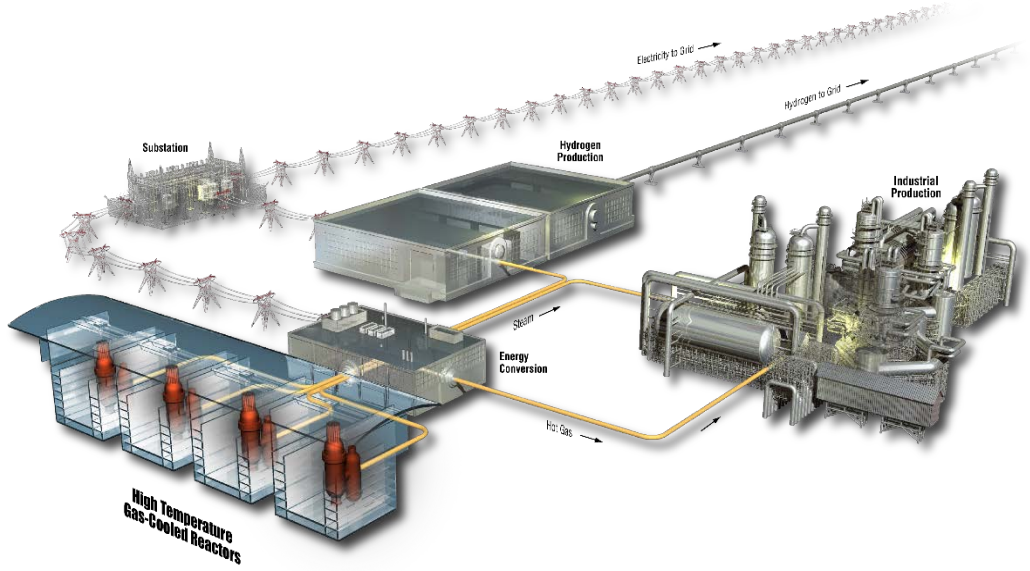
NDMAS Data Management and Archiving

Nancy Lybeck

NDMAS Technical Lead

Advanced Gas Reactor TRISO Fuels Program Review July 18-19, 2017



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Idaho National Laboratory

Motivation

- As scientists, we have a responsibility and a desire to properly preserve our very expensive, publicly funded data
- Future users might include:
  - Reactor vendor engineers
  - NRC
  - Researchers
  - Universities

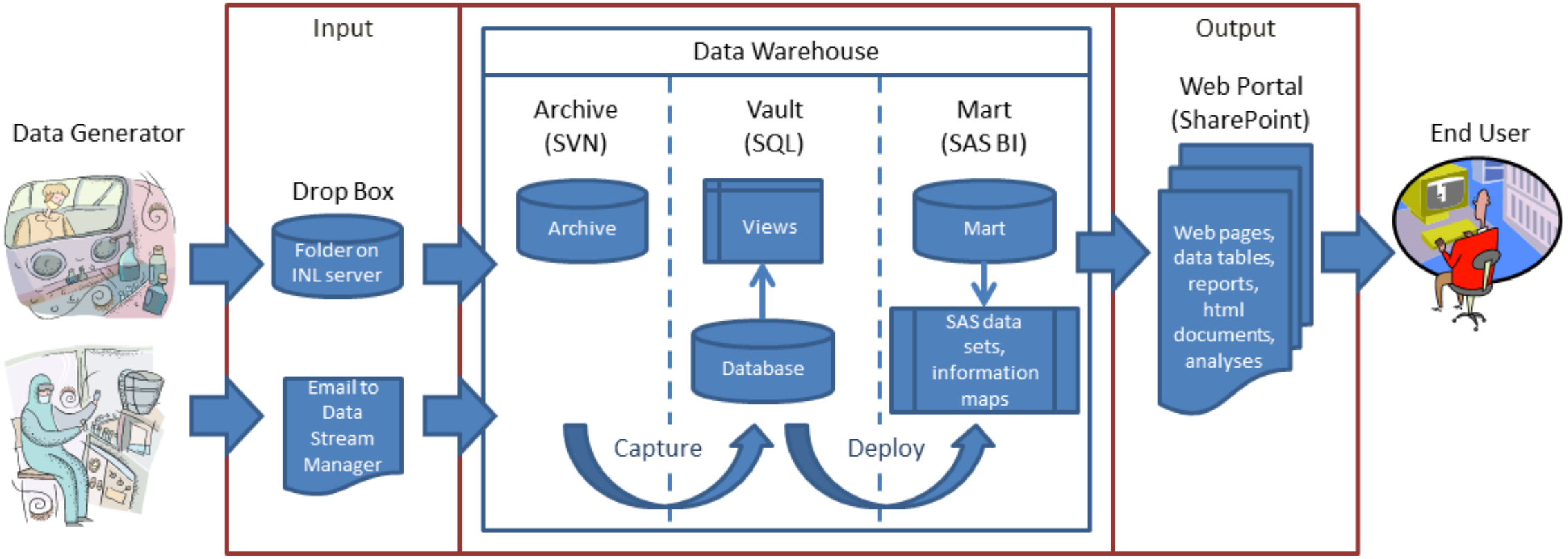
DOE Public Access Plan (2014)

- Effective data management has the potential to increase the pace of scientific discovery and promote more efficient and effective use of government funding and resources. Data management planning should be an integral part of research planning.
- Sharing and preserving data are central to protecting the integrity of science by facilitating validation of results and to advancing science by broadening the value of research data to disciplines other than the originating one and to society at large. To the greatest extent, with the fewest constraints possible, and consistent with the requirements and other principles stated in this document, data sharing should make digital research data available to and useful for the scientific community, industry, and the public.
- Not all data need to be shared or preserved. The costs and benefits of doing so should be considered in data management planning.

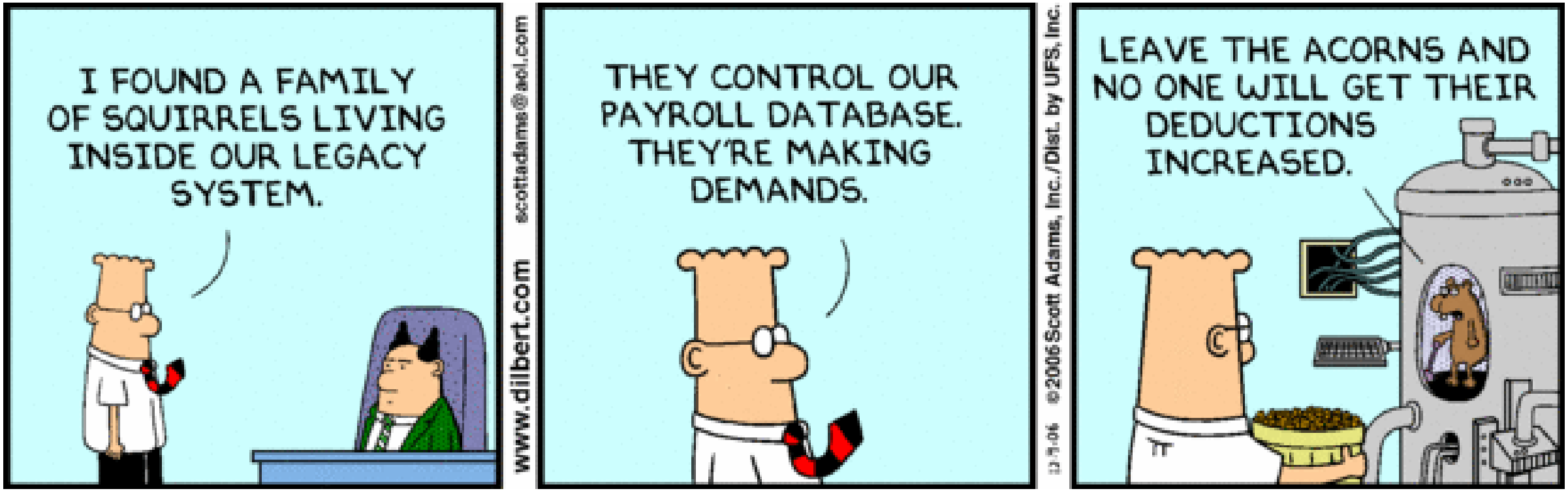
Nuclear Data Management and Analysis System (NDMAS)

- Provide a controlled and central repository and data management system for R&D data
- Provide qualification traceability to level required in support of design decisions and licensing
- Provide extensive statistical analysis and graphing capabilities
- Enable access-controlled web delivery of data, graphs, and analysis results to the research community
- Provide web-based collaboration capabilities to the research community
- Provide an adaptive system to meet individual program needs

NDMAS Data Processing Model




I THINK WE SHOULD BUILD AN SQL DATABASE.
UH-OH
E-mail: SCOTTADAMS@AOL.COM
DOES HE UNDERSTAND WHAT HE SAID OR IS IT SOMETHING HE SAW IN A TRADE MAGAZINE AD?
© 1995 United Feature Syndicate, Inc.(NYC)
WHAT COLOR DO YOU WANT THAT DATABASE?
I THINK MAUVE HAS THE MOST RAM.


I FOUND A FAMILY OF SQUIRRELS LIVING INSIDE OUR LEGACY SYSTEM.
www.dilbert.com scottadams@aol.com
THEY CONTROL OUR PAYROLL DATABASE. THEY'RE MAKING DEMANDS.
©2006 Scott Adams, Inc./Dist. by UFS, Inc.
LEAVE THE ACORNS AND NO ONE WILL GET THEIR DEDUCTIONS INCREASED.

NDMAS 2.0 Database

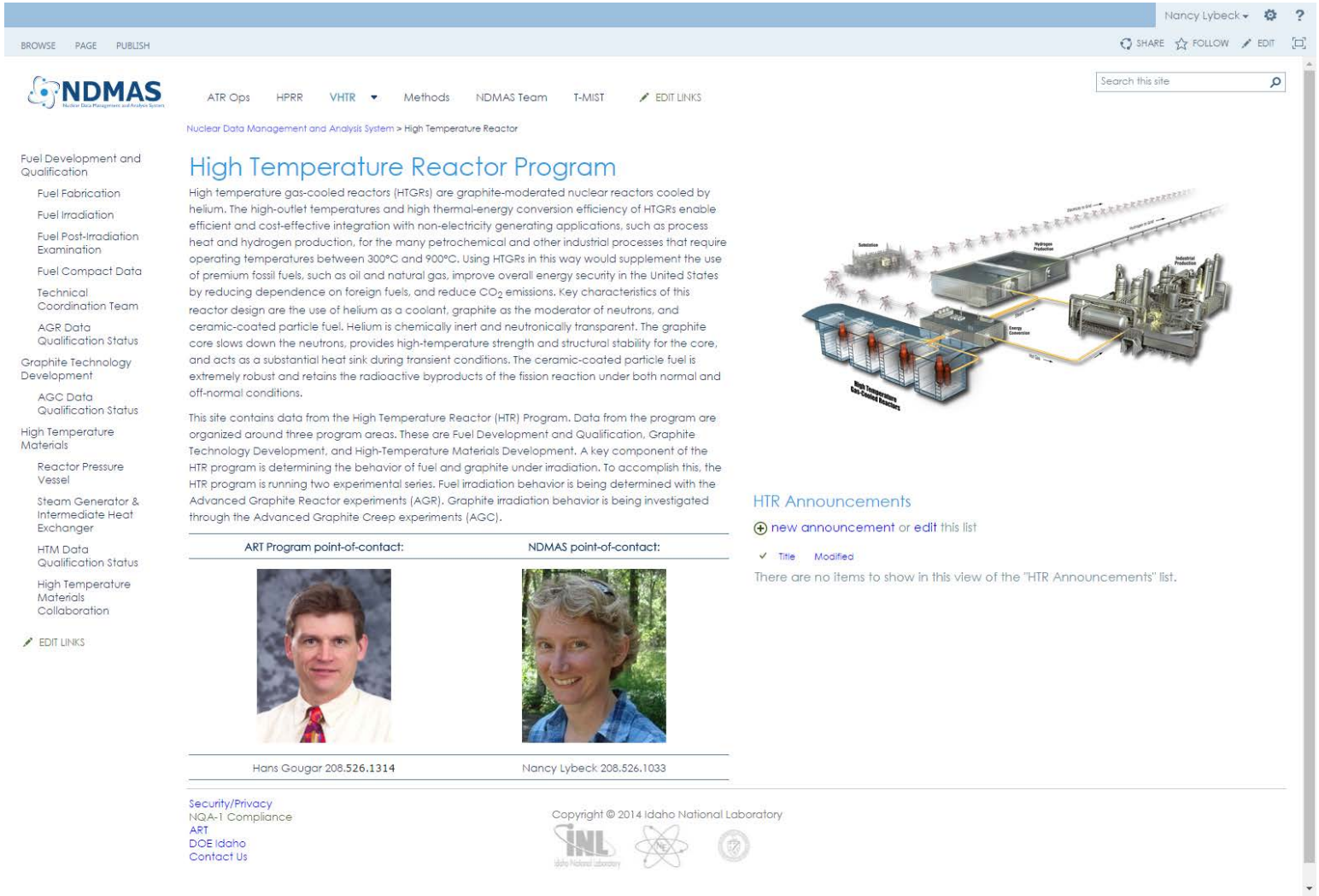
- Data that need to be readily accessible for analysis and dissemination are stored in the database
- Structured Query Language relational database (Vault)
- Access to database structure controlled to NDMAS team only
- Access to data within database controlled with approved authentication
- Conforms to INL Information Management standards
- Operates within framework of NQA-1 2008 / NQA-1a-2009 Addenda
- Uses Microsoft SQL Server technology
- Database structure (schema) is customized for each project

Reference: SDD-228 Rev. 1, “NDMAS 2.0 Database,” March, 2015.


ARE YOU SURE THIS IS HOW WE GET DATA INTO THE CLOUD?
IT

Web Delivery

- Uses SharePoint with SAS EBI to deliver experimental results to the program community over the Internet
  - Downloadable data tables
  - Graphs
  - Analysis results
- Full access control
  - In INL's DMZ
  - Role-based
    - Sites
    - Subsites
  - Row-level data security



ATR Operations

Current Cycle Data

Data for Cycle 161A Through 30JUN17:16:00

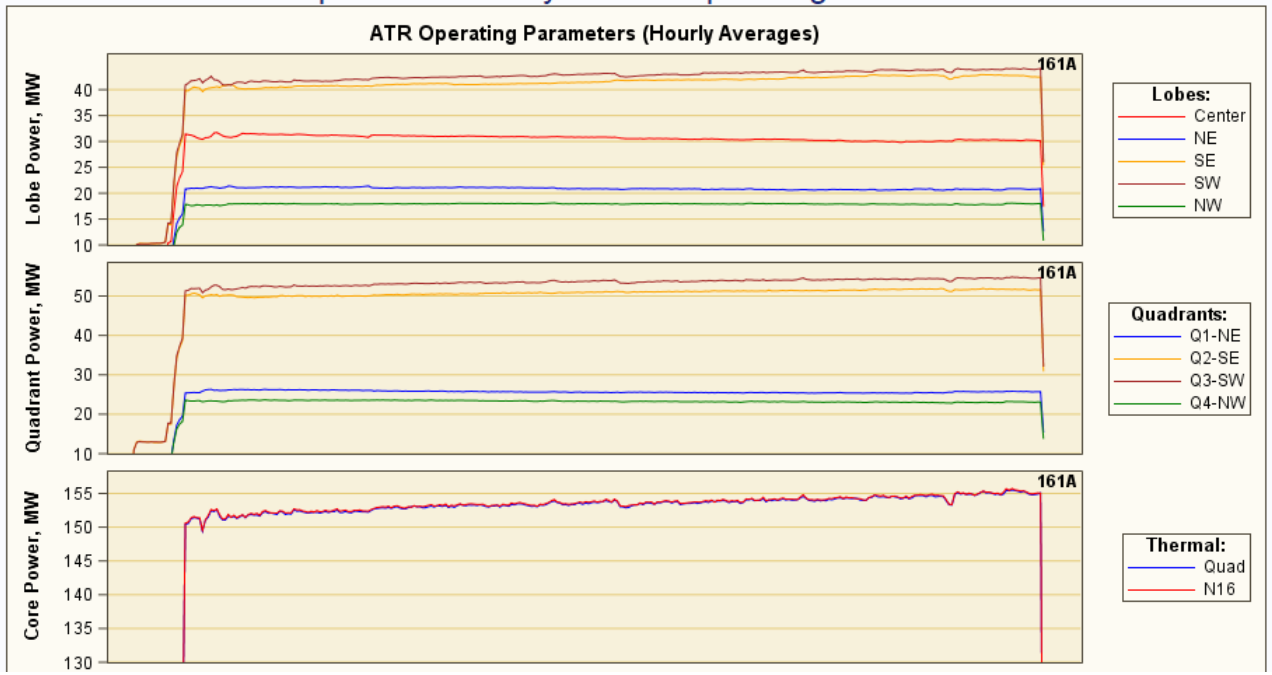
	C	NE	NW	SE	SW
Averaged Power (MW)	29.44	20.06	17.22	39.89	41.04
Maximum Power (MW)	31.73	21.41	18.12	42.91	44.11
Time of Maximum Power	30MAY17:13:00	01JUN17:18:00	04JUN17:11:00	10JUN17:17:00	11JUN17:07:00

Download Hourly Avg Operating Data for Cycle 161A

Cycle 161A Startup(s)
1 - 29MAY17:02:45

Download Center Lobe Power at Startup(s) for Cycle 161A

Graphical Summary of ATR Operating Parameters



Advanced Gas Reactor Irradiation Monitoring

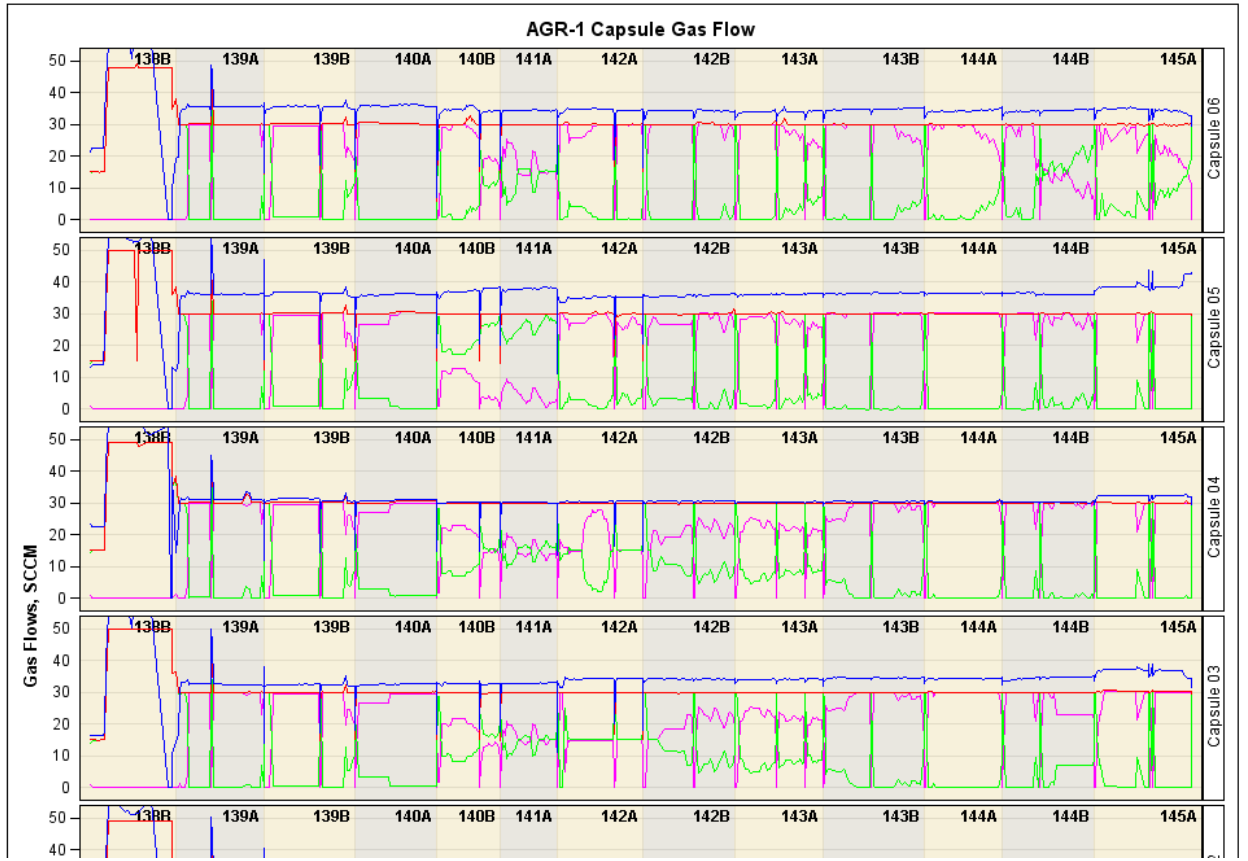
NDMAS

ATR Ops HPRR VHTR Methods NDMAS Team T-MIST EDIT LINKS

Nuclear Data Management and Analysis System > High Temperature Reactor > Fuel Development and Qualification > Fuel Irradiation > AGR-1 Irradiation

- Fuel Fabrication
- Fuel Irradiation
  - AGR-1 Irradiation
  - AGR-2 Irradiation
  - AGR-3/4 Irradiation
  - AGR-2 Irradiation (U.S.)
- Fuel Post-Irradiation Examination
- Fuel Compact Data
- Technical Coordination Team
- AGR Data Qualification Status

Gas Flow Rates

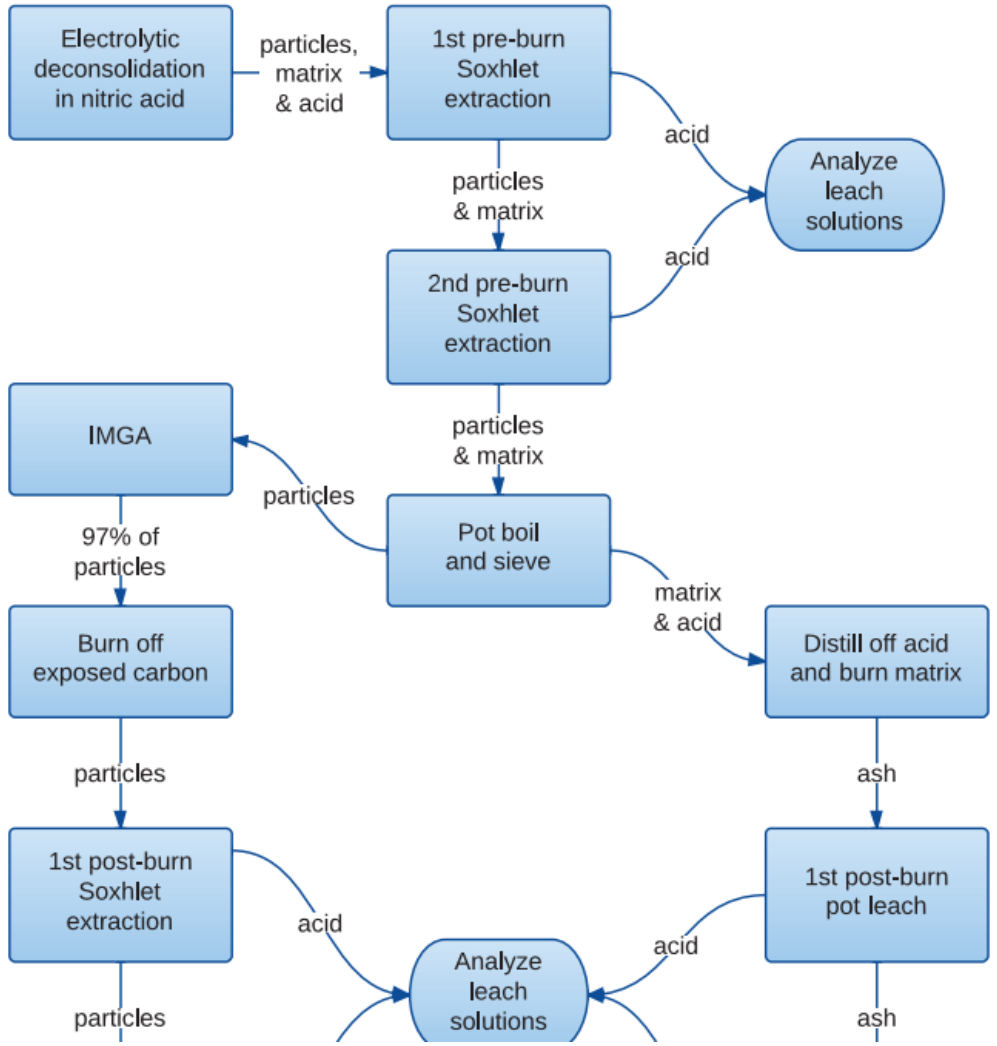


Post-Irradiation Examination

Table of Contents

1. DLBL Process
   - Flow diagram of compact DLBL processing
   - Compacts used for DLBL processing
2. DLBL Solutions for Compacts
   - 6-3-2
   - 5-3-1
   - 4-3-3
   - 4-1-1
   - 3-2-1
   - 1-3-1
   - Fractional Inventory
3. IMGA for Compacts
   - 6-3-2
   - 5-3-1
   - 4-3-3
   - 4-1-1
   - 3-2-1
   - 1-3-1

Flow diagram of compact DLBL processing



Fuel Fabrication

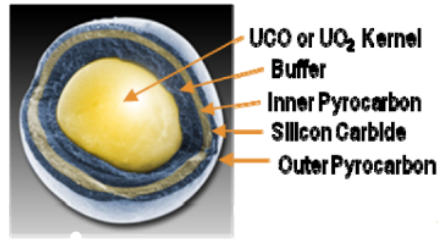
ATR Ops | HPRR | VHTR | Methods | NDMAS Team | T-MIST | EDIT LINKS

Search this site

Nuclear Data Management and Analysis System > High Temperature Reactor > Fuel Development and Qualification > Fuel Fabrication

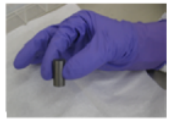
Fuel Fabrication

The Fuel Fabrication project develops and qualifies fuel fabrication processes that can serve as the foundation for fabrication of commercial-scale, coated-particle fuel for HTGRs. The fabrication process developed within the VHTR TDO/AGR fuel program begins with UCO or UO_2 kernels formed by the internal gelation process in which droplets of uranium-containing chemical broth are formed into gel spheres in a fluid medium. The resulting gel spheres are then dried and sintered into hard ceramic spheres yielding kernels of a controlled and consistent size and chemistry. Fuel kernels are coated using a fluidized-bed chemical vapor deposition process. The coatings include a low-density carbon layer (buffer layer), a high-density inner pyrolytic carbon (IPyC) layer, a silicon carbide (SiC) layer, and a high-density outer pyrolytic carbon (OPyC) layer. These coatings are designed to work together to make each fuel particle a mini pressure vessel that will maintain its integrity and retain fission products during normal reactor operation and potential accident conditions. The finished coated particle is a small (~1 mm diameter) carbon and ceramic sphere that is stable to temperatures well beyond 1,600°C.



Fuel particles are imbedded in a thermoplastic matrix consisting of petroleum pitch mixed with graphite powder and molded into right-circular cylinders. Each cylinder is called a compact. A compact contains from 1,800 to 4,200 particles depending on the uranium loading per kernel and the desired total uranium content per compact.


Coated Fuel Particles


Fuel Compact

Contact for Fuel Fabrication:	Contact for Web Page:
	
Doug Marshall 208.526.3657	Larry Hull, 208.526.1922

Links to Fabrication Data

✓	URL	Notes
	Particle Batch	Data from batches of TRISO particles. Data that are collected on a sample of particles to infer the properties of the entire batch of particles.
	Layer	Data on the multiple layers applied to the TRISO particles: buffer, IPyC, SiC, OPyC, and overcoat layers.
	Compact Lot	Data collected from a sample of fuel compacts used to infer the characteristic of the entire lot of compacts. Usually involves destructive testing.
	Kernel	Data for the fuel kernel which contains the uranium fuel.
	Compact	Information measured on individual compacts

Reactor Experiments

- Current Experiments
  - Reactor power and experiment monitoring data are delivered several times a day
  - Data are processed and pushed to the database immediately
  - Data are and plots are updated in SAS at least once a day
  - Researchers can view most recent plots or download data via stored processes
- Completed Experiments
  - Excel files have been generated and stored in SharePoint libraries for easy access

Documents

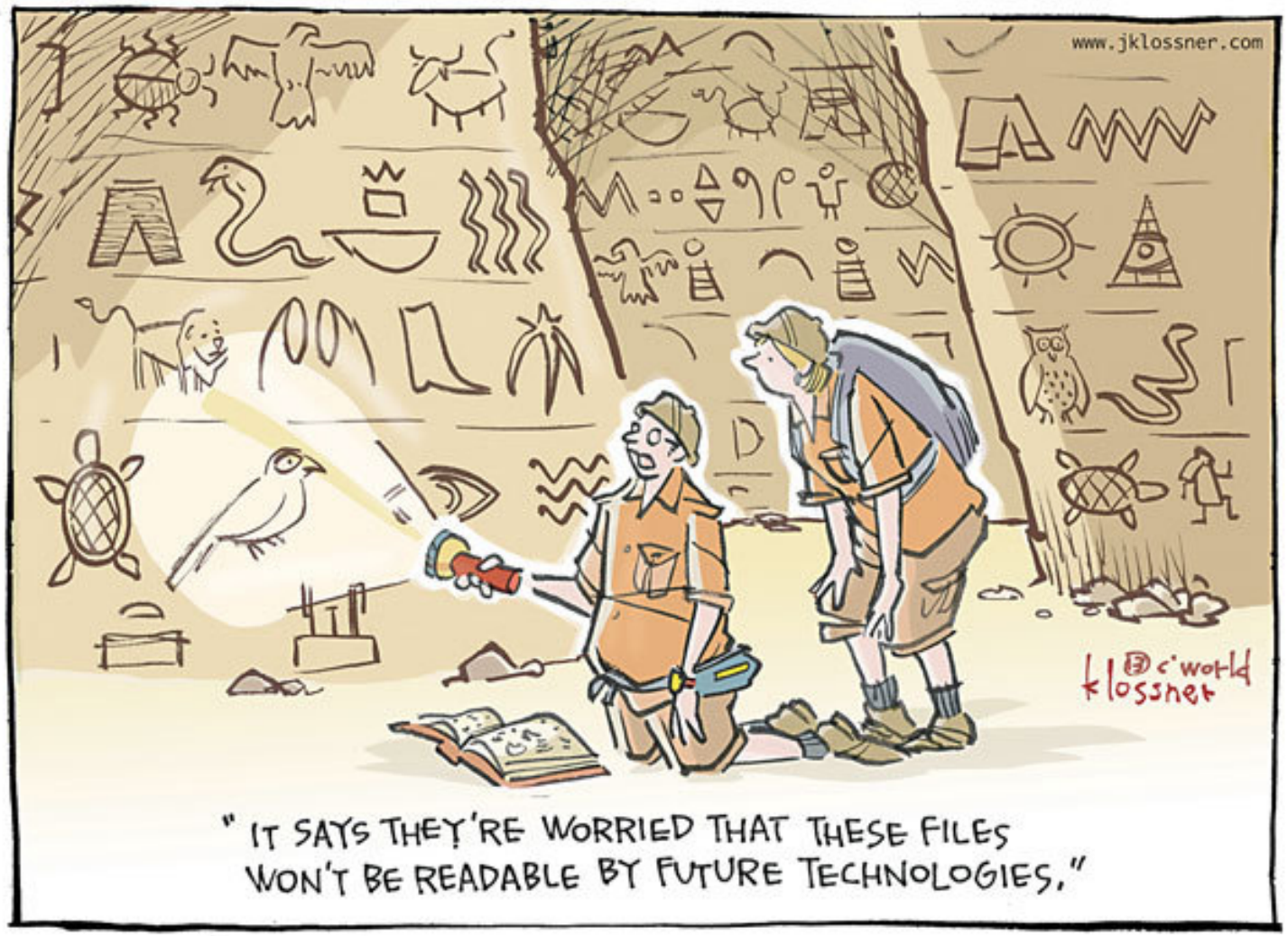
- All controlled documents are stored in EDMS
- SharePoint libraries can be used to store and organize important documents that need to be more accessible
  - As a file (pdf or word document)
  - As a link to EDMS (only accessible within the firewall)
- Term Sets can be used to categorize documents if desired
- Custom search applications can be developed as needed
- All documents included would have to have a full STIMS release
- Currently we only have select reports stored in SharePoint

Example: Fuel Irradiation Web Page

Data Qualification and Analysis Documents

The reports listed below are not record copies, and may not represent the most recent version. The INL Electronic Document Management System (EDMS) should be used to provide the record copy of the document. The ECARs listed below have a direct link to EDMS. Unfortunately, these links will not work for users outside the INL firewall. External users who wish to obtain a copy of a document stored in EDMS should contact Nancy Lybeck, 208-526-1033.

Name	Document ID
Experiment : AGR-1 (7)	
AGR-1 Thermocouple Data Analysis	INL/EXT-12-24761
AGR-1 Final As-Run Report Rev3	INL/EXT-10-18097
AGR-1 JMOCUP As-Run Daily Depletion Calculation	ECAR-958
AGR-1 Daily As-Run Thermal Analysis	ECAR-968
Release-to-Birth Ratios for AGR-1 Operating Cycles 138B through 145A	ECAR-907
AGR-1 Data Qualification Report	INL/EXT-10-17943
Uncertainty Quantification of Calculated Temperatures for the AGR-1 Experiment	INL/EXT-12-25169
Experiment : AGR-2 (6)	
Experiment : AGR-3/4 (7)	


www.jklossner.com
" IT SAYS THEY'RE WORRIED THAT THESE FILES WON'T BE READABLE BY FUTURE TECHNOLOGIES."

Moving Forward

- New users
  - Request account @ https://ndmas.inl.gov/SitePages/Home.aspx
  - Need an INL POC to verify their need to access data
  - A restricted party screening is run
  - Foreign nationals require a security plan
  - They will be added to one or more SharePoint (and SAS if needed) security groups based on the data they need to access
- As experiments close out, convert most data downloads to downloadable Excel files
- At end of project
  - Records retention 25 years past end of the project
  - Archive raw data files to company records system (EDMS)
  - Permanently archive the database to EDMS
  - As long as possible with minimal intervention:
    - Maintain the database
    - Maintain the web site
    - Add new users who are U.S. citizens

FY17 Milestone Status

- Level 2 Milestone (M2AT-17IN1603037), “Complete and Publish the AGR-1 PIE Subsite on the NDMAS Sharepoint Site” completed June 30, 2017.
- Submitted June 30, 2017 with technical evaluation, AGR-1 Post-Irradiation Examination Web Page Design, (INL/EXT-17-42302) as evidence of completion.

NDMAS Data

- Advanced Reactor Technologies
  - Fuel Fabrication
  - Irradiation Monitoring (Fuel and Graphite – near real-time)
  - Post-Irradiation Examination (Fuel & Graphite)
  - Graphite Characterization
  - High Temperature Materials Mechanical Tests
  - Methods Validation Data
    - JAEA's High Temperature Test Reactor
    - Argonne National Laboratory's Natural convection Shutdown heat removal Test Facility (NSTF)
    - Oregon State University's High Temperature Test Facility (HTTF)
- Advanced Test Reactor operations (near real-time)
- Accident Tolerant Fuel
- TMIST (near real-time)
- High Performance Research Reactor
- Advanced Fuel Campaign

Idaho National Laboratory