U.S. Department of Energy
Office of Civilian Radioactive Waste Management

Simplified Total System Performance Assessment

Presented to:
Nuclear Waste Technical Review Board (NWTRB)

Presented by:
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YUCCA MOUNTAIN PROJECT

Overview

- **Background**
- **Objective of the simplified TSPA effort**
- **Software**
- **Current status**
- **Ongoing efforts**

Background

- **TSPA Models can be difficult to communicate, both to technical experts and the general technical audience**
  - **Complexity of the total repository system**
  - **Complexity of the model itself - necessary for “compliance type” calculations**
  - **Representation of uncertainty and alternative conceptual models**
  - **Limitations of the system assessment software and additional linkages**

Background
(Continued)

- **The Project has received constructive criticism regarding model transparency**
  - **USGS, NWTRB, others**
- **Necessary to thoroughly understand models to conduct appropriate technical review of TSPA models and products**

Objective of the Simplified TSPA Effort

- **Develop a tool to help communicate to the general technical audience**
  - **High school graduates to college professors - multiple levels**
  - **What is TSPA**
  - **How does the TSPA model work**
  - **How do we expect the total repository system to perform**
- **Enhance technical review capability**
  - **Ensure transparency of the TSPA model to underlying documentation (can the model, analyses, and calculations be reproduced)**
- **Two-phased approach; prototype based on VA followed by simplified SR model**

TSPA Software - GoldSim

- **Simplified TSPA model built on same platform as TSPA-SR model: GoldSim**
  - **Evolution of the RIP software**
  - **Same analytic capabilities as RIP; improved user interface and presentation capabilities**
- **Features - "technical"**
  - **Ability to link to external codes and/or "routines"**
  - **Model and results are self contained**
  - **Ability to link to external data sources (database and/or spreadsheet)**
  - **Model can be documented internally and with hyperlinks to supporting documentation**

TSPA Software - GoldSim

(Continued)

- **Features - "user interface"**
  - **Graphical, object-oriented**
  - **Model can be structured on a component basis**
  - **Hierarchy can be used to "push" details down**
  - **Ancillary text, figures, and pictures can be included in the model to help explain**
  - **Result elements can be added in any location**

Phase I Model - Technical

- **Prototype (proof of principle), simplification of TSPA-VA**
- **Simplified does not mean simple**
  - **Constraint to reproduce results of TSPA-VA (overall and sub-system)**
  - **Model is still quite complex; all components included**
- **Some VA models were simplified**
  - **Some sufficiently simple (climate, biosphere)**
  - **Some could not be simplified without affecting results (EBS transport, seepage)**
  - **Others significantly simplified (EBS representation, UZ & SZ flow and transport)**

Phase I Model - Technical

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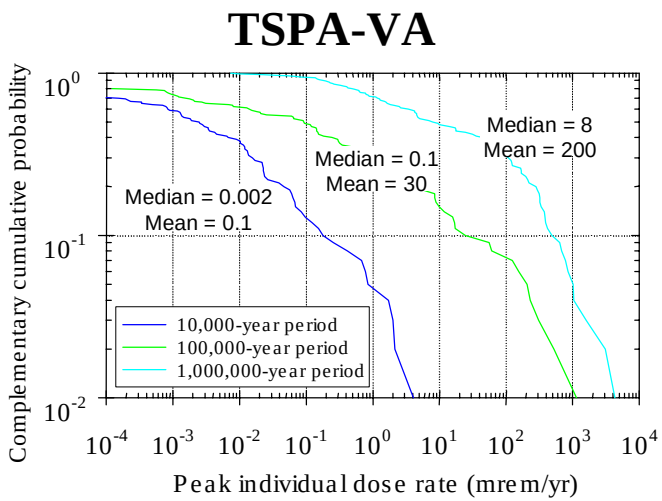
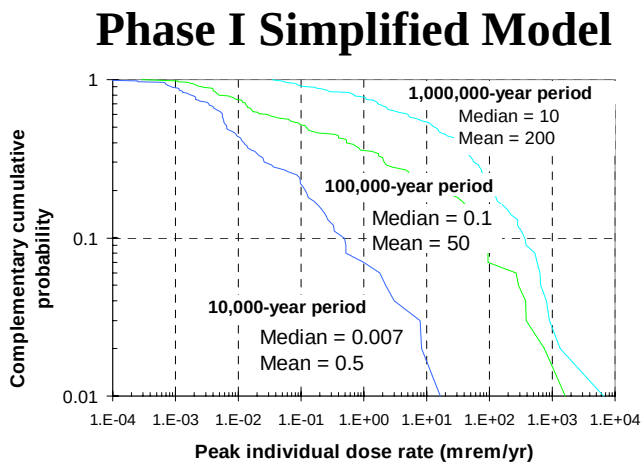
- **Self contained model, results consistent with TSPA-VA**



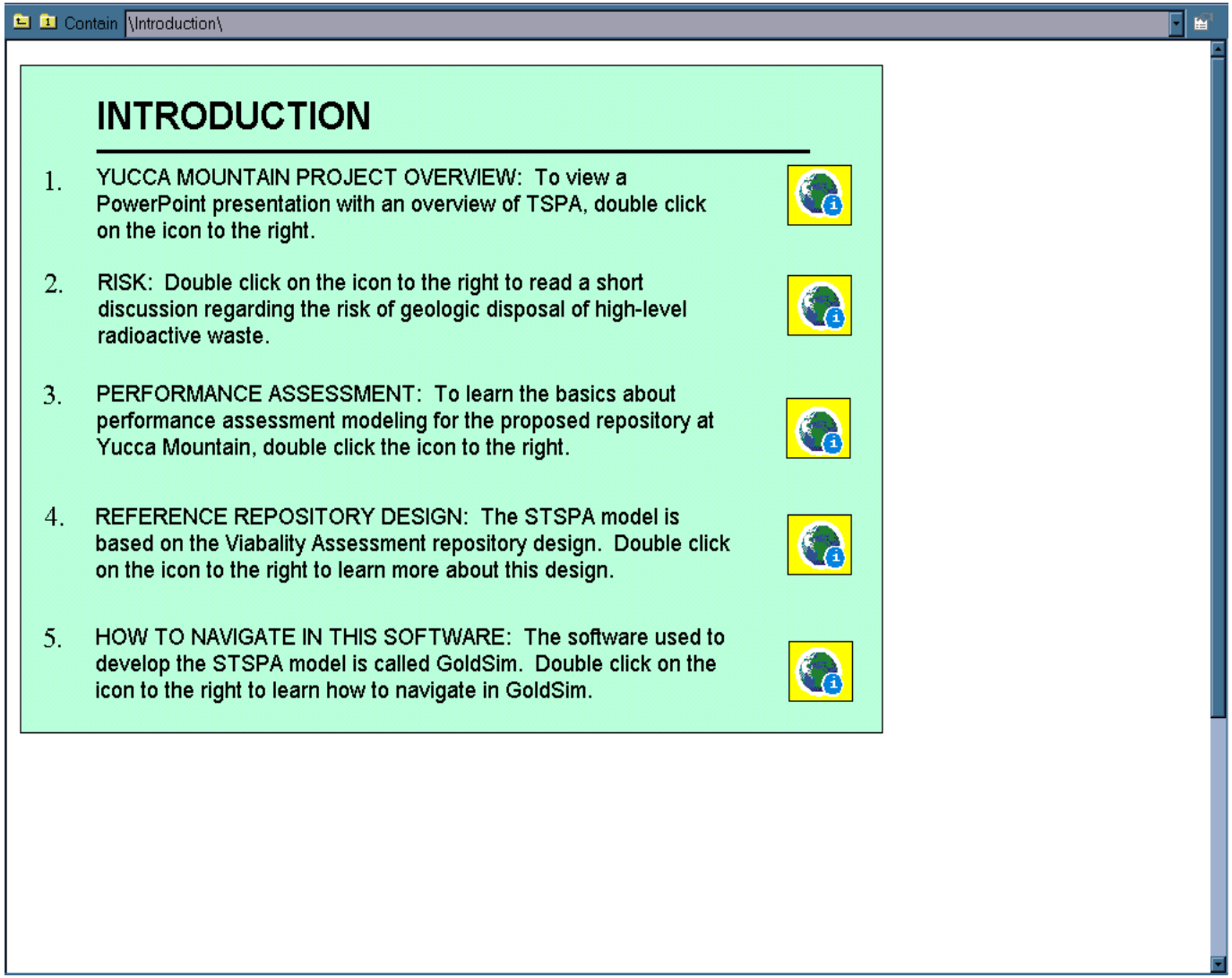


- **It is a functioning model**
  - **Single realization simulation requires one minute of run-time**

Phase I Model - Communication

- **Introductory page to "set the stage"**
  - **Overview of geologic disposal and the Yucca Mountain Project, primer on PA, primer on risk in the context of geologic disposal, brief summary of design**
  - **Hyperlinks to semi-interactive presentations**
- **Results toward "top" of model, concise**
  - **Presented on component-by-component basis**
- **Sub-component model structure used hierarchy to "push" detail down**
  - **Importance at the top (mass transport, general model structure)**
  - **Detailed calculations that drive model "underneath"**
  - **Allows user to browse model at level desired**

Phase I Model - Examples



Phase I Model - Examples

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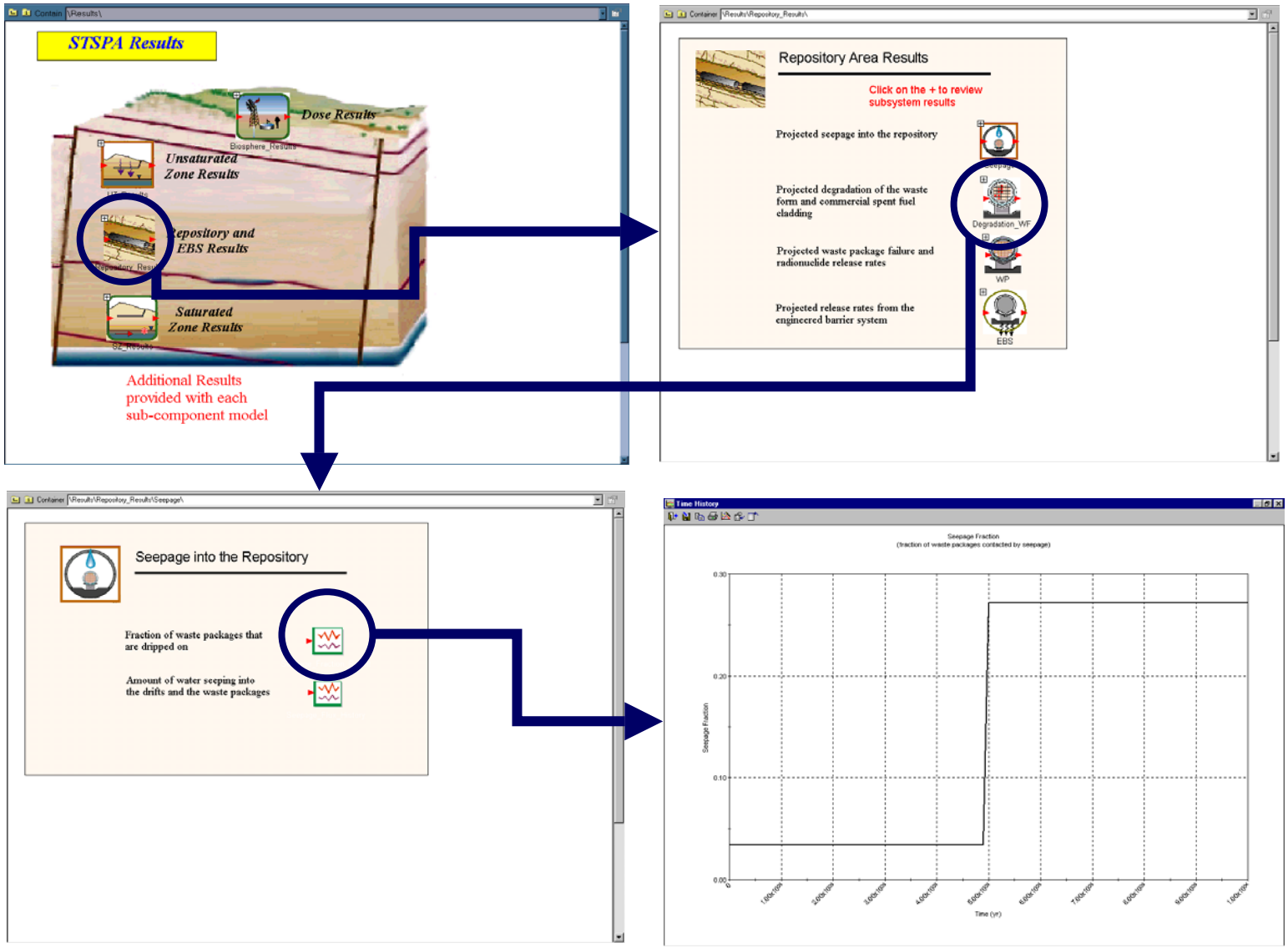

Phase I Model - Examples

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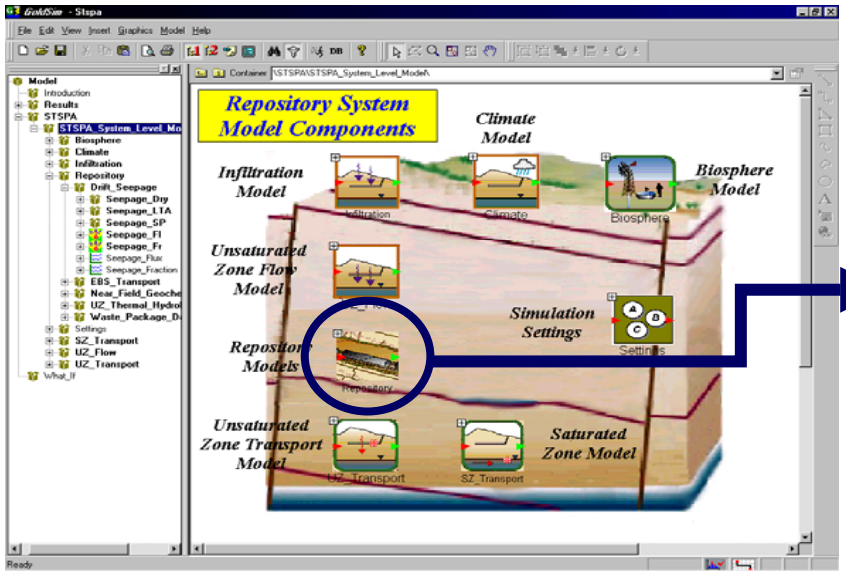
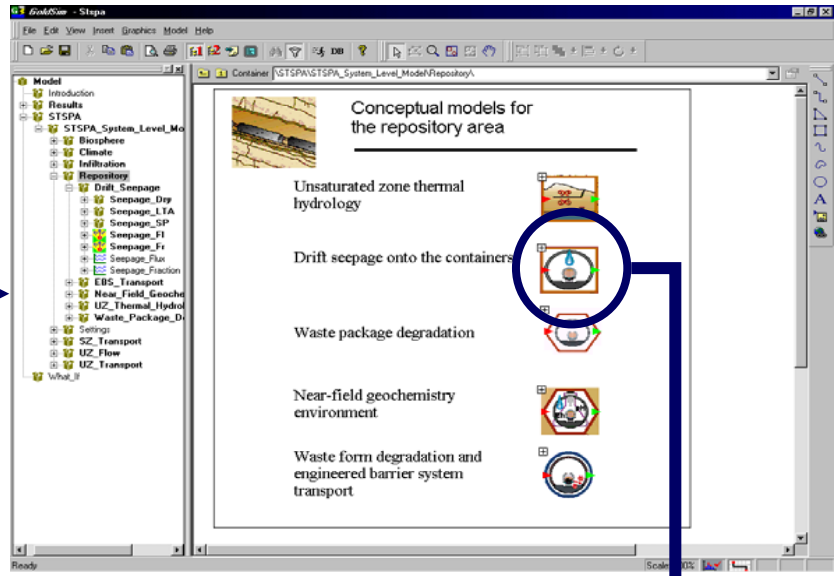
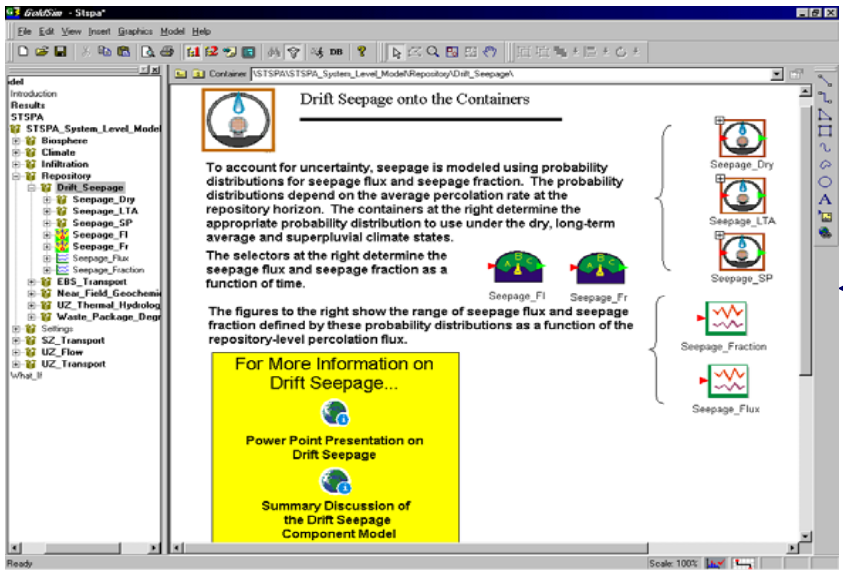




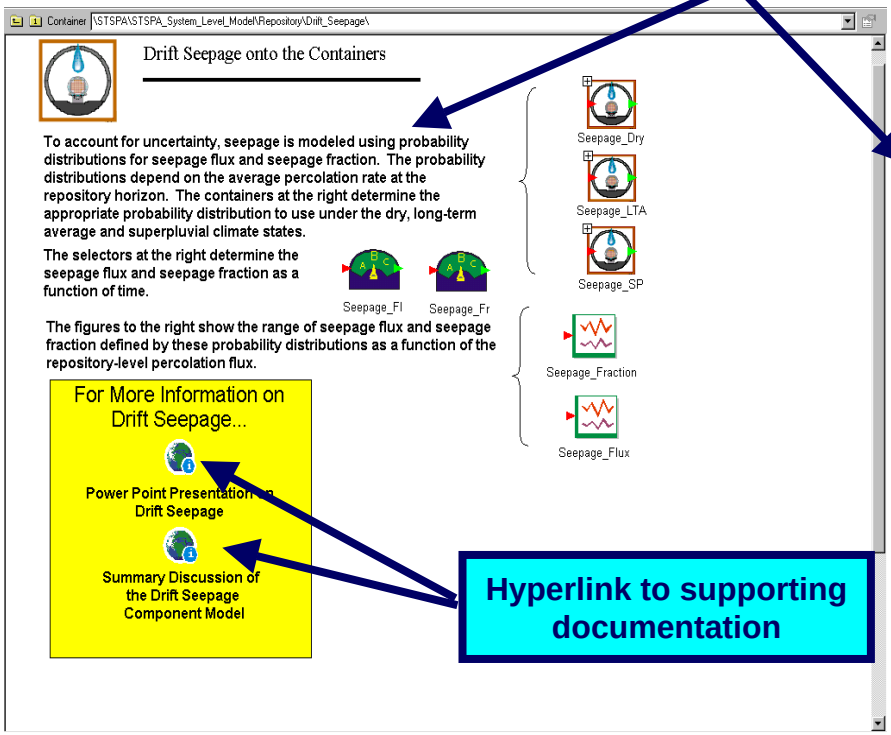


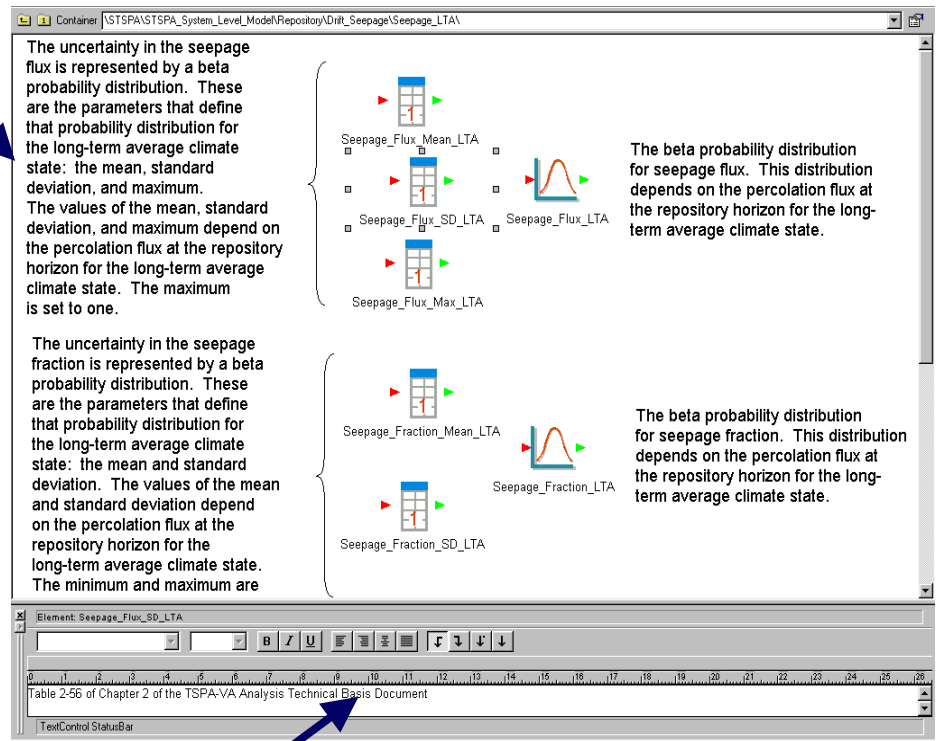
Phase I Model - Communication

- **Sub-component models heavily documented**
  - **Summary notes included on each graphic pane**
  - **Hyperlinks to detailed explanatory text with hyperlinks to VA documentation**
  - **Hyperlinks to semi-interactive discussions of various sub-components**
    - **What, how affects repository performance, how modeled, results - at two levels (summary and more detailed)**
    - **Hyperlinks to TSPA-VA and supporting documentation**
    - **Emphasis on "how" with limited discussion of the underlying basis ("why")**

Phase I Model - Examples

Explanatory summary notes in graphic pane





Hyperlink to supporting documentation

Notes showing data source

Phase II - Development of the Simplified SR Model

- **Simplified SR model refinement based solely on analysis and model reports (AMRs)**
  - **Support transparency of AMRs (feedback to authors)**
  - **May simplify at multiple levels**
  - **Refine documentation of the model (how the simplified model works)**
- **Parallel effort to enhance communication capabilities**
  - **Enhance discussions of sub-components based on current understanding**
    - **Consistent with PMRs**
    - **Bring PMR discussions up to another audience level**

Phase II - Development of the Simplified SR Model

(Continued)

- **Investigate "what-if" capability for user**
  - **Allow user to change uncertain parameter values (within pre-defined ranges) and execute model**
  - **Remainder of model "locked"**
- **Develop animated simulation of repository performance**
  - **How the repository system works and illustrated importance of various components**
  - **Investigate dynamic linking to model**
- **Work in progress; feedback from NWTRB and others would be appreciated**