

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TRIP REPORT

SUBJECT: GoldSim Training Course
(20.06002.01.011)

DATE/PLACE: December 10–12, 2002
Redmond, Washington

AUTHOR: F. Paul Bertetti

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BACKGROUND:

GoldSim is an object-oriented computer program designed for carrying out dynamic probabilistic simulations. The program was originally designed by Golder Associates, Inc. with funding from the U.S. Department of Energy (DOE) and other agencies. Although originally developed as a general purpose simulator, GoldSim has been primarily used to address radionuclide and other contaminant transport problems. DOE has chosen GoldSim as the software for development and implementation of its Total System Performance Assessment model for the proposed Yucca Mountain repository.

PURPOSE OF TRIP:

Golder Associates, Inc. offers workshops designed to introduce users to the basics of modeling using GoldSim. P. Bertetti attended two GoldSim workshops over the three day period from December 10–12, 2002. The first workshop focused on GoldSim basic concepts (2 days), while the second 1-day workshop focused on radionuclide transport modeling.

PERSONS PRESENT:

Although a majority of the attendees were employees of Golder Associates (an attendance list is attached), the workshops were attended by persons from a number of organizations including the Institute of Nuclear Energy Research (Taiwan), University of Nevada Las Vegas, University of Washington, and DOE contractors from Yucca Mountain and Idaho National Engineering and Environmental Laboratory. About half of the attendees, including one or two Golder employees, attended the radionuclide transport workshop conducted on the third day.

SUMMARY OF ACTIVITIES:

The workshop consisted of a well-paced agenda that highlighted many aspects of the software and also provided a brief overview of general modeling concepts and potential pitfalls. The first two-day basic concepts workshop consisted of several sessions that generally progressed from an introduction of basic features to detailed examples and application of important and commonly used functions in the software (a workshop agenda is attached). Several 'hands-on' exercises were conducted to allow students to get a feel for the software and to practice

building simple models. The third day focused on the radionuclide transport module. This session covered the basic steps in representing and simulating contaminant transport in an environmental system. The radionuclide transport module solves for the movement of mass (contaminant) through a model system, but does not solve for the movement of media. Flow rates must be provided by the user, or the flow model must be explicitly constructed within GoldSim. Two powerful components of the radionuclide transport module are the cell pathway and pipe pathway functions. Cell pathways act as mixing cells in which mass is instantly mixed and partitioned based on user supplied constraints, such as boundary conditions or solubility limits. The behavior of a cell pathway network in GoldSim is similar to that of a network of finite difference nodes. The pipe pathway function uses Laplace transforms to represent one dimensional advection and associated contaminant behavior such as dispersion, retardation, and matrix diffusion. The third day concluded with a brief discussion of GoldSim's capabilities to simulate source terms, such as containers and container failure rates, and dose to receptors.

CONCLUSIONS:

GoldSim is a powerful simulation software package that provides flexibility in model development and the ability to link to external models, while providing a visual display of model structure and integration. The workshop, as conducted by Rick Kossik and the Golder Associates staff, covers a significant amount of material in a short time frame and is well designed for a technical audience.

PROBLEMS ENCOUNTERED:

None.

PENDING ACTIONS:

None.

RECOMMENDATIONS:

NRC and CNWRA staff should become familiar with GoldSim as part of their preparation to review a potential DOE license application for the proposed Yucca Mountain repository. GoldSim also offers the staff the capability to develop small-scale models to review and model specific components of the Yucca Mountain system. Results could be used to guide development of modules in future versions of the NRC Total-system Performance Assessment tool. Because GoldSim simulations are designed to incorporate stochastic input and provide a probabilistic output, staff could use GoldSim to assist in developing risk information and identifying important processes and conceptual models as part of any licensing review effort. Reviews of GoldSim advantages and disadvantages from a regulatory perspective have been previously presented by NRC staff (e.g., Esh, 2001).

REFERENCES

Esh, D.W. "What Regulators Are Looking for in an Environmental Model. GoldSim User's Conference". April 25-26, 2002. Seattle, WA. 2002.

SIGNATURES:



F. Paul Bertetti

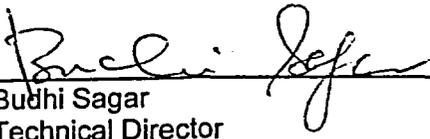
20 Dec 02
Date

CONCURRENCE:



English C. Pearcy,
Manager, Geohydrology and Geochemistry

Dec. 20, 2002
Date



Budhi Sagar
Technical Director

12/23/2002
Date

**GoldSim Training
December 2002
Redmond USA
Attendee List**

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Attendee List



Paul Bertetti
Southwest Research Institute
San Antonio, TX USA

Email: pbertetti@swri.edu

Amanda Brandt
UNLV - Harry Reid Center
Las Vegas, NV USA

Email: brandt@unlv.edu

Cameron Clayton
Golder Associates Ltd.
Burnaby, BC Canada

Email: cclayton@golder.com

Tom Doe
Golder Associates Inc.
Redmond WA USA

Email: tdoe@golder.com

Harris Greenberg
Booz Allen Hamilton
Las Vegas, NV USA

Email: harris_greenberg@ymp.gov

Lee Holder
Golder Associates Inc.
Redmond, WA USA

Email: lholder@golder.com

Scott Hutsell
Golder Associates Inc.
Lansing, MI USA

Email: shutsell@golder.com

Andreas Kammereck
Golder Associates Inc.
Redmond, WA USA

Email: akammereck@golder.com

Kate Klise
Golder Associates Inc.
Redmond, WA USA

Email: kklise@golder.com

Cliff Knitter
Golder Associates Inc.
Redmond, WA USA

Email: cknitter@golder.com

Steve Kramer
University of Washington
Seattle, WA USA

Email: kramer@u.washington.edu

Paul LaPointe
Golder Associates Inc.
Redmond, WA USA

Email: plapointe@golder.com

Tracy McFarland
Neptune and Company
Los Alamos, NM USA

Email: tracy@neptuneinc.org

Layne Pincock
Bechtel
Idaho Falls, ID USA

Email: layne@inel.gov

Cathy Smith
Golder Associates Inc.
Redmond, WA USA

Email: csmith@golder.com

Che-Chung Tseng
INER
Taiwan

Email: cctseng@iner.gov.tw

Adrienne Yang
Golder Associates Inc.
Redmond, WA USA

Email: ayang@golder.com

**GoldSim Model Building: Basic Concepts
(Scientific and Engineering Track)
December 10–12, 2002**

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(Scientific and Engineering Track)
December 10-12, 2002**

Day 1

Morning (9 AM – 12 PM)

Introductions and Objectives
GoldSim Approach and Philosophy
GoldSim Overview
GoldSim Quick Tour

Afternoon (1 PM – 5PM)

Introduction to the GoldSim User Interface
Navigating and Exploring a Model
Basic GoldSim Elements

Day 2

Morning (8:30 AM – 12 PM)

Advanced GoldSim Elements
Delays
Discrete Event Modeling

Afternoon (1 PM – 5PM)

Advanced GoldSim Features
Conditionality
Localization
Cloning
Version Control

Day 3 (Optional 1-day Radionuclide Transport Modeling Using GoldSim: Basic Concepts)

Morning (8:30 AM – 12 PM)

GoldSim Contaminant Transport Model
Overview
Cell Pathways

Afternoon (1 PM – 5PM)

GoldSim Contaminant Transport Model
Pipe Pathways
External Pathways
Source Elements
Receptors