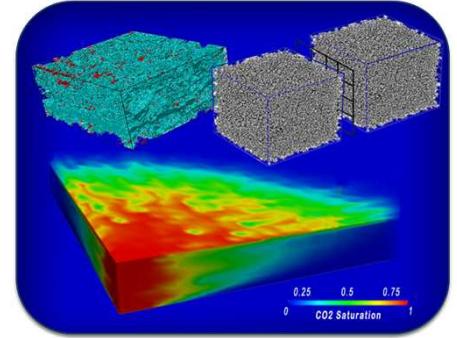
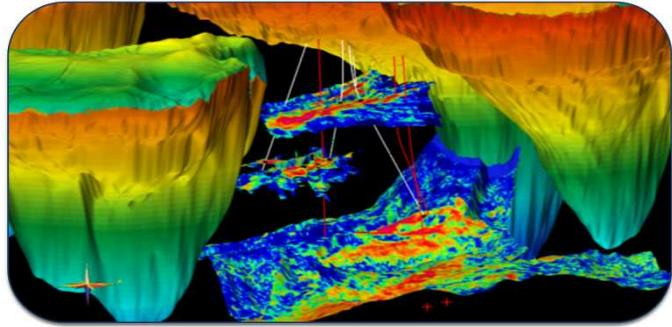


*Exceptional service in the national interest*



## Summary and extension of the collaborative US/German salt repository research, design and operation agenda

Frank D. Hansen PhD PE

Sandia National Laboratories

Presentation by video link to Salt Club Meeting

NEA headquarters

Issy-les-Moulineaux, France

25 February 2015 Start 14:00 pm End 18:00 pm Paris time



Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000. SAND NO. 2013-XXXX

# 5<sup>th</sup> US/German Workshop



- Operational Safety
- Geomechanics Issues
- Underground Research Laboratory
- Capturing Early Evolution of Salt Excavations
- Features, Events and Processes

<http://energy.sandia.gov/energy/nuclear-energy/ne-workshops/usgerman-workshop-on-salt-repository-research-design-and-operation/>

## *Proceedings of the 5<sup>th</sup> US/German Workshop on Salt Repository Research, Design, and Operation*

### **Fuel Cycle Research & Development**

*Prepared for  
U.S. Department of Energy  
Used Fuel Disposition Campaign  
Francis D. Hansen, Christi Leigh  
Sandia National Laboratories  
Walter Steininger, Karlsruhe Institute  
of Technology/ Water Technology and  
Waste Management  
Wilhelm Bollingerfehr and Thilo von  
Berlepsch, DBE TECHNOLOGY GmbH*

**January 30, 2015**  
FCRD-UFRD-2015-00514  
SAND2015-0500R



# US/German Collaborations Extended

- Five annual workshops were organized
- Collaboration in the Joint Project on benchmarking constitutive models
  - including 140+ additional laboratory tests on WIPP salt
  - supports current effort to compare bedded and domal salt for repository purposes
- Contributions to conferences, workshops and journals were made
- Participation in EC-projects(MoDeRn) and IGDT-TP activities

# Lessons Learned

- Comprehensive knowledge and sound expertise of US and German scientists in various fields of salt repository science and engineering can be applied to the problems defined and guarantee to tackle existing and future challenges
- Ongoing activities and scientific results exemplify the benefits of this collaboration and prove the importance of international cooperation
- Collaboration helps optimize scarce human resources in joint projects and activities
- Duplication of efforts can be avoided in the process of adding value of shared national capabilities (computer resources, modeling, URL experiments)
- Knowledge preservation, education and training
- Different perspectives and diverse perception of identical issues support the finding of solutions
- Cooperation with foreign partners (e.g., via the Salt Club, conferences and publications) generates great benefit for the national programs

# Outlook of Certain Activities

- Compendium comparing bedded and domal salt for HLW repositories
- Future Work concerning Mechanical Behavior of Rock Salt
- Joint Project III--the most productive and valuable collaboration at this time
- Collaborate on future field testing (if any)
- Joint publication on geotechnical seals
- Book of Salt?

# Book of Salt

- Primer on salt mechanics that includes
  1. Introduction to the basics of salt deformation
  2. Isochoric deformation
  3. Damage and healing
  4. Reconsolidation of granular salt
  5. Experimental techniques
  6. Applications
  7. Numerical methods
- The purposes of this book or special issue are first to be useful (basic and thorough) and second to serve as a reference of status and preservation of knowledge. It will focus on salt geomechanics and it will be understandable for experts and nonexperts.

# 6<sup>th</sup> US/German Workshop on Salt Repository Research, Design, and Operation

## TENTATIVE AGENDA

Dresden, Germany, September 7-10, 2015

Day 1 Morning	Day 2 Morning	Day 3 Morning
<b>Opening addresses (BMWi, USDOE)</b>  <b>Safety Case considerations</b> <b>Salt Club update</b>	Geomechanics Joint Project III Testing WIPP salt Bedded vs Domal salt Special topics on geomechanical behavior (BGR, TU BS, DBETEC, IfG)	Plugging and Sealing DOPAS REPOPERM Mine-by test Salt URL ELSA-project
Day 1 Afternoon	Day 2 Afternoon	Day 3 Afternoon
<b>Operational Safety (Human behavior/errors, QM, technical issues, fire/emergency)</b>  <b>Monitoring</b>	Breakouts on selected topics	Special Topics ABC Workshop summary  Extended storage  Netherlands/Poland