In the “Gap Analysis to Support the Extended Storage of Nuclear Fuel,” Rev. 0 (PNNL-20509, 2012), several technology needs were identified to close the technology gaps to allow extended storage in existing transportation and storage casks. The cask materials monitoring system addresses three of the gaps identified:

1. Develop systems for early detection of confinement boundary degradation, monitor cask environmental changes, and transmit data without compromising cask or canister boundary.
2. Measure temperatures within the cask.
3. Develop systems for early detection of corrosion.

The cask materials monitoring system provides a method to deploy and retrieve monitoring equipment through the cask primary lid fill/drain port. The system consists of:

- Monitoring Module:
  - Contains the equipment for monitoring the cask environment
- Sliding Shield Plug:
  - Provides shielding when module is not deployed
  - Slides out of the way for module deployment
- Primary Seal Flange:
  - Bolted directly to cask lid
  - Seals cask for long-term storage
  - Allows release of seal for module retrieval
  - Interfaces with containment tube to provide cask confinement at all times
- Containment Tube:
  - Allows deployment of module without loss of confinement
  - Provides containment of monitoring equipment before and after deployment

Additionally, concepts for future work include:

- Camera deployment
- Temperature monitoring
- Moisture monitoring
- Sample cylinder for gas sampling
- Gas-absorbing coupon
- Active gas sampling when other cask penetrations are not available

CONCLUSIONS

- Integration of the camera inspection system and CMMS
- Development of a prototype CMMS for deployment on the CASTOR V/21 cask (or other similar cask)
- Development of additional monitoring modules to be used with the CMMS

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