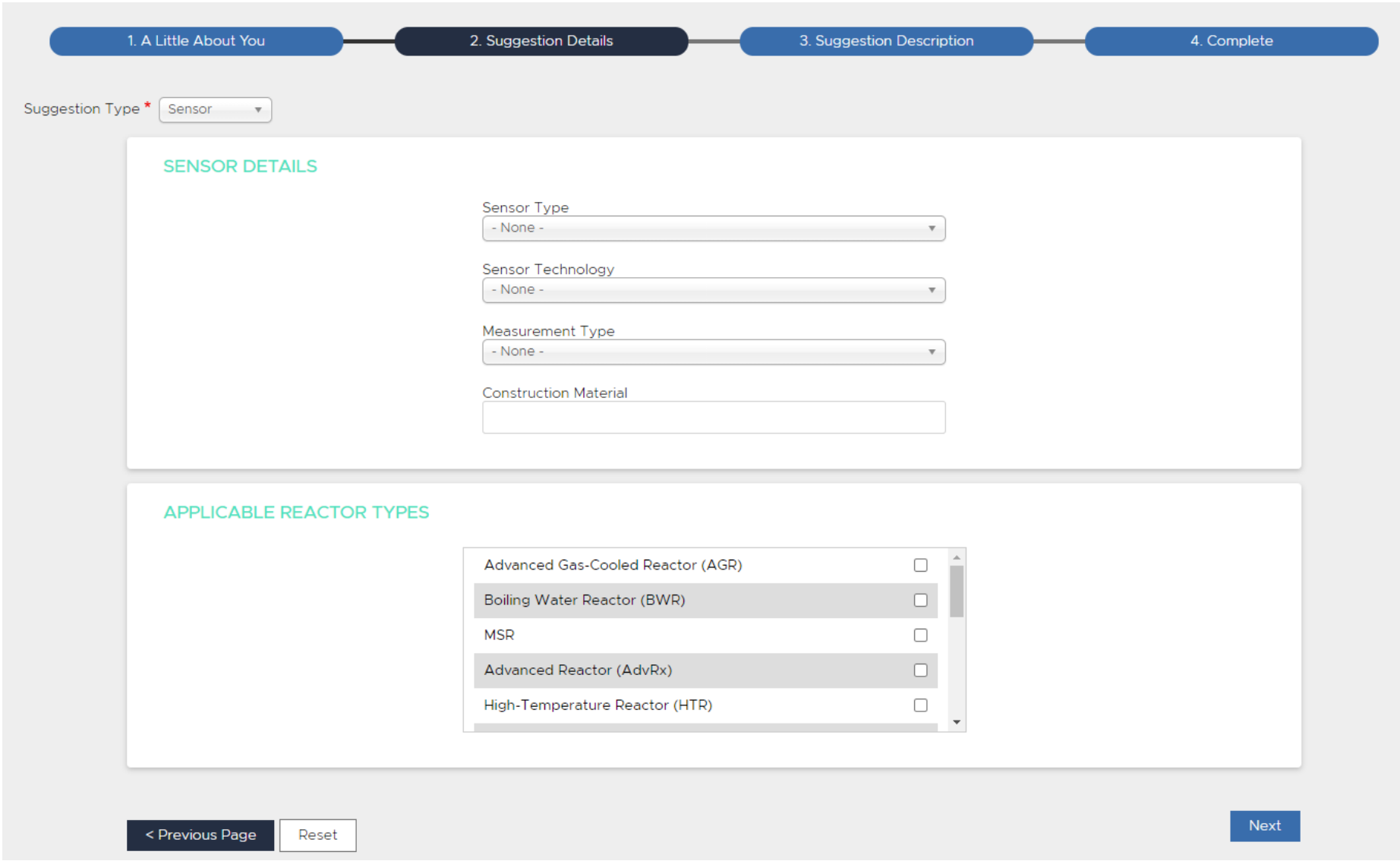
Downloads
DETAILS

Sensor Data Base Information - Report 1.1.1 Rev 0 - BWR SRM_2.pdf

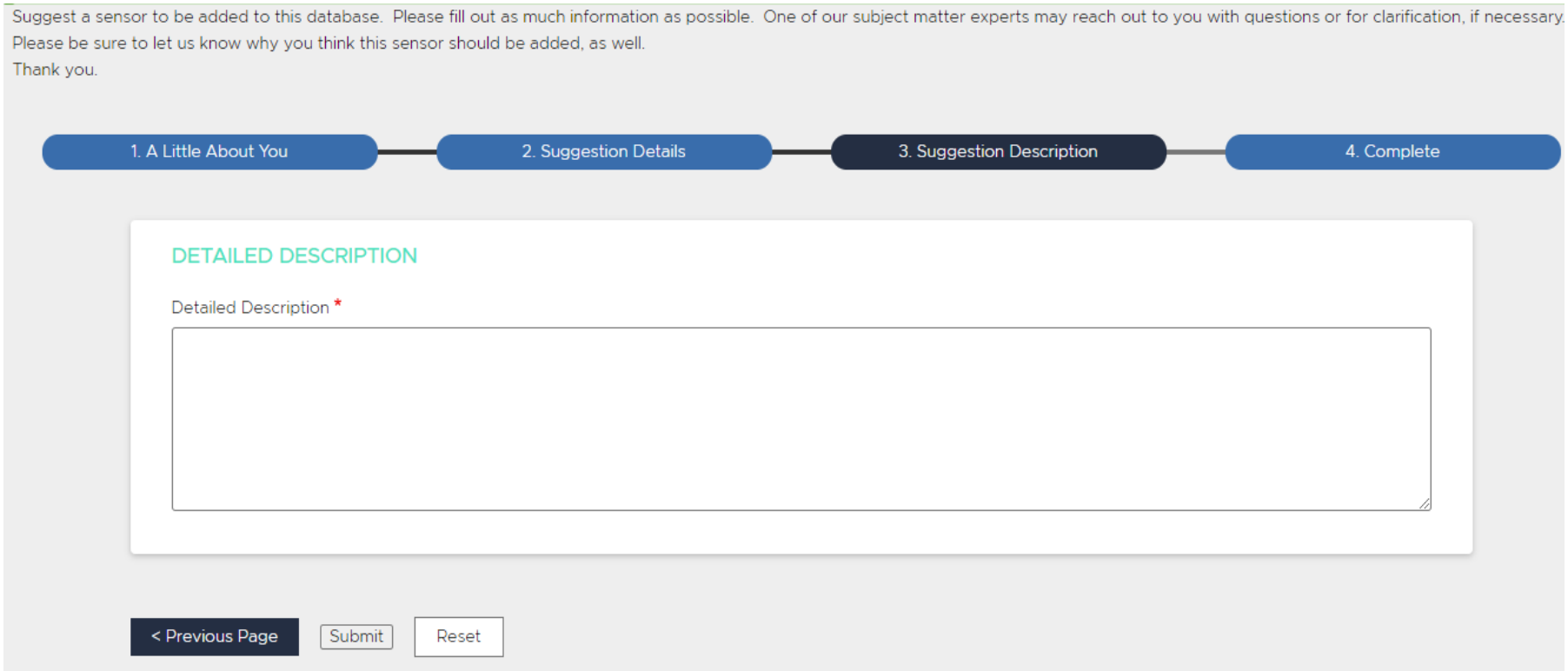
Accomplishments – Website Tour – Suggest Sensor



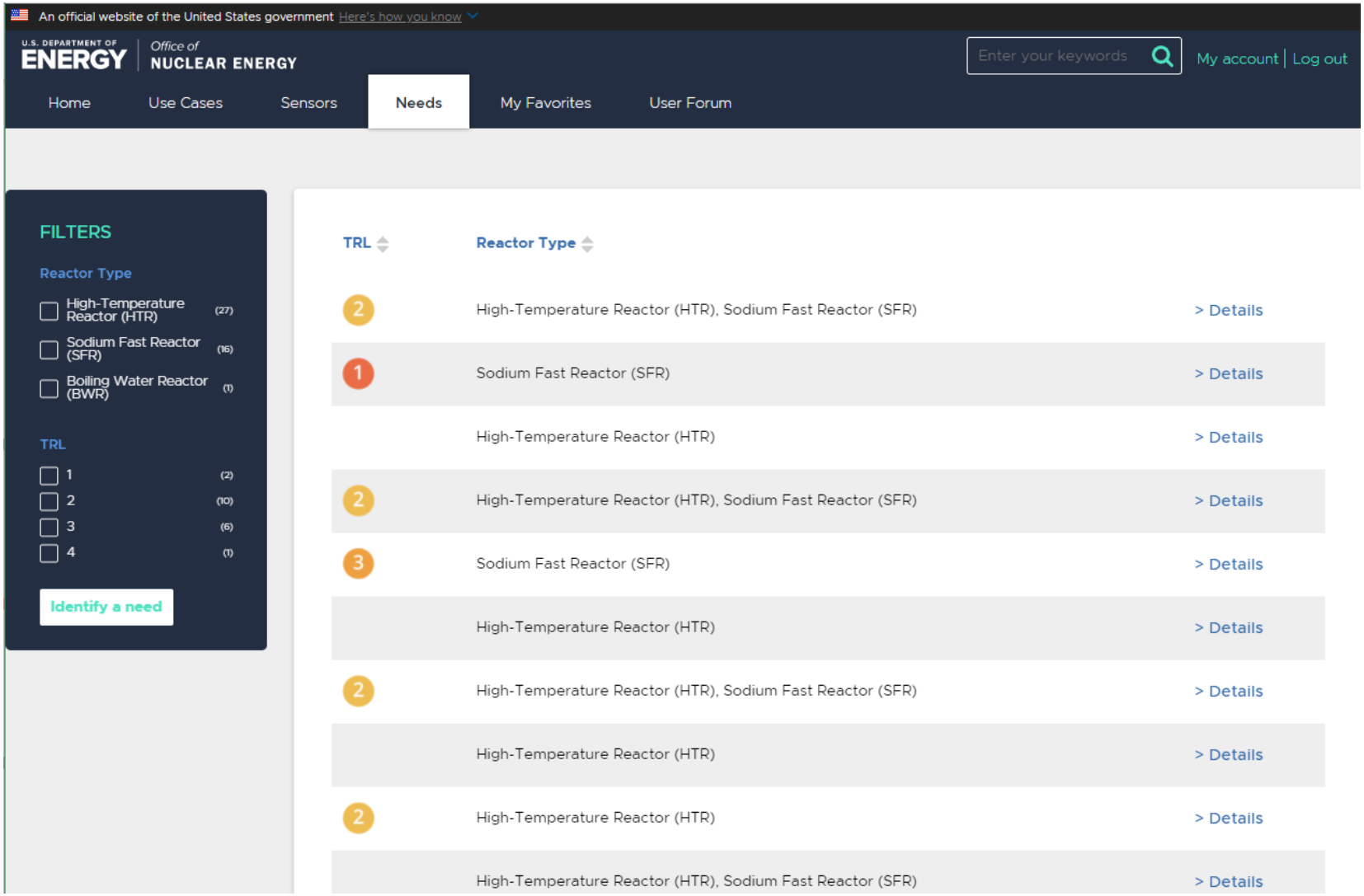
Accomplishments – Website Tour – Suggest Sensor



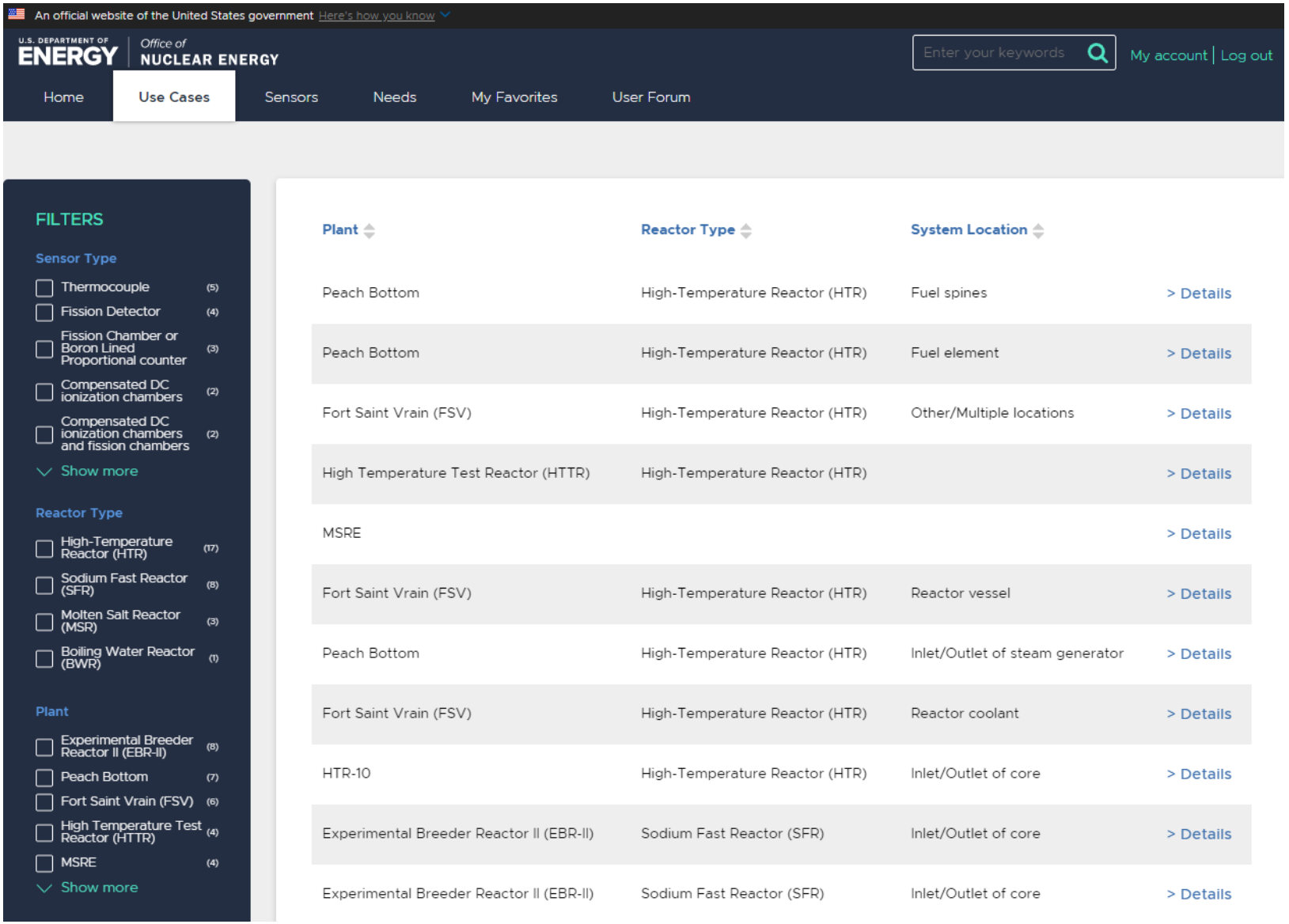
Accomplishments – Website Tour – Suggest Sensor



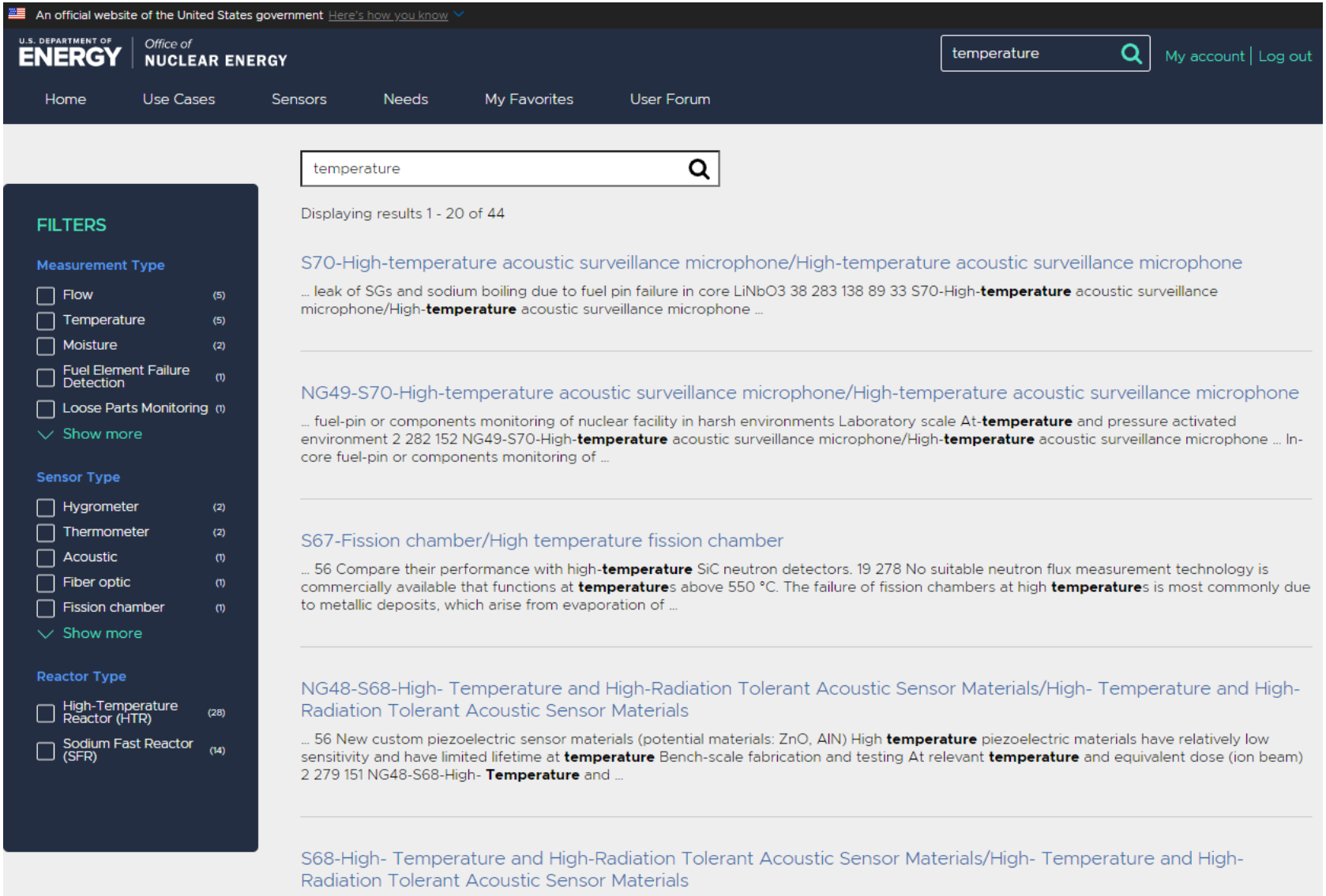
Accomplishments – Website Tour – Needs/Gaps



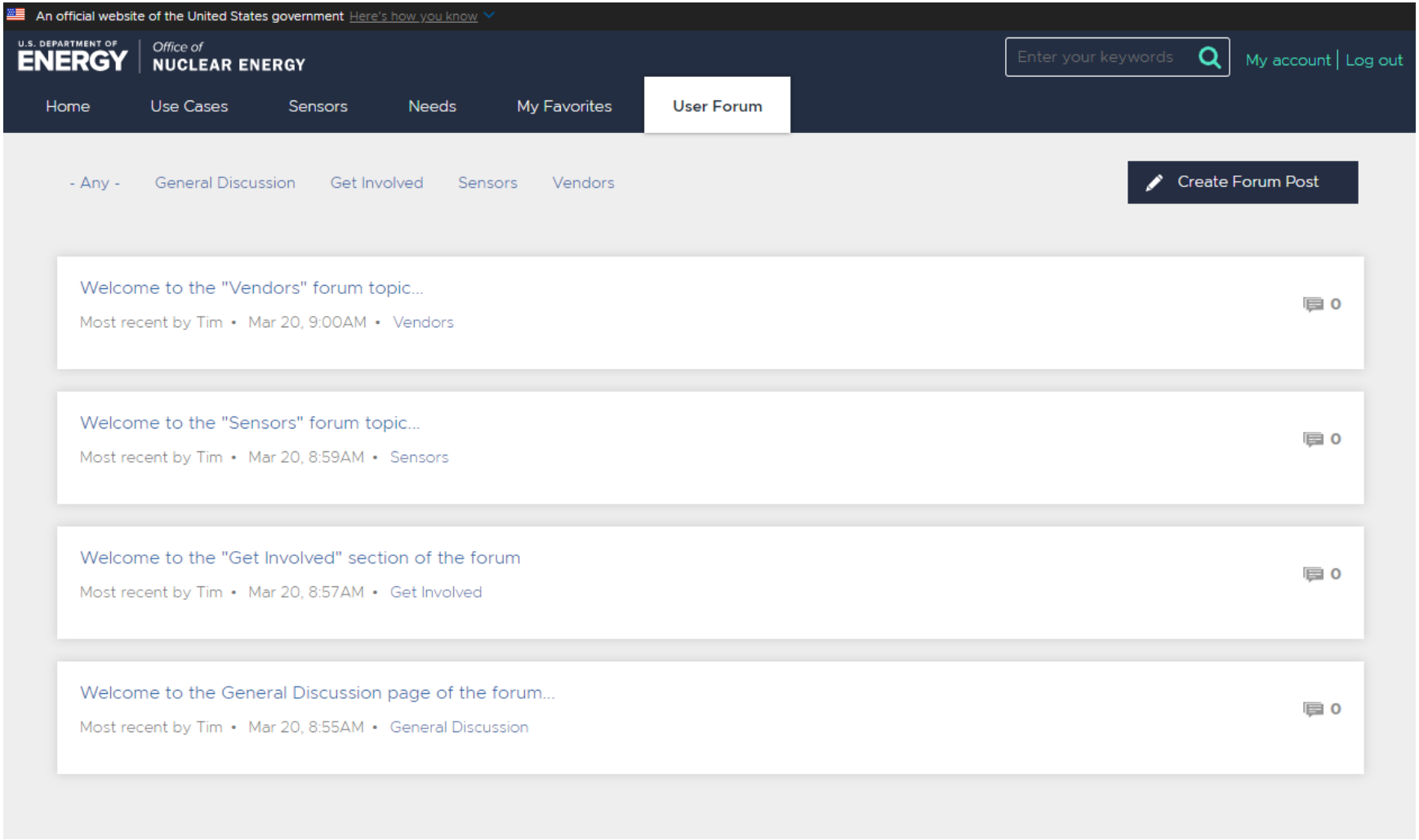
Accomplishments – Website Tour – Use Cases



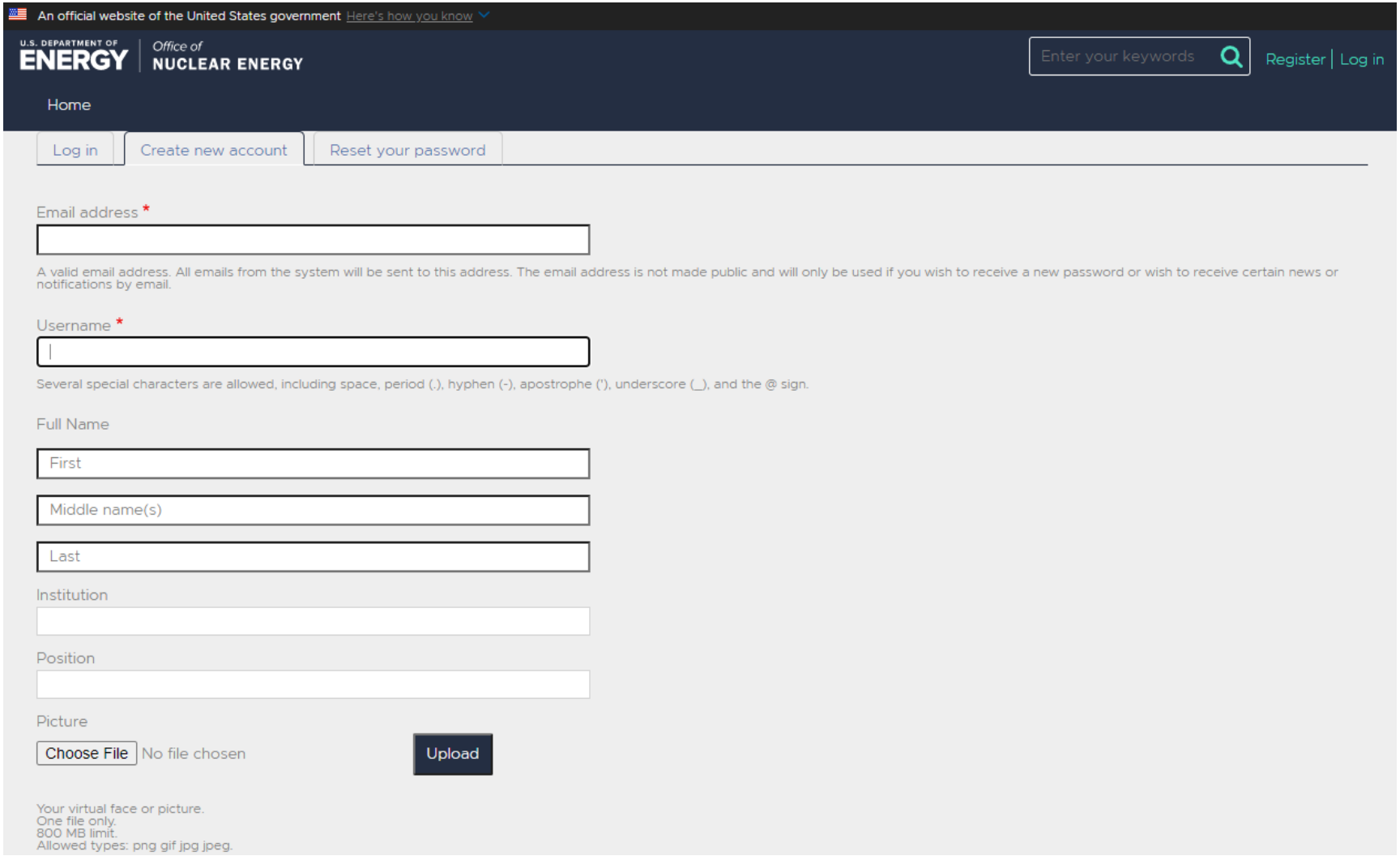
Accomplishments – Website Tour - Search



Accomplishments – Website Tour – User Forum



Accomplishments – Website Tour - Register



Conclusion

Summary: The Nuclear Energy Sensors Website provides a resource for the Nuclear Energy Industry to maintain searchable information on current technology and help guide R&D for the future. It can be expanded as needed to maintain additional information.

URL: https://nes.energy.gov/

- Questions?
- Tim Downing (tim.downing@pnl.gov) for any additional questions that may not be answered during the webinar.