

# UNF-ST&DARDS: A used (spent) nuclear fuel management and analysis tool

**Problem:** Long-term management of used nuclear fuel (UNF) through final disposition is a complex undertaking requiring a variety of data and analysis tools. These tools and data are essential for realistic, time-dependent characterization of UNF and its related systems (e.g., cask systems) to perform the following: (1) address emerging issues during extended storage; (2) support a large-scale transportation campaign; (3) plan for, design, and operate interim storage facility; and (4) support eventual geologic disposition of UNF. There is currently no established software tool providing UNF data and analysis integration streamlining UNF management over many generations.

**Solution:** In response, ORNL is developing Used Nuclear Fuel-Storage, Transportation & Disposal Analysis Resource and Data System (UNF ST&DARDS) for accurately accounting for the changing nuclear and mechanical characteristics of UNF over time, and understanding how these characteristics affect the different storage, transportation, and disposal options. UNF-ST&DARDS incorporates a UNF database integrated with nuclear analysis capabilities, enabling automated assembly- and cask-specific analysis, including depletion/decay, criticality, shielding, and thermal analyses. To enhance the commercial appeal of UNF-ST&DARDS an automated loading algorithm for transferring UNF from a spent fuel pool to a dry-storage cask providing a more comprehensive, long-term UNF management view based on historical and projected UNF inventory will be developed.

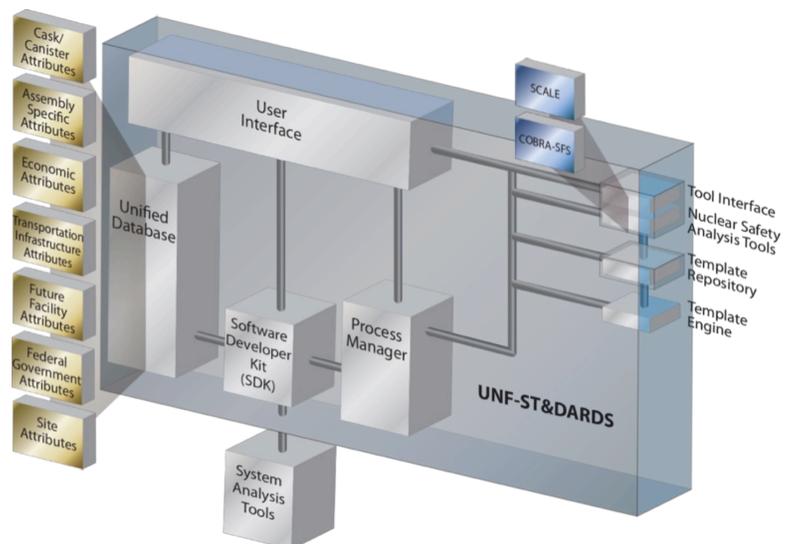
**Impact:** It is evident that industries and other entities (e.g., governmental entities) must manage UNF for several decades. The United States has no current pathway established for permanent disposal of UNF, and it is likely that each nuclear site will require long-term UNF management. UNF-ST&DARDS is being developed to help characterize UNF, so that future decisions can be simplified. UNF-ST&DARDS advantage over the other commercially available codes is the UNF database. The proposed UNFST&DARDS will include a dry storage loading optimization algorithm. While current standard industry software used for dry storage loading lack long-term planning capabilities, UNF-ST&DARDS armed with an inventory projection algorithm, provides a unique capability to develop the loading optimization algorithm to consider all discharges from a reactor.



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## Patent and Invention Disclosures

Used Nuclear Fuel-Storage, Transportation & Disposal Analysis Resource and Data System (UNFST&DARDS), US Copyright TXu2-049-499, June 23, 2017



## Publications

- K. Banerjee, "Special Issue on UNF-ST&DARDS," *Nuclear Technology* 199(3), (September 2017). [http://www.ans.org/pubs/journals/nt/v\\_199:3](http://www.ans.org/pubs/journals/nt/v_199:3)
- K. Banerjee, K.R. Robb, G. Radulescu, J.M. Scaglione, J.C. Wagner, J.B. Clarity, R.A. LeFebvre, and J.L. Peterson, "Estimation of Inherent Safety Margins in Loaded Commercial Spent Nuclear Fuel Casks," *Nuclear Technology*, 195(2), 124-142 (2016).
- K. Banerjee, K.R. Robb, G. Radulescu, P.L. Miller, J.M. Scaglione, J.M. Cuta, and H. Liljenfeldt, "UNF-ST&DARDS: A Unique Tool for Automated Characterization of Spent Nuclear Fuel and Related Systems," *PATRAM 2016, Japan Society of Mechanical Engineers and Atomic Energy Society of Japan, Kobe, Japan* (September 2016).

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