Quality Assurance (QA) Lessons Learned

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May 26, 2011

Why is QA Important?

- January - European Commission, Performance Assessment Methodologies in Application to Guide the Development of the Safety Case
  - Modeling and data generation procedures expected to draw particular attention from regulators

- March - GAO Report, DOE Needs a Comprehensive Strategy and Guidance on Computer Models that Support Environmental Cleanup Decisions
  - DOE needs comprehensive strategy for managing models

- April – Defense Nuclear Facilities Safety Board Letter to DOE
  - DOE lacks control of computer program

LFRG Review Criteria

- Sufficient documentation and verification of the analytical and numerical models
- Input data are traceable to sources
- Assumptions used are justified and defensible
- Computational steps are clearly described

Sufficient Documentation

- Findings

– GoldSim models computational steps not adequately documented

– Insufficient documentation of all components of the model

– Insufficient detail on the hydrostratigraphic units such as the distribution and characteristics of sedimentary interbeds

“But it’s an iterative process!”

Sufficient Documentation
(continued)

- Corrective Action
  - All code, whether major, pre-/post- processors or even small queries need to be documented
  - Document as if authors are not available to explain incremental steps and leaps of faith
  - Years of development can be forgotten and not be reproducible

Sources

Good Sources

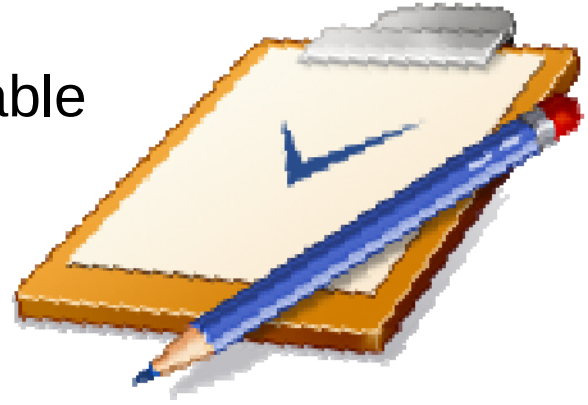
Element	Value	Units	Source/comments
Da_HTO	0.242 @ 293 K	cm^2/s	CRC (1995), p. 6-251
Da_Rn	0.11	cm^2/s	Rogers and Nielson (1991)

Bad Sources

Element	Value	Units	Source/comments
GCD_FDF	1/2		placeholder
ReturnPeriod	N	1/yr	e-mail from Mark

Sources
(continued)

- Corrective Actions
  - – Must be credible and traceable
    - Personal communication
      - – Name, date, time



  - – Peer reviewed publication
    - Journal vs. Waste Management Symposium

“I asked an expert.”

Technical Justification

- Findings
  - Model did not adequately justify the high technetium Kd
  - Insufficient justification for the low technetium Kd
  - Conceptual model description requires rationale for simplifying model
  - Technical basis or calculations for 1 mrem/year contribution needed
  - Site-specific study results supporting conceptual model assumptions not presented

"It seemed reasonable."

Technical Justification
(continued)

- Corrective Action
  - Detailed documentation of the reasons and assumptions used to make decisions allows reconstruction and justification

Inconsistencies

- Findings
  - Inconsistent treatment of porosity and dispersivity parameters for groundwater models
  - Carbonation models and associated write-ups are not consistent
  - Information presented needs to be clarified, expanded, or corrected in terms of technical justification, presentation of results, and interpretation of results
  - Section 1.2 identifies the area as 980 square miles, while other documents reference 890 square miles

"I didn't work on that model."

Inconsistencies
(continued)

- Corrective Action
  - Program coordination to ensure consistency
  - Quality assurance check during development can catch inconsistencies

Configuration Control

- Findings
  - Inadequate configuration control of approved model; Need formal process to ensure only approved models are used in decision making
  - Configuration control process and change control log for software and databases were not evident

“That’s the wrong version.”

Configuration Control
(continued)

- Corrective Action
  - Need strict control of:
    - Model (input, output, executable, processors, etc)
    - User documentation
    - Model documentation
  - Acceptance process for any new versions
  - Corrective action process for problems or errors

Archives

- Finding
  - Archive should be reviewed for adequacy, relevancy, and correctness

- Corrective Action
  - Procedure for archiving and documenting files with a naming convention and directory hierarchy
    - Useless if files are archived without regard to execution or need

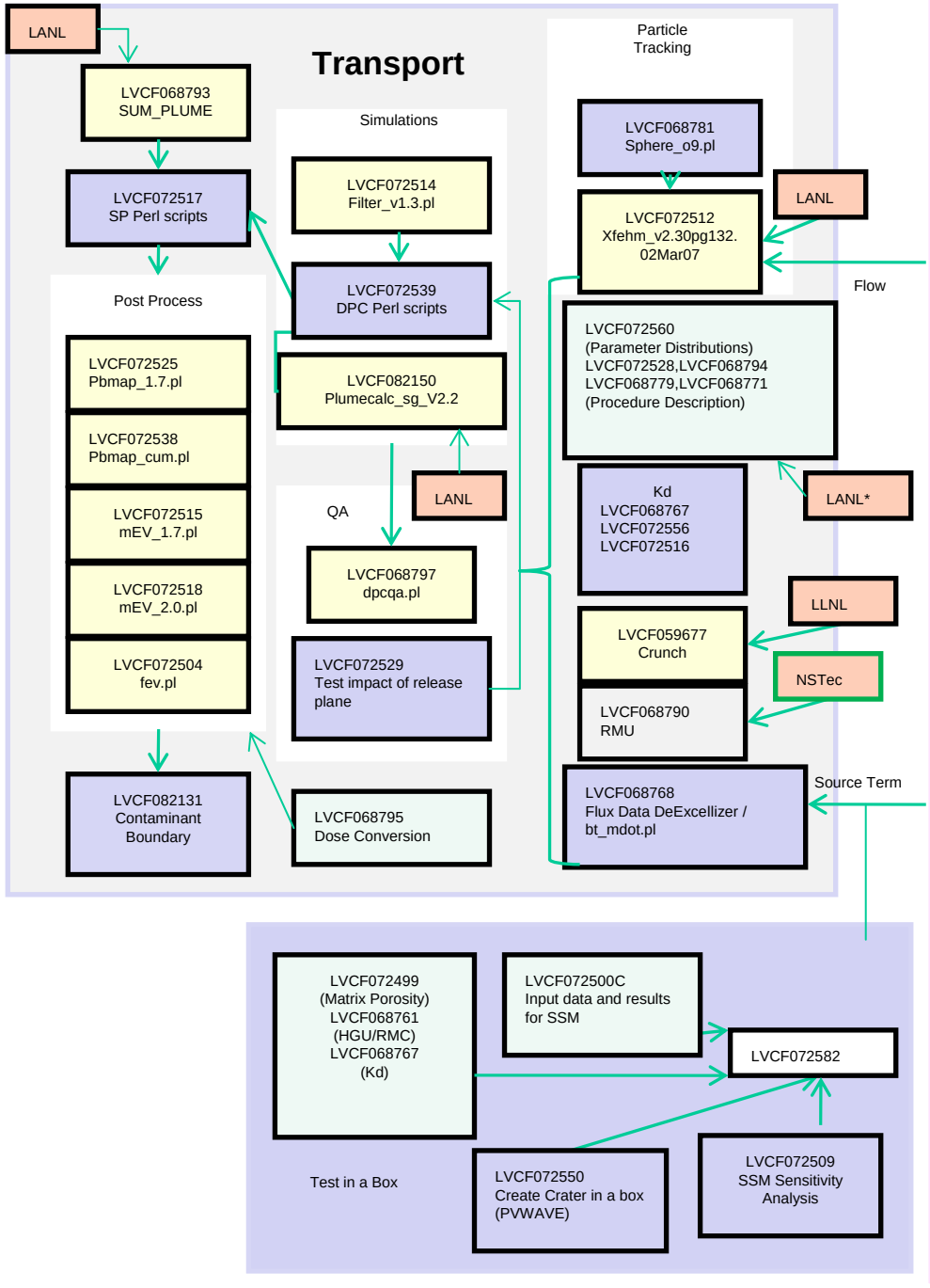
"Oh, you need version 10.2 service pack 3."

Reviewers

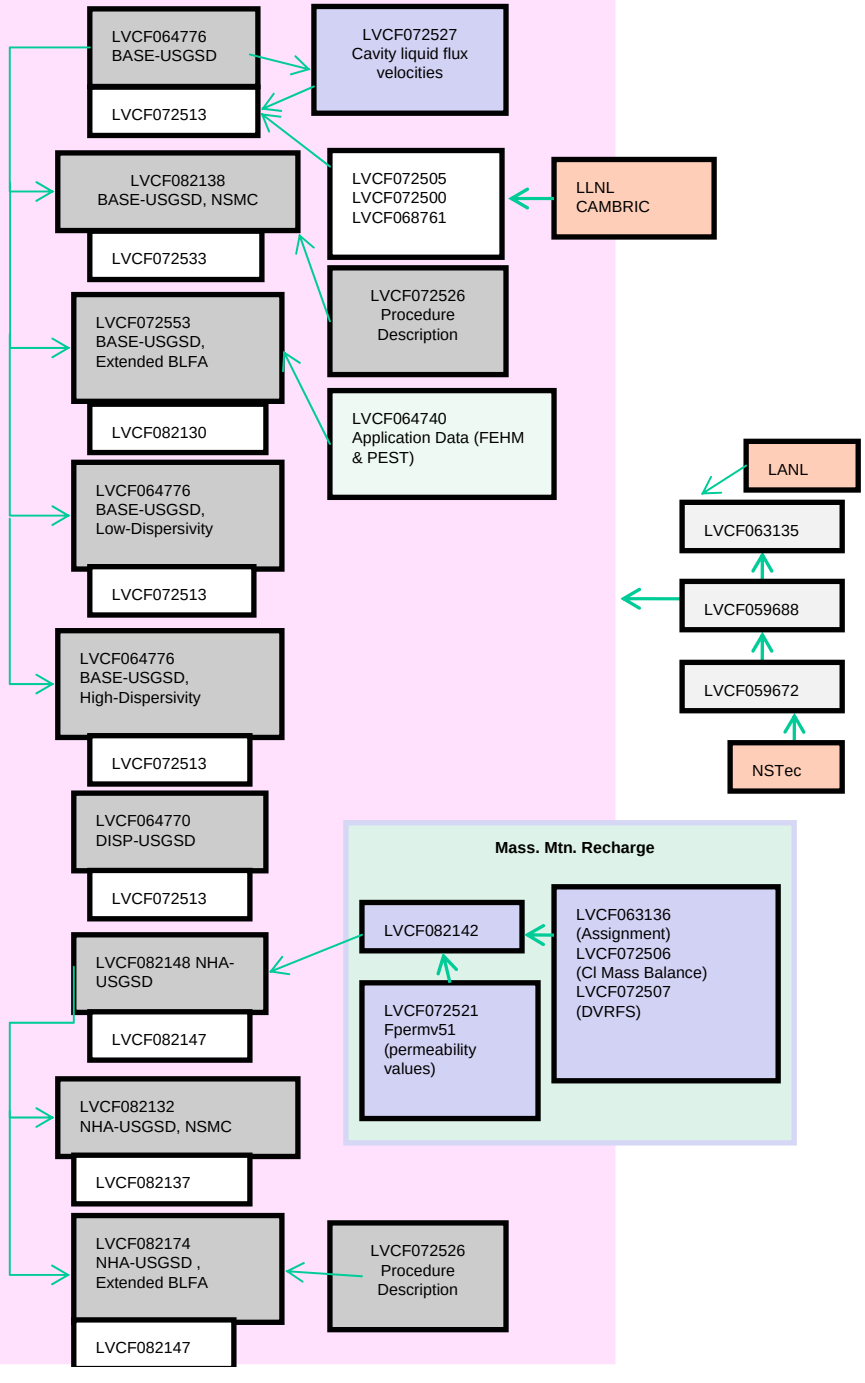
- Modeler
  - Knowledge of the code and process used to build model
  - Training as auditor
- QA specialist
  - Knowledge of modeling processes and language
- Roadmap
  - Pictorial or text
  - Identify model hand-off points (flow to transport)
  - Useful for peer reviews

“Not just anybody can do this.”

Road Map



Flow and Source



Print

Close

Ending Thoughts

"Always code as if the guy who ends up maintaining your code will be a violent psychopath who knows where you live."

(Martin Golding)

"Show your work"

(Anonymous math teacher)