U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

Office of Nuclear Regulatory Research

RADIATION PROTECTION CODE
RAMP
ANALYSIS AND MAINTENANCE PROGRAM

HABIT v1.2
(Control Room Habitability)

Casper Sun, PhD, CHP, FHPS
Syed I. Haider, PhD
Radiation Protection Branch,
Division of System Analysis

Prepared for 2015 Joint Action Group for Atmospheric Transport and Dispersion Modeling meeting, at George Mason University, Fairfax, VA: June 9, 2015

https://carlwillis.wordpress.com/tag/control-room/

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Peach Bottom Atomic Power Station

Conservation Equation

$$\frac{\partial \Phi}{\partial t} + \nabla \cdot (\mathbf{F} + \Phi \mathbf{V}) - H = 0$$

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

HABIT COMPUTER CODE

- **HABIT was reengineered from EXTRAN (1991)**
- **Version 1.1 (1995): IBM/DOS code. Available at RSICC/ORNL**
- **Version 1.2 (2015): Windows 7/8 (64-bit) code. Available at RAMP/NRC**

Http://www.USNRC-RAMP.com

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

User-Need Request: NRO-2011-007

- **HABIT Code Evaluation and Update**
  - **NRO TL – Syed Haider (NRO/DSRA/SBCV)**
  - **RES COR – Casper Sun (RES/DSA/RPB)**
- **Action Items:**

Phase 1: Re-hosting HABIT to Windows 7

- Upgrade FORTRAN and modernize GUI
- Build-in tooltips and develop "User's Manual"

Phase 2: Adding Dense-Gas Functions

- Add DEGADIS and SLAB to HABIT
- Update RG 1.78 and associated TBDs

RG 1.78: Evaluating the Habitability of a Nuclear Power Plant Control Room During a Postulated Hazardous Chemical Release (2001)

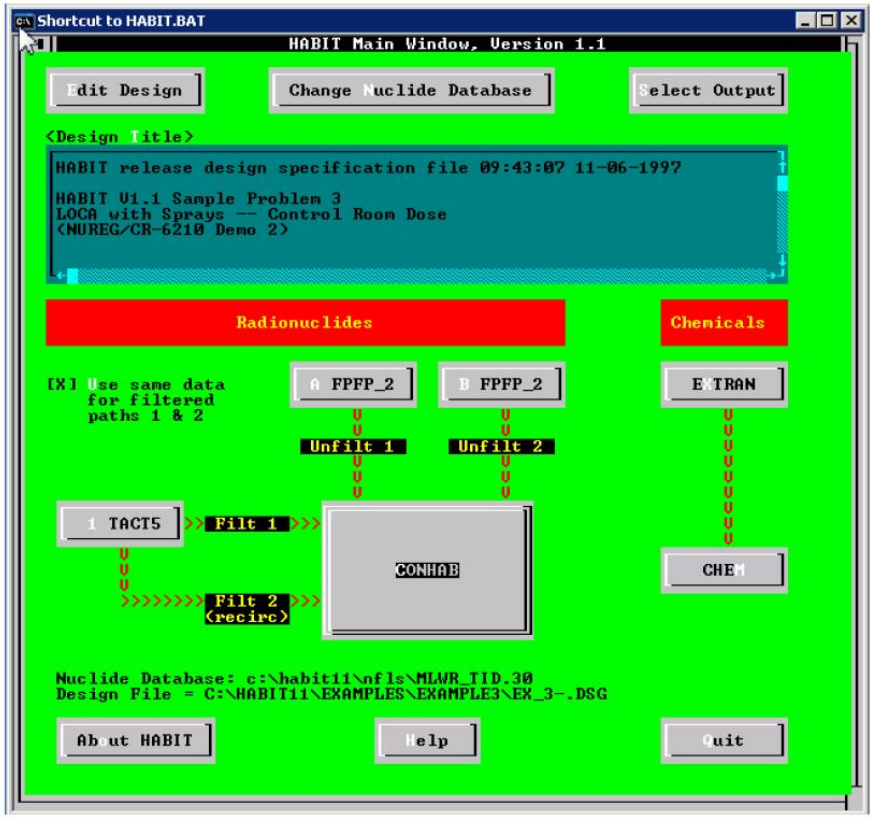
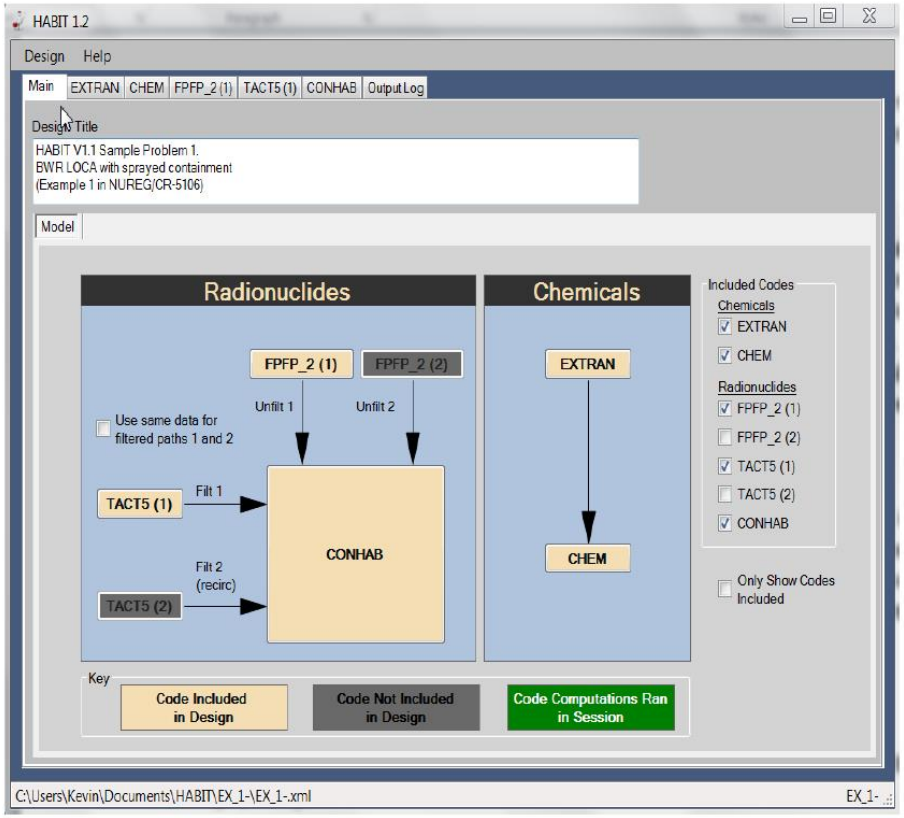

活〆
航空便
長尚
勝浦
青
山口

RADIOACTIVE III
CONTENTS
ACTIVITY
TRANSPORT INDEX
7

What's New in HABIT v1.2 (2015)

- **Used Intel Visual FORTRAN compiler for compatibility with Windows 7 (64-bit)**
  - **I/O are identical as HABIT v1.1**
  - **Backwards compatible for old designed (.DSG) files and FORTRAN input (.INP) files**
- **Used new Microsoft .NET technology for graphical user interface (GUI) development**
  - **Consistent module interface design (tabs)**
  - **Section 508 Compliance (e.g., color blinder or muted use of color, JAWS accessibility)**

Main Screen Makeover

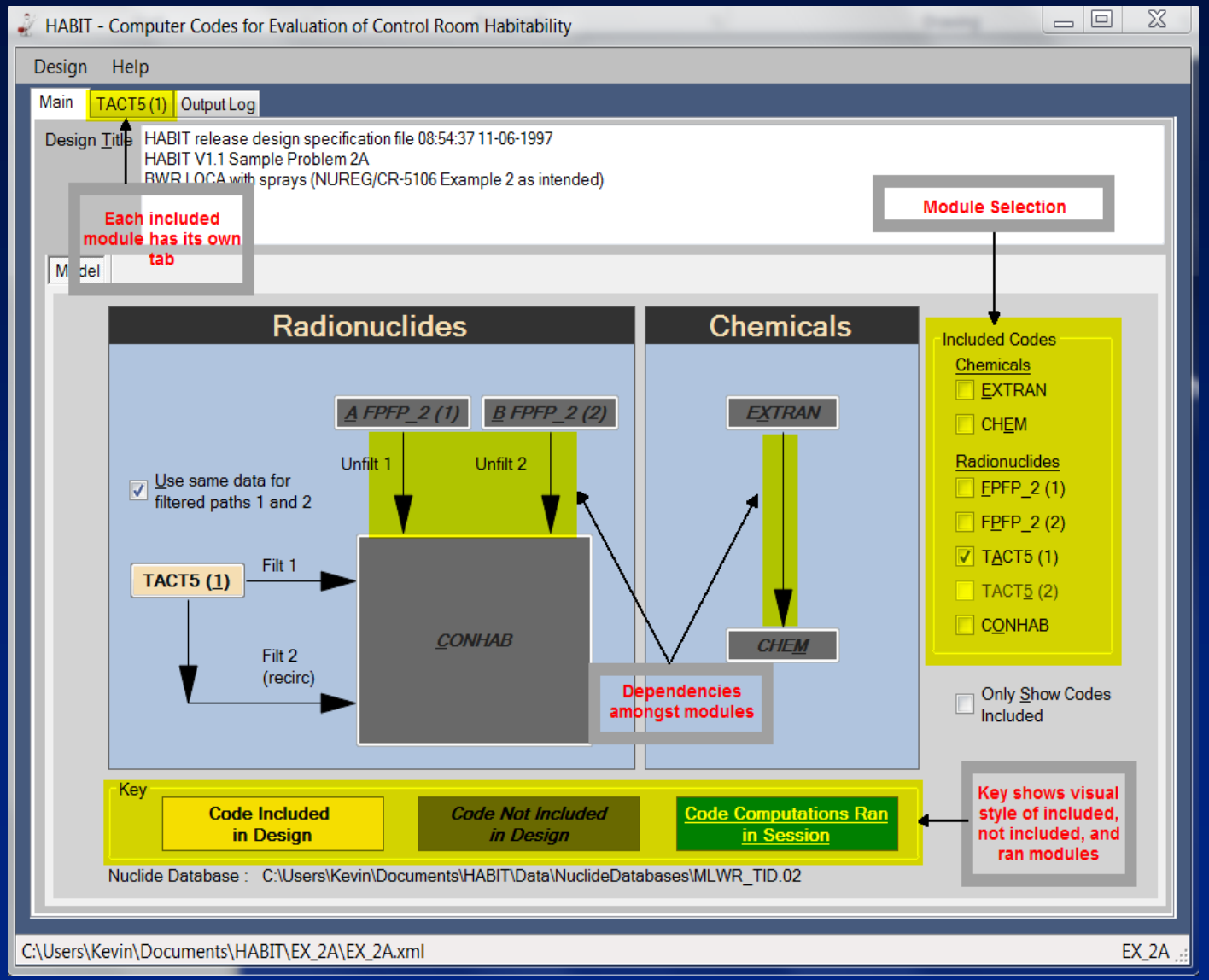
Original	New
	

HABIT v1.2: GUI

The GUI

(1) depict the relationships between the modules and

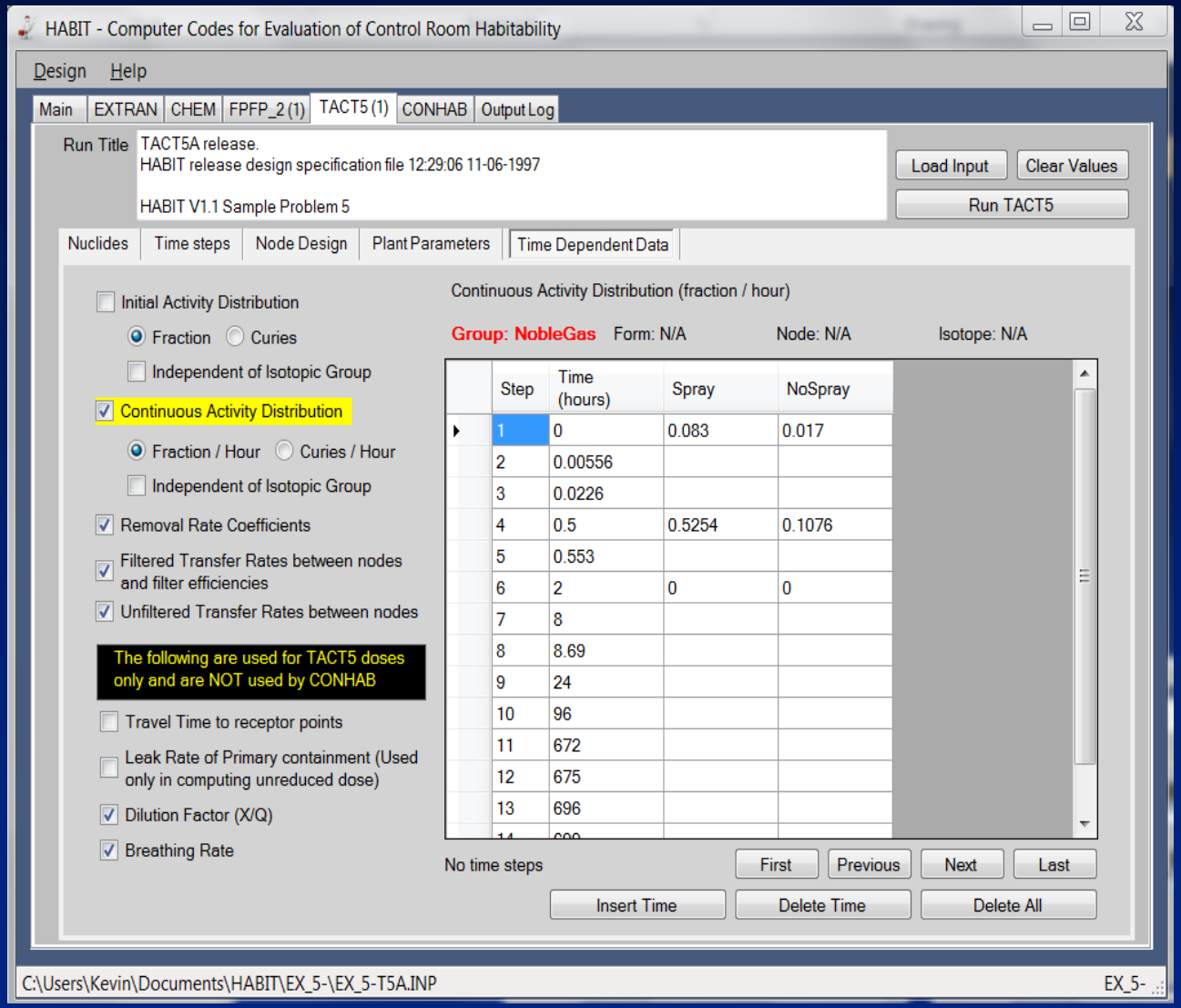
(2) show running modules in the current calculation.



U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

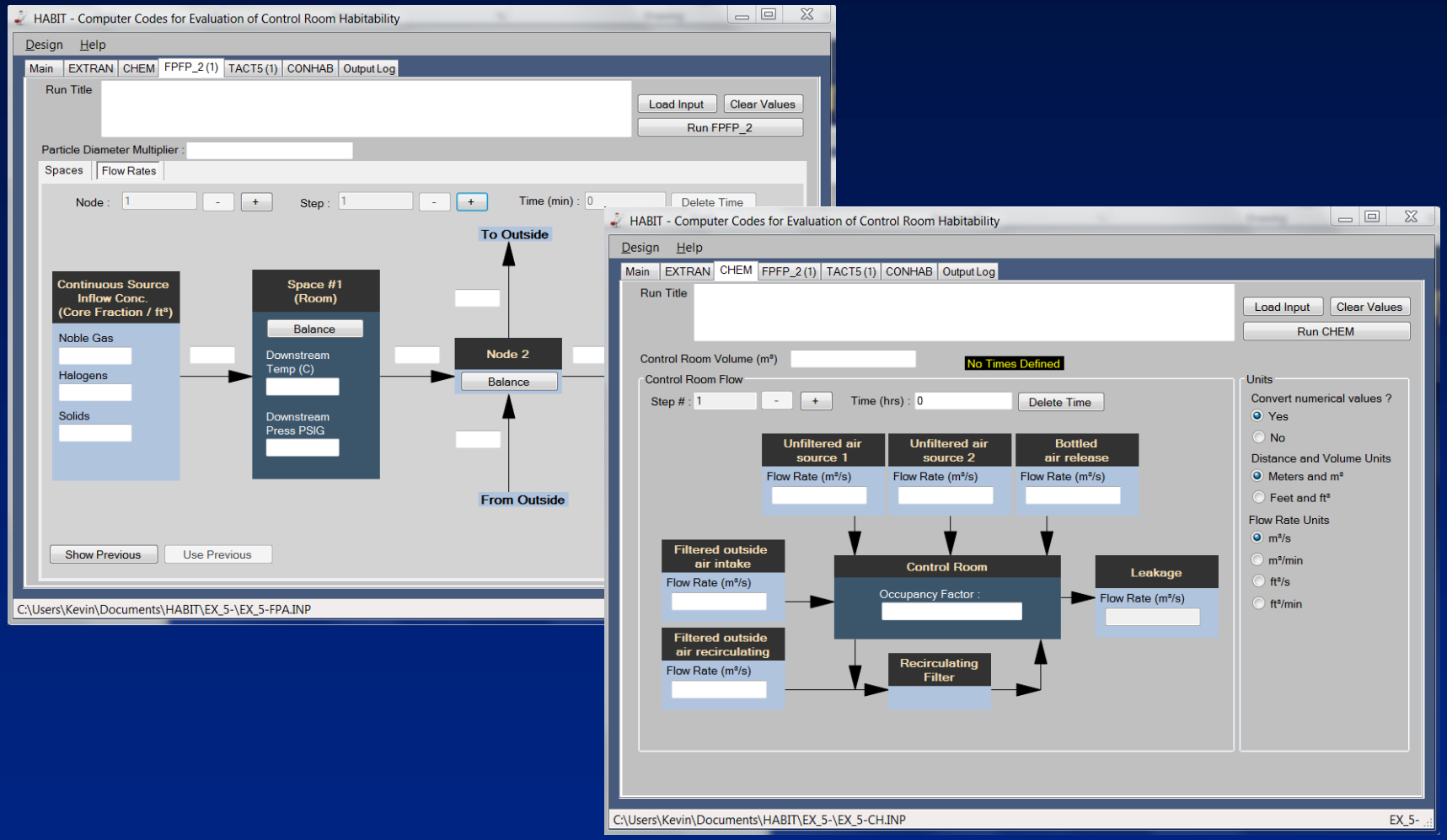
GUI: Input to Modules

Input to modules are selected from the main GUI screen. Each module has its own I/O tab.



U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

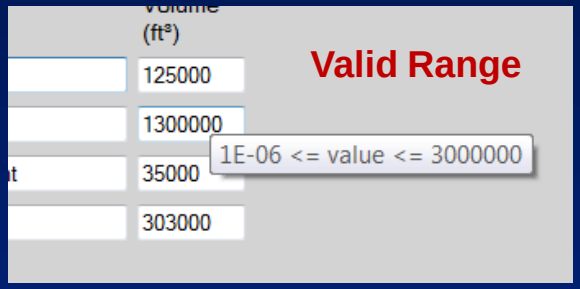
Example screens HABIT v1.2 GUI

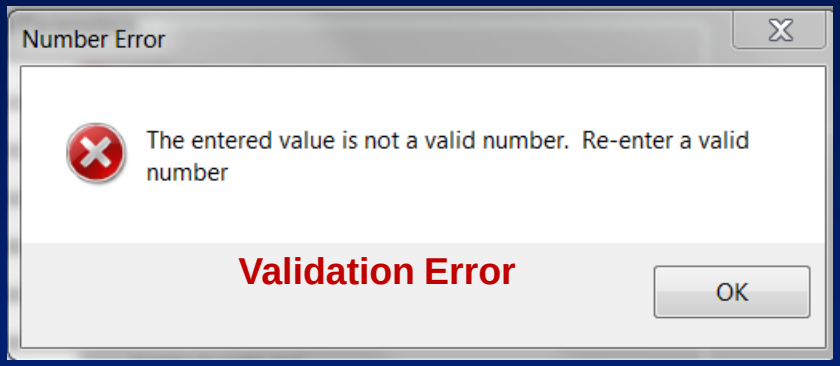


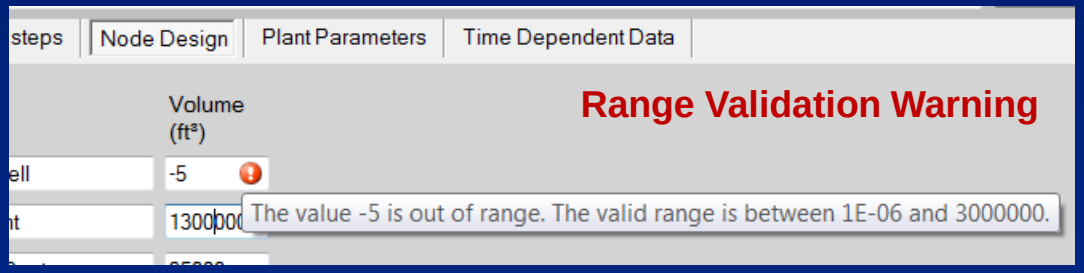
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

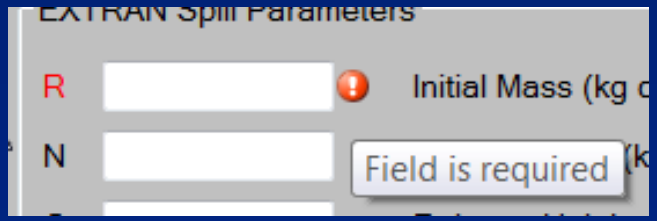
HABIT v1.2: Tooltips

Tooltips provide a convenient way to see the expected range for fields and provide validations to prevent entering bad data.









Required Field Warning

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Verification and Validation

- FORTRAN modules and I/O data:
  - Bugs identified and modified in HABIT v1.1
  - Precision of reproduced results
- Operational steps in the new HABIT v1.2 “User Manual”

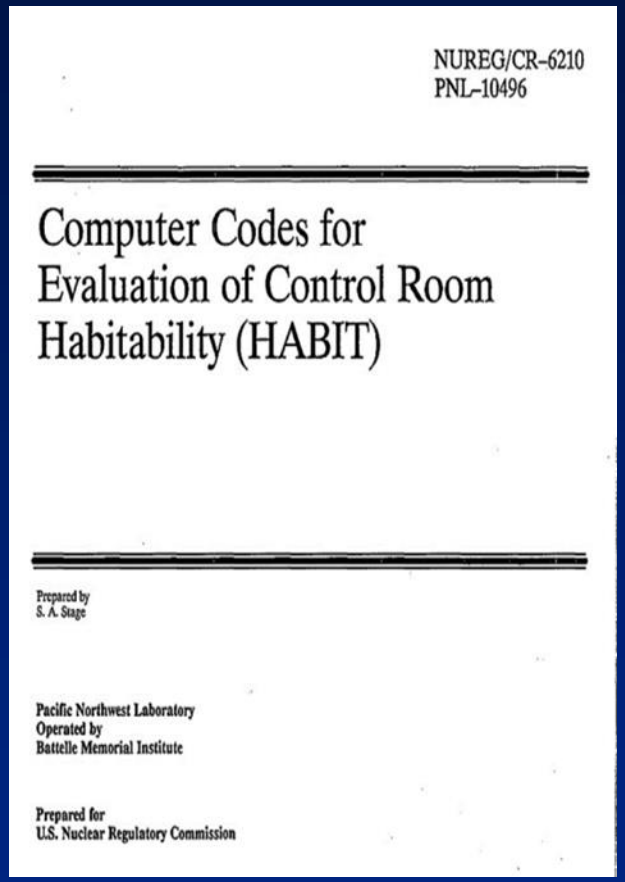
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Dense-Gas Models

- **DEGADIS** solves the gas concentrations by gravity-driven, over flat terrain, then into the entrainment layers
- **SLAB** solves gas concentrations by mass, energy, and momentum balances at downwind locations.
- **Both Models can perform for release from pool evaporation, jets, and explosion scenarios.**

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Work-in-Progress



NUREG/CR-6210
PNL-10496

Computer Codes for Evaluation of Control Room Habitability (HABIT)

Prepared by
S. A. Stage

Pacific Northwest Laboratory
Operated by
Battelle Memorial Institute

Prepared for
U.S. Nuclear Regulatory Commission

- Re-host **DEGADIS** and **SLAB**
- Improve **HABIT** ATD computations
- Design GUI and interface I/O with **Excel©**
- Update TBDs

Targeted completion date: 12/30/2016

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

On-Going Enhancements

- Add **SI units**
- Add **chemicals**
- Add **ICRP 60/103 dose coefficients**
- Move into RAMP

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Casper.Sun@NRC.gov

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment