

# Matthew Denman

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*Nuclear Power Reliability Engineer*

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## Education

2007-2011 **Doctor of Philosophy in Nuclear Engineering**, *Massachusetts Institute of Technology*, Cambridge MA.

2003-2007 **Bachelor of Science in Nuclear Engineering**, *University of Florida*, Gainesville, FL.

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## Work History

2019-Present **Kairos Power**, *Principal Engineer, Reliability Engineering*, Albuquerque, NM.

- Responsible Engineer, architect, and lead modeler for the Hermes reactor's Maximum Hypothetical Accident (MHA). The Hermes MHA is the first MHA developed for specifically for a reactor with a "functional containment" safety case. The Hermes MHA is found in Chapter 13 of the Hermes Construction Permit Application.
- Responsible Engineer for the Hermes reactor's Steady State Effluent Release and associated off-site dose methodology development and analysis. The Hermes MHA is found in Chapter 13 of the Hermes Construction Permit Application.
- Responsible Engineer for the Kairos Power Fluoride Salt-Cooled High Temperature Reactor (KP-FHR) Mechanistic Source Term methodology development project which resulted in the first Nuclear Regulatory Commission approved topical report. The first revision of the submitted in June, 2020 and the Safety Evaluation was issued in April 2022.
- Contributor to the development of the KP-FHR Risk-Informed Performance-Based Licensing Basis Development Methodology Topical Report focusing on LBE and SSC classification.

2017-2019 **Sandia National Laboratories, Nuclear Energy Systems**, *Principal Member of the Technical Staff*, Albuquerque, NM.

- Principal Investigator for the reconstitution of the Centralized Reliability Database Organization (CREDO) database to support Probabilistic Risk Assessments and Safety Analysis for Sodium Fast Reactors.
- Project Manager for joint Japanese Atomic Energy Agency and Sandia bilateral (through the Civil Nuclear Energy Working Group) research effort to benchmark effort for sodium fire codes using Sandia Lab Directed Research and Development funded sodium fire test data.
- Project Manager for the incorporation of sodium fire models into the MELCOR computer code.

*Kairos Power*

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- Principal Investigator for an Office of New Reactors evaluation of scoping source terms for High Temperature Gas Reactors, Liquid Fueled Molten Salt Reactors, and Sodium Fast Reactors and developing Risk-Informed Security Criteria.
- Contributing Investigator responsible for the Level 2 Spent Fuel Pool PRA development as part of the NRC Level 3 PRA project.
- Participant in the development of the Generation 4 International Forum Sodium Fast Reactor Safety Design Guidelines Task Force.

2011-2017 **Sandia National Laboratories, Nuclear Energy Systems**, *Senior Member of the Technical Staff*, Albuquerque, NM.

- Contributing Investigator responsible for the development of uncertainty distributions for Safety Relief Valve failure, Safety Vent Valve failure, Decay Heat, and Core Collapse parameters in the Surry and Sequoyah SOARCA Uncertainty Analysis.
- Investigator responsible for characterizing of uncertainties and sensitivity studies on the Fukushima 1F1 accident analysis using MELCOR.
- Principal Investigator for a multi-institute, multi-disciplinary examination of safety and licensing gaps for the Sodium Fast Reactor.
- Principal Investigator of a Lab Directed Research and Development project to create the mathematical formulation for Dynamic Fault Trees to inform decision makers of evolving state of support system success probability mid-accident.
- Principal investigator for a two proof-of-concept Level 2 Risk Assessments to inform the development of Severe Accident Management Guidelines for both integral Pressurized Water Reactors and Sodium Fast Reactors, using a combination of:
  - Severe accident simulation (via MELCOR and SAS4a codes),
  - Discrete Dynamic Event Trees via the ADAPT code, and
  - Decision analysis using Bayesian Networks.

## Professional Society Postions

2022-Present **Sub-Committee of Standards Integration**, *Chair*, Facilitating New Standards.

2019-2022 **Sub-Committee of Standards Development**, *Chair*, Facilitating New Standards.

2018-2019 **Executive Committee**, *Chair*, Budget and Plan Activities.

2021-Present **Advanced Reactor Safety (ARS) Program Committee**, *Chair*, Organize the revival of the ARS conference series..

2019-2020 **ANS Trinity Executive Committee**, *Chair*, Organize and Run Dinner Meetings, Organized Society Activities.

## Awards and Certificates

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- 2020 - JCNRM Certificate of Acclimation for technical contributions to the ANLWR PRA Standard
- 2019 - ANS Certificate of Governance, Chair, NISD, 2018-2019
- 2011 - MIT College of Engineering Reinhold Rudenberg Memorial Prize
- 2009 - ANS Student Conference Best Fast Reactor Presentation
- 2007 - ANS Student Conference Best in Poster Completion
- Honor Societies:
  - Alpha Nu Sigma
  - Tau Beta Pi
- Professional Development Courses:
  - 2012 - Decision-Making, Design, and Strategy Under Uncertainty
  - 2014 - Tackling the Challenges of Big Data, MIT
  - 2016 - Nuclear Plant Safety, MIT (Most Persistent Questioner Award)

## Publications

1. Denman, M. R., LaChance, J., Sofu, T., Flanagan, G., Bari, R., & Wigeland, R. (2012). *Sodium Fast Reactor Safety and Licensing Research Plan-Volume I* (No. SAND2012-4260). Sandia National Laboratories (United States). <https://www.osti.gov/servlets/purl/1044972>.
2. Denman, M. R., & Brooks, D. M. (2015). *Fukushima Daiichi Unit 1 Uncertainty Analysis-Exploration of Core Melt Progression Uncertain Parameters-Volume II*. (No. SAND2015-6612). Sandia National Laboratories; <https://www.osti.gov/biblio/1211553>.
3. Jankovsky, Z. K., Denman, M. R., & Aldemir, T. (2018). Dynamic event tree analysis with the SAS4A/SASSYS-1 safety analysis code. *Annals of Nuclear Energy*, 115, 55–72.
4. Darling, M. C., Luger, G. F., Jones, T. B., Denman, M. R., & Groth, K. M. (2018). Intelligent modeling for nuclear power plant accident management. *International Journal on Artificial Intelligence Tools*, 27(02), 1850003.
5. Power, K. (2021). *KP-FHR Mechanistic Source Term Methodology* (KP-TR-012-A). Kairos Power; <https://www.nrc.gov/docs/ML2127/ML21272A378.pdf>.
6. Power, K. (2022). *Hermes Non-Power Reactor Preliminary Safety Analysis Report; Sec. 11.1.5, 13.1.1, 13.2.1* (HER-PSAR-001 Rev. 1). Kairos Power; <https://adamswebsearch2.nrc.gov/webSearch2/main.jsp?AccessionNumber=ML22272A595>.
7. Power, K. (2020). *Hermes Non-Power Reactor Environmental Report; Sec. 4.8.2, 4.11.13* (HER-ER-001 Rev. 0). Kairos Power; <https://adamswebsearch2.nrc.gov/webSearch2/main.jsp?AccessionNumber=ML21306A133>.
8. Denman, M., Hagaman, J., & Tinsley, G. (2019). *Fluoride-Cooled High Temperature Reactor Licensing Modernization Project Demonstration* (SC-29980-203 Rev 0). Southern Company; <https://www.nrc.gov/docs/ML1924/ML19247C198.pdf>.

## Patent

Dynamic, risk informed decision support systems and methods; US-10997513-B1. Issued May 4, 2021; <https://image-ppubs.uspto.gov/dirsearch-public/print/downloadPdf/10997513>

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