

Pit 9

A Systems Engineering Success Story from the Energy Sector

Texas Gulf Coast Chapter

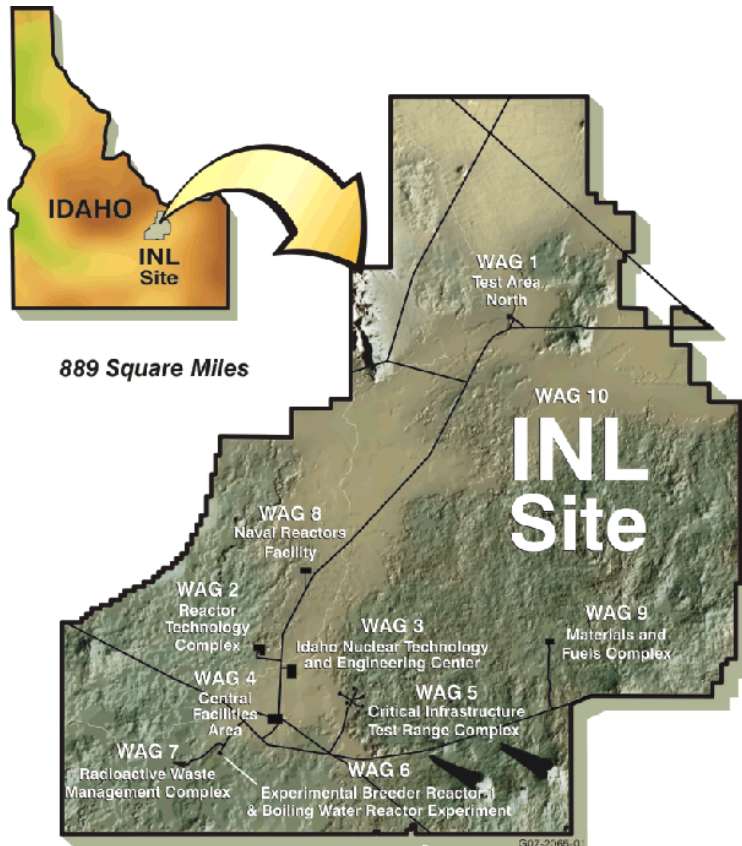
INCOSE

19 September 2013

Mark A. Powell

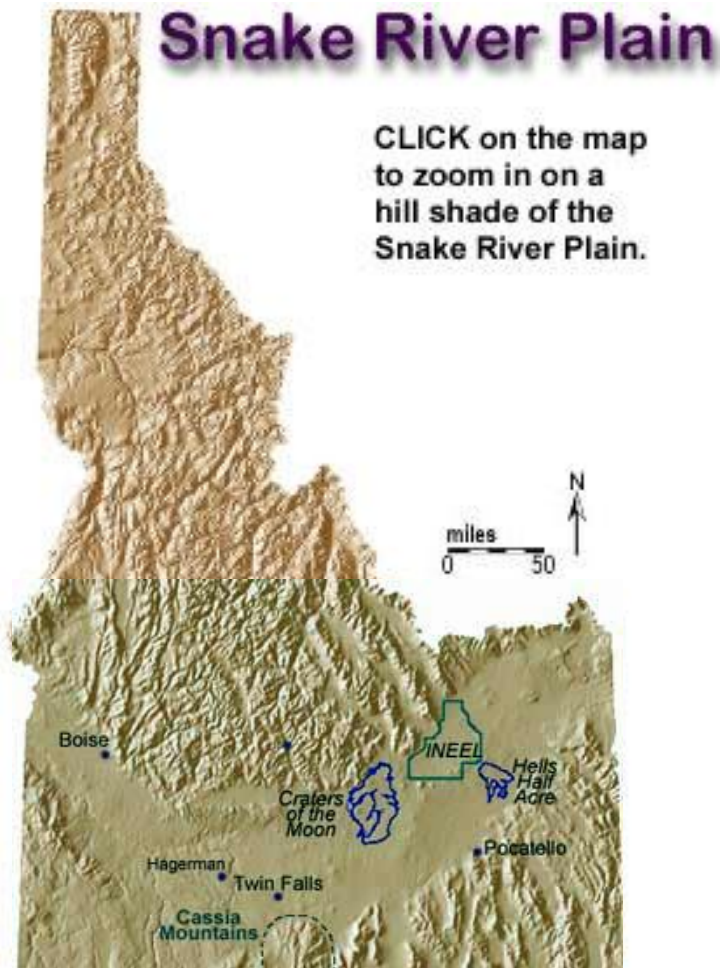
Attwater Consulting

The Idaho National Laboratory



- Formerly known as the Idaho National Engineering Laboratory (INEL) and the Idaho National Engineering and Environmental Laboratory (INEEL)
- Nation's lab for nuclear power research
- Reactors for all US nuclear power built at the INL
- Prior to LMITCO winning M&O contract in 1995, little SE exposure or use

A Geology Primer for the Snake River Plain



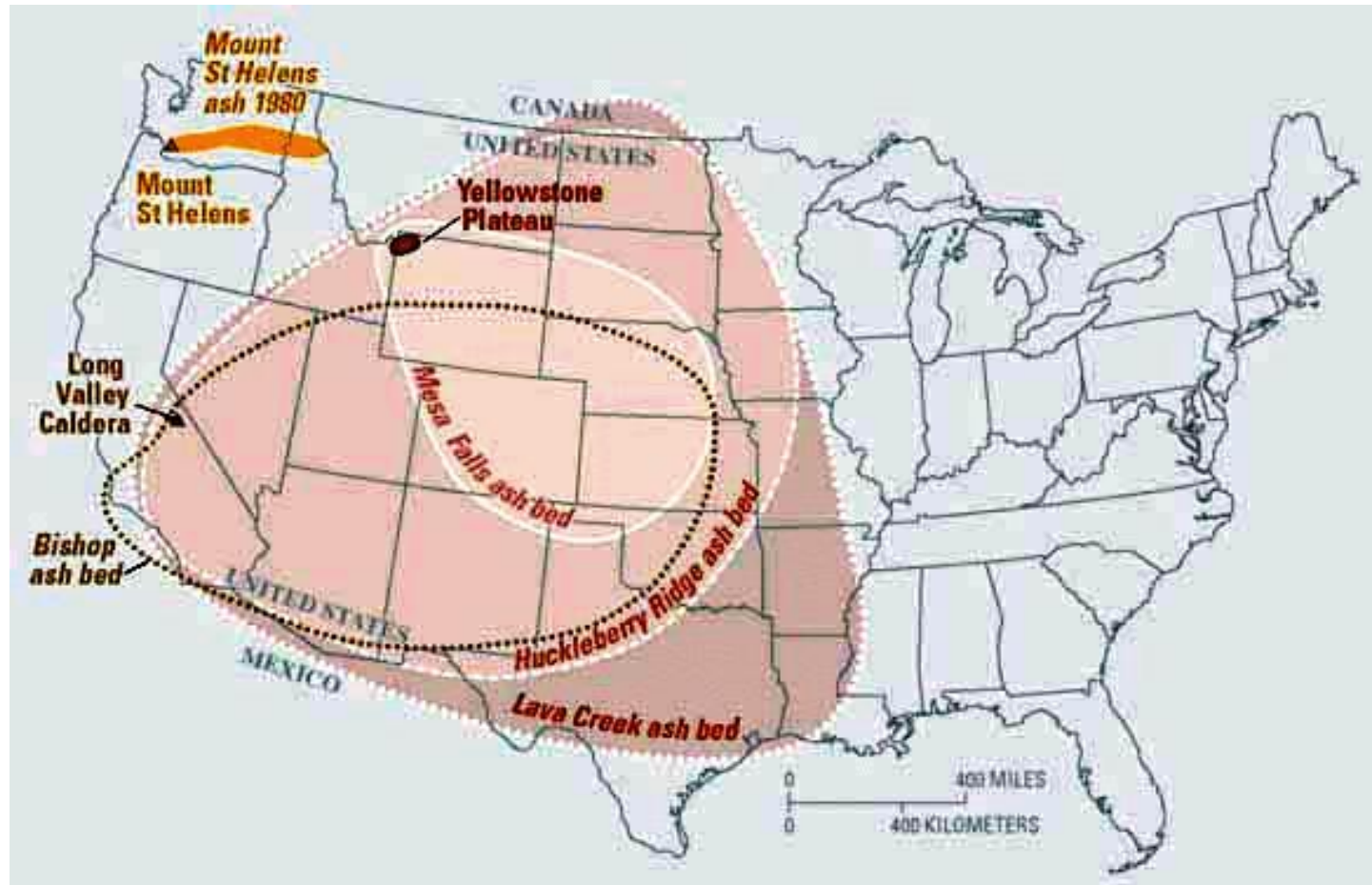
A Geology Primer for the Snake River Plain



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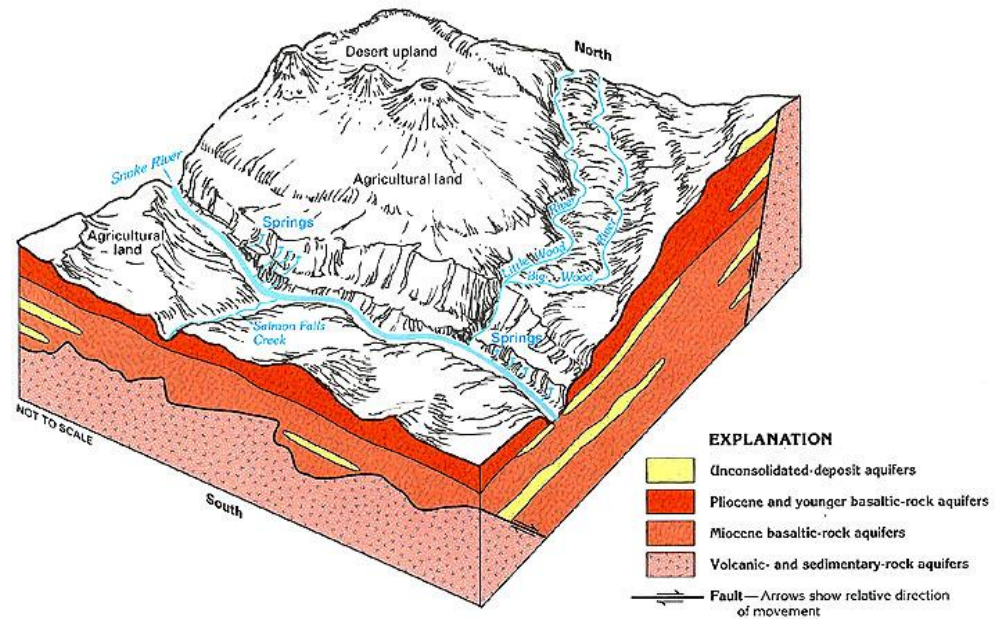
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How the Pit 9 Project Came About

- **Radioactive Waste Management Complex (RWMC) - perfect place to dump and store nuclear and VOC wastes**
 - Average 8” annual precipitation
 - 400’ of solid basalt between surface and aquifers
- **Snake River Alliance and other environmental activist groups objected to waste stored at RWMC**
 - Feared increased risk for cancer in Twin Falls, 120 miles away
 - SRA unacceptable risk increase: ***1 in 10,000 increase in risk of Twin Falls cancers over the next 50,000 years***
- **Pit 9 selected as demonstration project for safe waste removal for all of RWMC wastes**

The Pit 9 Project History



- Award 1994: Lockheed Martin Advanced Environmental Services (LMAES)
- Equivalent to midstream or downstream oil and gas project
- EPC contractors used
- Owner/operator: Lockheed Martin Idaho Technologies Company (LMITCO) – M&O contractor for INEL
- Contract not for profit, BUT fine enforceable milestones and performance objectives
- 1998 – LMITCO terminated contract for LMAES default
- Lawsuits proliferated

The OU 7-10 Staged Interim Action Project

- **Pit 9 became the poster child for failed projects for DOE**
- **Fine enforceable milestones and performance objective still in place for M&O LMITCO**
- **New replacement project, informally known as *Alternate Pit 9* – started in October 1997 when LMAES default became imminent, \$182M budget**
- **Subject to hands-on oversight by DOE, EPA, and ID-DEQ**
- **Considered very risky DOE project, and perhaps most visible ever**

My Introduction to Alternate Pit 9

- **October 1997, asked to be CSE on Alternate Pit 9 (only at INEL for 2.5 months)**
- **Knew nothing of Pit 9 history, or LMAES default**
- **Asked by PM and APM to provide basis of estimate NTE 1.5 EP (FTE) for SE on project**
 - **As honest broker, developed SE BOE based on project requirements**
 - **Requirements based BOE needed 28 SE personnel – BOE not well received by PM and APM**
 - **SE BOE reduction would require omission of SE products**
 - **Next day – received full authorization to proceed with 28 SE's**
 - **Immediately began staffing project with SE's**
- **Unaware of project risk perceptions and visibility levels**

As Chief Systems Engineer

- **Plan development: SEMP, CMP, and RMP**
all < 50 pages; plans > 50 pages never used
- **Selected tools to use for project communications and information infrastructure**
- **Integrated engineering specialties into development and design**
- **Reorganized project schedule to assure product requirements satisfied by fine enforceable milestones**
- **Assembled a good balanced SE staff, including INEL heritage and aerospace heritage**
- **Integrated oversight agencies into PM IPT**

The Alternate Pit 9 SEMP

- **SEMP**
 - **Project organization and operations**
 - **Project communications infrastructure**
 - **Project records infrastructure**
 - **Review processes**
 - **All subordinate plans discussed and directed**
- **Well received by SE's, supporting traditional discipline engineers (~1:3 ratio), and ES's (~1:2 ratio)**
- **As with CMP and RMP, got signature approval by oversight agencies**
- **Became the *bible* for project operations, carried around daily by most SE's and engineers on project**
- **Available by request – contact me**

The Alternate Pit 9 SE Tool

- **SE Tool – started with CORE, then SLATE, then converged on RDD-100 by February 1998**
 - **Schema included parent-child relations, engineering specialty links (cousins), rationale, and links to trades/analyses**
 - **One click to see everything related to any requirement**
 - **Supported project information infrastructure via HTML**
- **Initial population by all applicable documents, parsed and numbered as requirements (desirements, goals, hopes, wishes, dreams and other assorted nebulosities)**
- **Secondary population by children requirements linked to initial population with verifications (rewrites of applicable documents into verifiable requirements with verifications)**

Culture Shock: Engineering Specialty Integration

- **INEL operated with Engineering Specialties using the *throw-it-over-the-fence* process**
 - **ES personnel generally hated by everybody else at INEL**
 - **ES personnel and orgs felt that hatred**
- **SEMP integrated all relevant specialties into all IPT's as required quorum members**
- **ES orgs at INEL initially resisted, but eventually relented to support over project lifecycle**
 - **Started slow, participation mostly passive**
 - **Once started though, hatred disappeared and involvement got active and very productive**

Culture Shock: Operational Readiness Review

- **SOP for INEL was to schedule 24 months for Operational Readiness Review (SIOT)**
 - **Needed for all the redesign and rebuild**
 - **Never seemed to be enough time (23 monuments on the desert)**
- **Reduced to 3 months**
 - **With good SE and ES Integration, plenty of time**
 - **No redesign or rebuild should be required**

Formal Reviews

- **Different names from aerospace**
 - **Conceptual Design Review = SRR**
 - **Technical and Functional Design Review = SDR (fine enforceable)**
 - **Title I Review = PDR (fine enforceable)**
 - **Title II Review = CDR (fine enforceable)**
- **SRR reviewed rewrites (with supplementation for completeness) of applicable documents**
- **Review process per SEMP very successful**
- **PDR completed on schedule March 1999 – 2501 RIDs received, 6 hour RID review**

My Experiences and Perceptions

- **SE, LMITCO resented by INEL heritage folks, I perceived resistance to SE overall**
- **EPC traditional engineering disciplines resented relegation to support roles before PDR (Title I)**
- **PM and APM attempted to sabotage SE efforts**
- **Requiring oversight agency signatures approving documents and plans eliminated 99% of vagueness and risk**
- **Trained and developed many good SE's**
- **Portions of SEMP cut and pasted into DOE orders**
- **August 1999, left government contracting to pursue academia and consulting**

What Happens in Pit 9



What has Happened Since

INL contractor finally cleans up Pit 9 nuclear waste dump¶

Submitted by [Rocky Barker](#) on Thu, 09/08/2011 -- 3:21pm¶

[Clean up crews finished up removing waste from Idaho's most infamous nuclear dump.¶](#)

CH2M-WG Idaho, the INL clean up contractor, completed the Pit 9 clean up ahead of schedule and millions of dollars under budget. It spent \$12 million in stimulus funds and another \$22 million in federal funds, a far lower cost than initially envisioned in the 1990s.¶

http://voices.idahostatesman.com/2011/09/08/rockybarker/inl_contractor_finally_cleans_pit_9_nuclear_waste_dump#storylink=cpy

What has Happened Since

PIT-9: From "Black Eye" to Part of DOE Cleanup Success¶

There was a time back in the late 1990s and early 2000s when the words "Pit-9" were synonymous with failure. Failure on the part of a large company to execute its contract to clean up Pit-9. Failure on the part of the Federal government to meet the deadlines to clean up nuclear waste. And failure of a new approach to government contracting -- "privatization" -- that was supposed to make contractors more results-oriented and accountable. ¶

Now, as we head toward the end of 2010, you'll probably be hearing about Pit-9 again, but in a much different context. Sometime near the end of this year, CWI, our cleanup contractor, will begin digging up buried radioactive and hazardous waste from Pit-9. This will be the beginning of the end of the Pit-9 saga, and offers a good time to reflect on what went wrong with the contracting approach that made "Pit-9" code words for failure; it's also a good time to put Pit-9 into the context of all the things that have gone right with cleanup at DOE's Idaho Site since. ¶

Editorial Date November 30, 2010; By Brad Bugger

Summary and Conclusions

- **Systems Engineering saved Pit 9**
- **When needed in the energy sector (oil and gas), SE can greatly reduce risk and increase probability of success**
 - **Aerospace SE's must be sensitive to differences between government contracting projects and for-profit oil and gas projects**
 - **The right SE personnel mean everything**
- **A really good CSE is critical**
- **There will be culture shock**
- **But SE can have a tremendous payoff in the energy sector**

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