Process Flow Diagrams and Node Descriptions (PFDND) for the WMS

Robby Joseph, Rob Howard, Gordon Petersen, Richard Hale (ORNL)
Mark Nutt (ANL)

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josephiraiii@ornl.gov
(865)241-3039

PFDND can enhance and inform many aspects of NFST work

- **Process flow diagrams are being developed for the various material flow operations described in the WMS architecture studies (FY12 and FY13)**
  - Flow diagrams with individual process node descriptions
  - Equipment lists for each node

- **PFDND can help the NFST project in a variety of ways:**
  - Help inform the Functions and Requirements activity
  - Better evaluate storage and transportation scenarios
  - Next generation systems tools development
  - Training of people new to the project

- **Process Flow Diagrams and Node Descriptions structure**
  - Equipment Lists
  - Outline

- **Continued Work**

- **How the PFDND can help our project**

- **Demonstration of PFDND**

# The Visio program allows for a multilayered visual aid of the PFDND

- **Top Level starting point is based on System Architecture studies**
- **"Options" worksheets allow user to select option of interest**
- **"Process" worksheets give detailed information about flows**

- **Node Descriptions and Equipment Lists give detailed information about the WMS**
  - "Nodes" are defined as a processing event that contains a node description and an equipment list in the PFDND

"Top level" worksheet starting point is based on system architecture studies

- **Chart on right represents all the paths from reactor sites to disposal that were studied in the FY2012 system architecture study**

- **Clicking on various 'boxes' on top level worksheet allows you to drill down into process flow details**

- **Under the top level slide are either "Options" worksheets or "Process" worksheets**
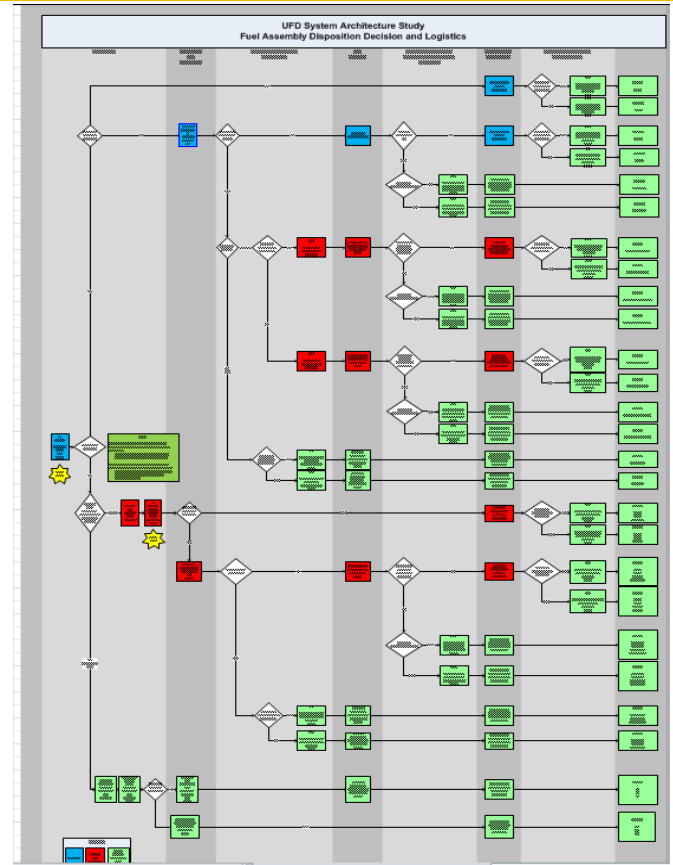
UFD System Architecture Study Fuel Assembly Disposition Decision and Logistics

- **"Options" worksheets have various options instead of process flow steps**

- **Worksheet shown to the right shows the transportation options that users can select**

- **"Options" worksheets link to "Process" worksheets or Node Descriptions**

Waste Acceptance from Origin and Transportation Operations

Node C8a

Rail Option 1- Rail Track Available to Utility Cask Receiving Area inside protected area

Rail Track Available to Utility Cask Receiving Area inside protected area. In Rail Option 1, the rail cask car has the ability to move directly under the crane hook at the cask receiving area

Node C8b

Rail Option 2- Heavy Haul and Legal Weight Truck

Because of a lack of rail track into the cask receiving area, limits on rail car length in the CRA, floor weight restrictions in the cask receiving area, or crane weight restrictions in the cask receiving area, the cask must be transloaded by a portable crane onto a heavy-haul (HH) vehicle or legal weight truck (LWT) for placement under the cask receiving area crane hook.

Node C8c

Rail Option 3- Rail Line Available to Utility Owner Controlled Area

The Intermodal Barge Option involves barge transport; and may use Heavy Haul vehicle or LWT as appropriate to the specific facility requirements. Coordination with the Captain of the Port and the Coast Guard will be required for this option.

Node C8d

Intermodal with Heavy Haul Truck Option

The rail line ends before it reaches the utility owner controlled area. LWT or Heavy Haul vehicles are used to transfer the casks between the end of the rail line and the protected area. This highway movement is over public roads and therefore requires coordination and permits from the State and possibly local governments.

Node C8e

Intermodal Barge Option

The Intermodal Barge Option involves barge transport; and may use Heavy Haul vehicle or LWT as appropriate to the specific facility requirements. Coordination with the Captain of the Port and Coast Guard will be required for this option

C.8,D.4; E.4,F.4; P.8, Q.7; R.4; S.4; T.4

Source: WMS Concept of Operations, Appendix A

"Process" worksheets give detailed information about WMS flows

■ **Some process worksheets are upper level processes that hyperlink to more detailed process worksheets**

■ **Process worksheets also link to node descriptions and equipment lists**

Wet Packaging Operations
(Canister Based Storage System)
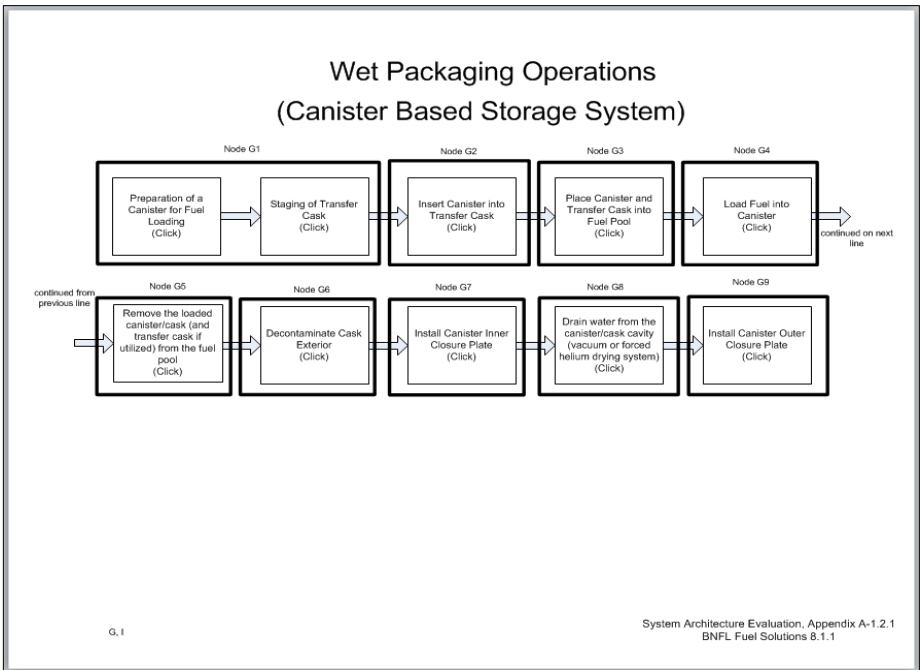
Node descriptions and equipment lists give in-depth details of processes

■ **Node descriptions contain many details about the steps being described**

(Excerpt from node description)

> ■ **The bare fuel will be wet loaded, so the cask must first be put in the water. To place the cask into the pool, first connect the cask lifting yoke to the hook of the fuel building crane, if not already in place and hang the top shield plug from the lifting yoke using the associated yoke rigging cables. ……..**

■ **Each node has a suggested equipment list**

■ **Very general for now based on available information**

- Possible to expand to vendor-specific equipment lists when more information is available

(Excerpt from equipment lists)

- Equipment involved in Node C3:
  - Transfer Cask
  - Lifting Yoke
  - Fuel building crane
  - Top shield plug
  - Rigging cables
  - Clean demineralized water
  - Compressed air

NFST
NUCLEAR FUELS STORAGE & TRANSPORTATION

Visio diagram strategy chosen to be user-friendly

■ Easy Navigation

- Back button (Visio-only) and hyperlinks make PFDND exploration easy

■ Users have two ways to view the PFDND file

- Obtain Visio
- Download Visio reader add-on to Internet Explorer from Microsoft website

NOTE: MAC users must run Windows in parallel to read Visio file

- **An outline has been created that shows the worksheet paths that can be taken by the user**

- **Excerpt of outline shown at the right**

- **Worksheets A,B,C, etc. can be linked from the logic sheet 'I'**

  - Worksheets 1,2,3,etc. can be linked from Worksheet 'A'

I. **Logic Sheet**
A. **At Reactor Storage Existing Sized Containers**
   1. Preparation of a Canister for Fuel Loading
   2. Staging of Transfer Cask
   3. Insert Canister into Transfer Cask
   4. Etc.
B. **At-Reactor Operations for On-Site Dry Storage**
   1. Preparation of a Canister for Fuel Loading
   2. Staging of Transfer Cask
   3. Etc.
C. **Transport Bare Fuel in Reusable Casks to CIS**
   1. Set Site Specific Campaign Plan
   2. Receive the Cask
   3. Put the cask into the Pool

Variety of resources have been incorporated into PFDND

■ **List of resources used include:**

- WMS Concept of Operations
- System Architecture Evaluation FY12 and FY13
- DOE-CH-TOP-001-1987
- DOE-CH-TOP-001-1992
- Dry Storage of Used Fuel Transition to Transport
- Wet handling Facility Event Sequence Development Analysis
- YM Wet Handling Preliminary Throughput
- BNFL Fuel Solutions Storage System FSAR
- Progress Review Meeting TO#14: Transfer of UNF Stored in Non-Disposable Canisters
- IAEA-TECDOC-1081: Spent Fuel Storage and Cask Decontamination and Modification
- NWTRB Evaluation of the Technical Basis for Extended Dry Storage and Transportation of UNF

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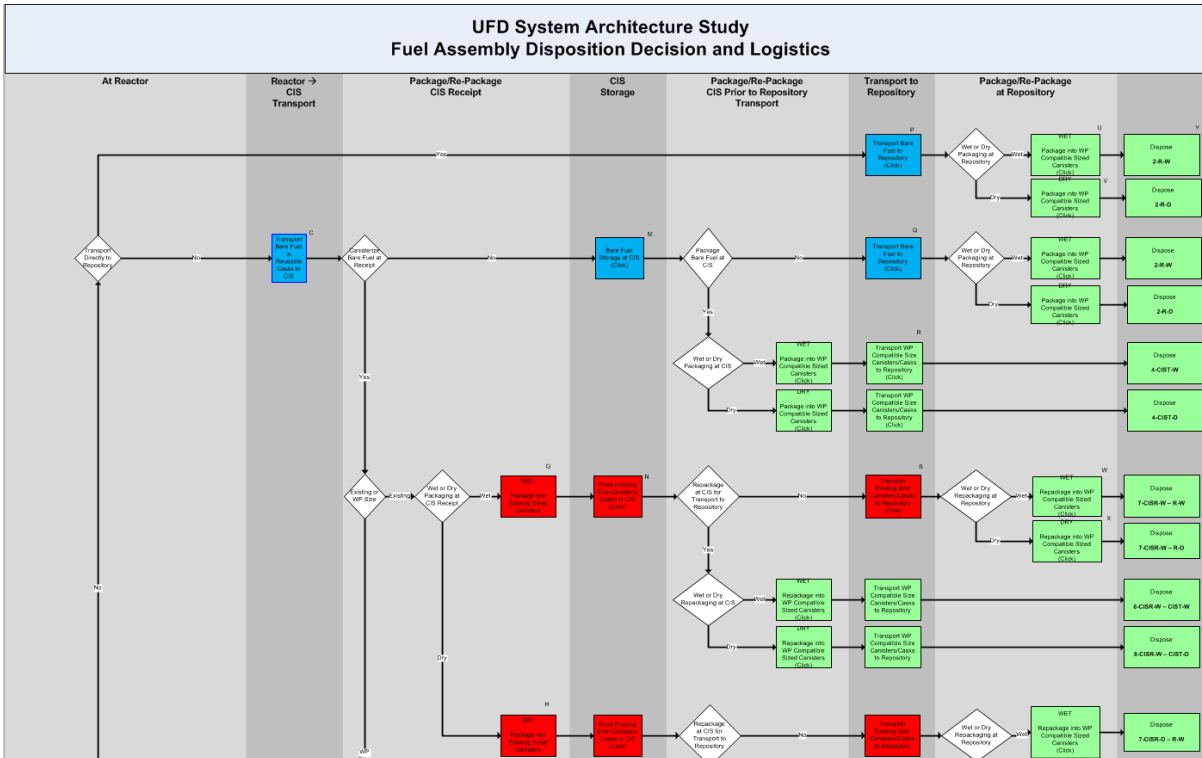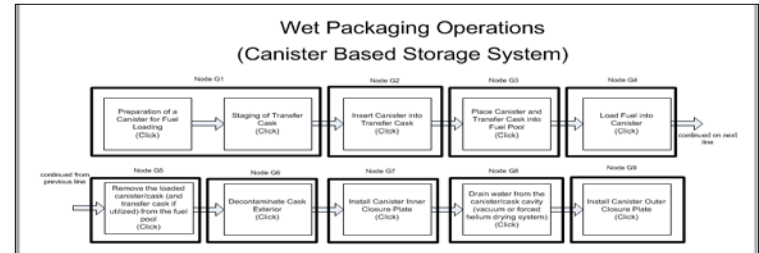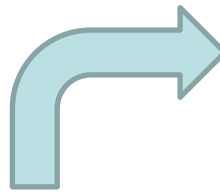# PFDND will continue to be expanded, updated, and improved

■ **Will continue to update:**

- PFDND
- Equipment Lists
- Outline

Quantitative data can be stored in each process node

Process Node Flow Diagrams contain Qualitative Data for Process Tasks

Wet Packaging Operations
(Canister Based Storage System)

UFD System Architecture Study
Fuel Assembly Disposition Decision and Logistics

Shape Data

Quantitative Data Behind Process Node

NFST
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- **Inform and enhance the Functions and Requirements activity**
- **Plan and evaluate scenarios for the transportation and storage of UNF**
- **Research doses and durations for individual processes**
- **Next-generation systems code development**
- **Training of people new to the project**
- **Possibly others**

What do the PFDND look like?

- **Short Visio Demonstration of PFDND**