Pit 9

A Systems Engineering Success Story from the Energy Sector

Texas Gulf Coast Chapter

INCOSE

19 September 2013

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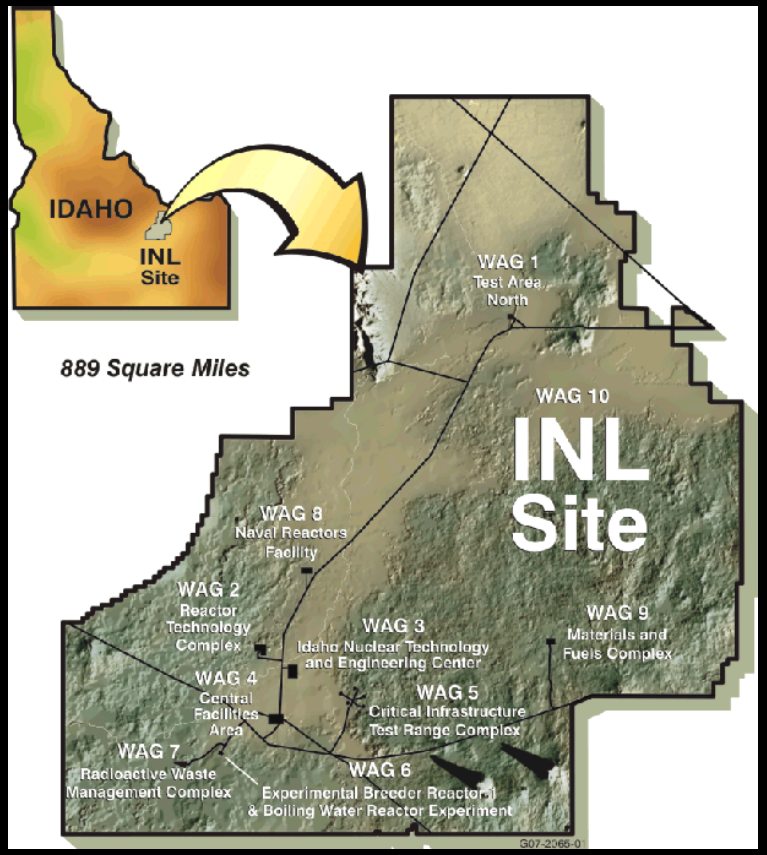
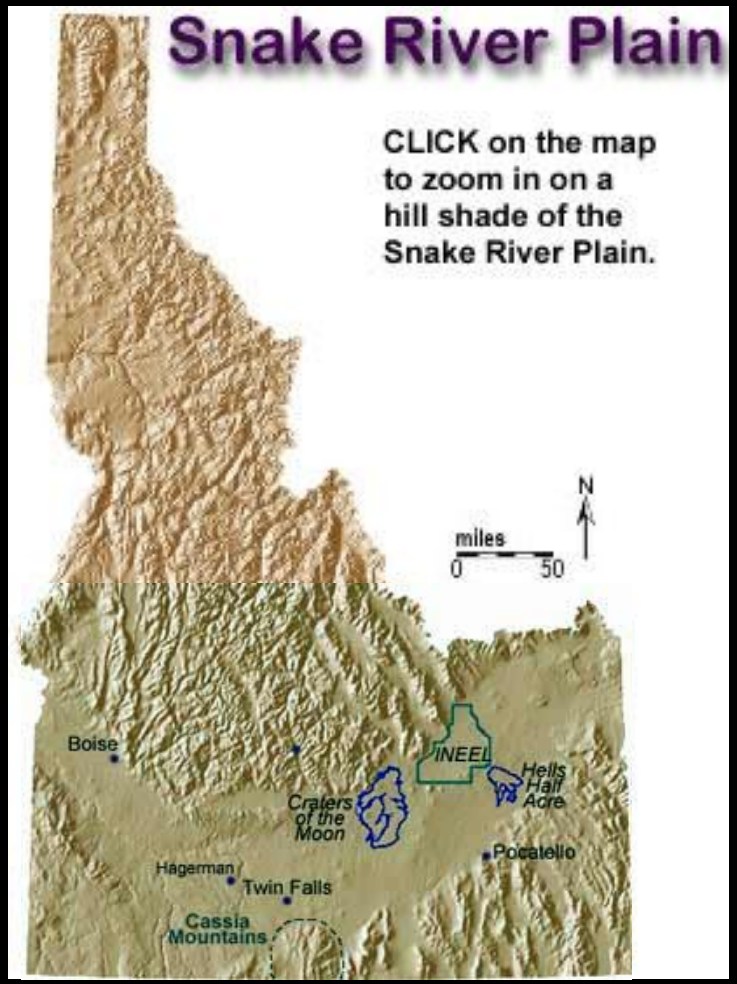
Attwater Consulting

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



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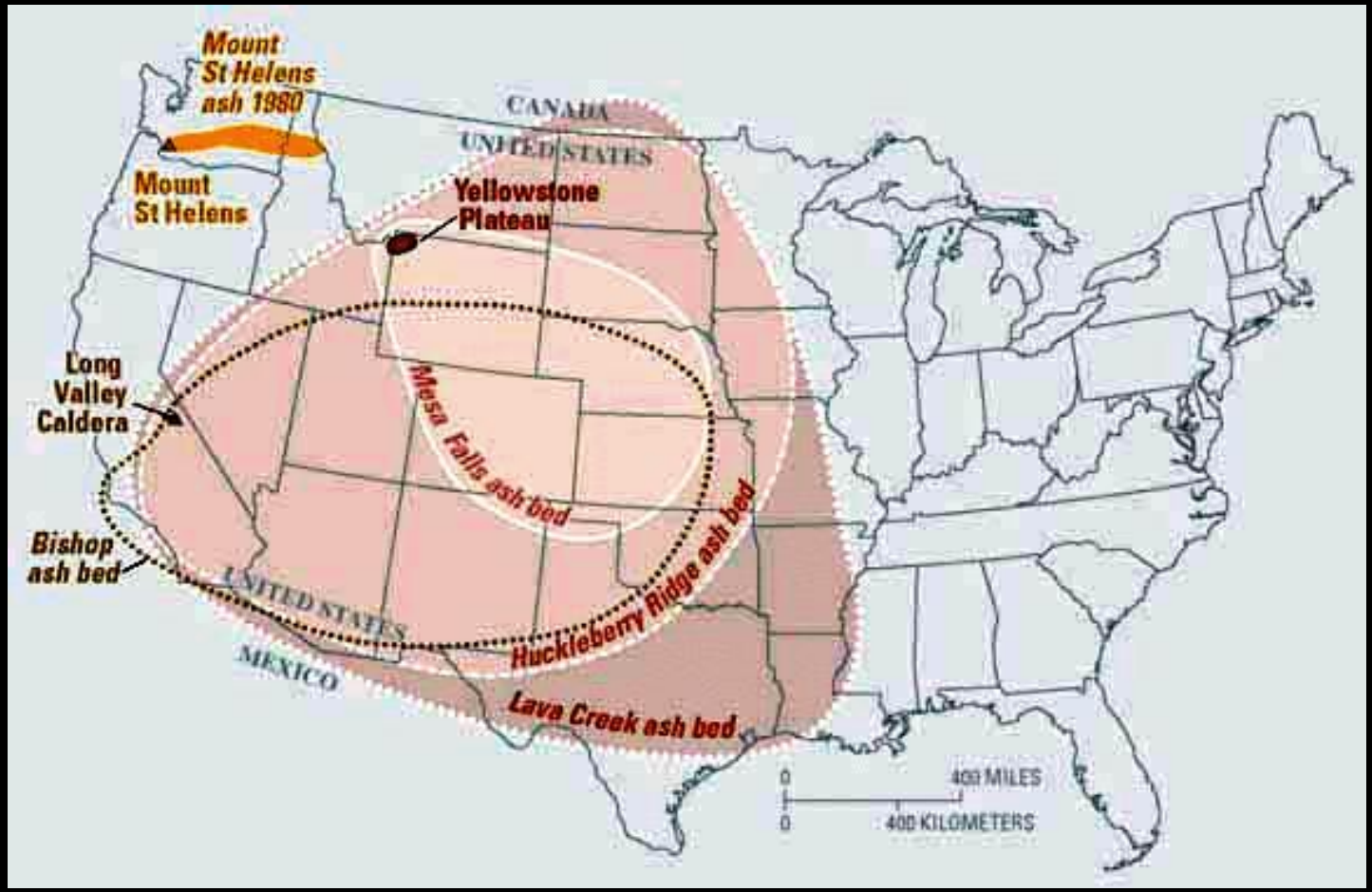

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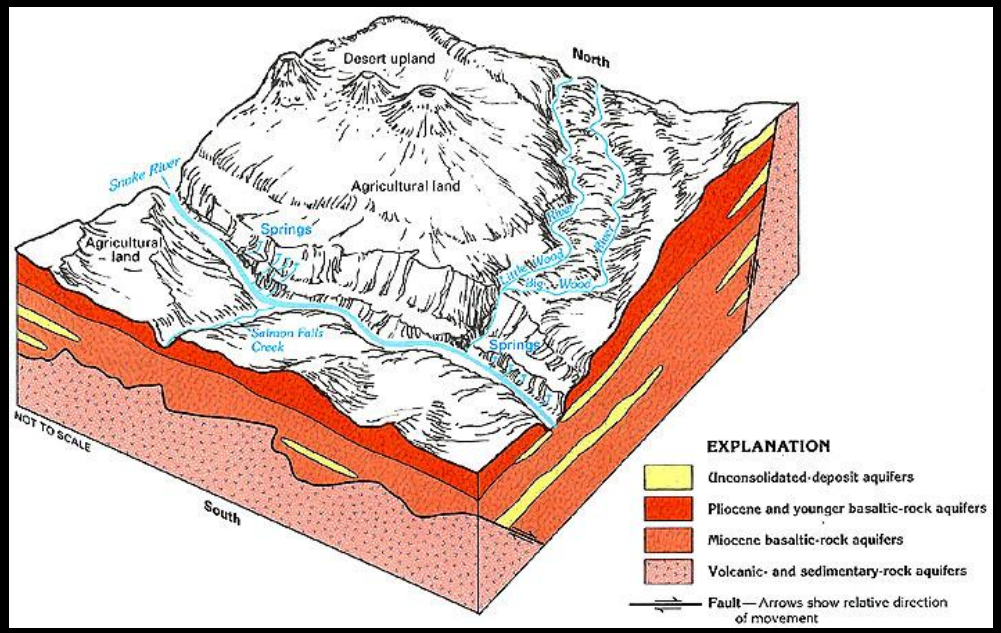
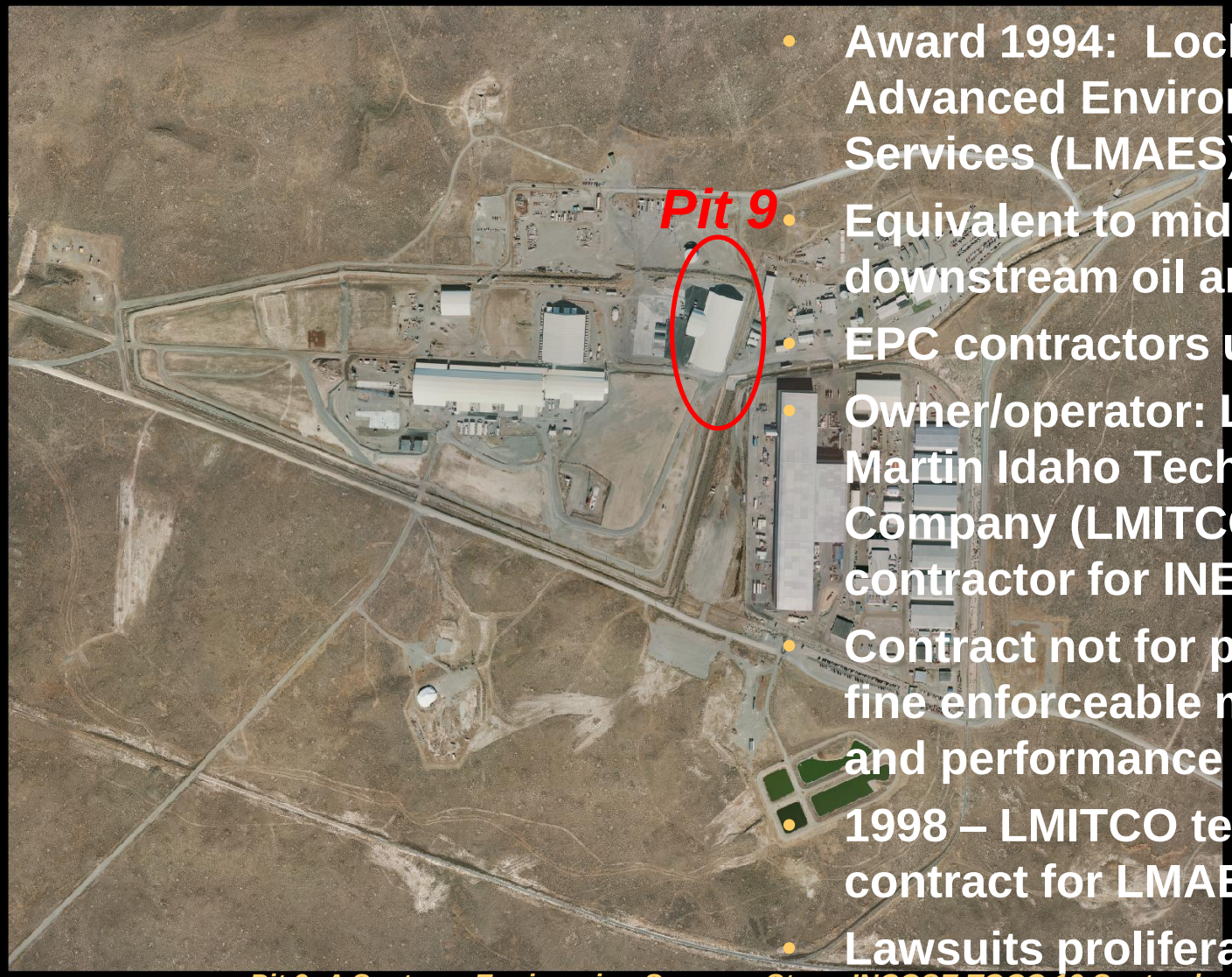


A Geology Primer for the Snake River Plain

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 nebulousities)**
- **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

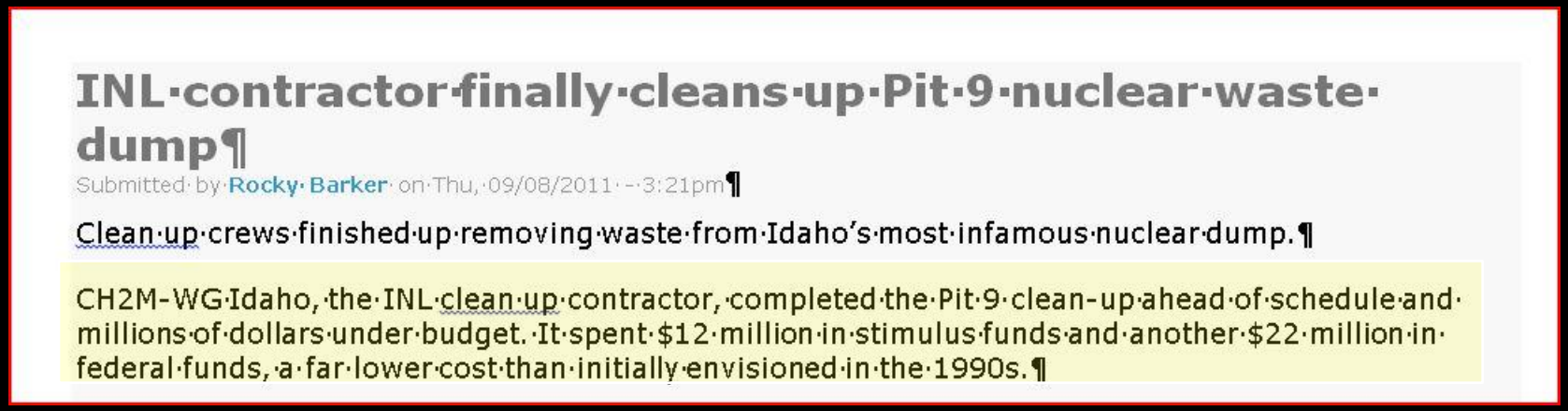
- Different names from aerospace
  - Conceptual Design Review = SRR
  - Technical and Functional Design Review = SDR (fine enforceable)
  - Title I Review = PDR (fine enforceable)
  - Title II Review = CDR (fine enforceable)
- SRR reviewed rewrites (with supplementation for completeness) of applicable 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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