# Tritium/C14 Working Group
# Final Report

Canada

AECL
Atomic Energy
of Canada Limited

# Table of Contents

# Introduction

- Background
- Situations considered
  - Tritium and C-14
  - Terrestrial and aquatic ecosystems
  - Steady-state and dynamic conditions
  - Acute and chronic releases
- Definition of OBT

# Test Scenarios

- Perch Lake Scenario
- Mussel Scenario – Uptake Phase
- Mussel Scenario – Depuration Phase
- Pickering Scenario
- Pine Tree Scenario
- Soybean Scenario
- Pig Scenario
- Rice Scenario
- Potato Scenario

# Scenario nn

- Brief scenario description
- Observations
- Modelling approaches
- Comparison of predictions and observations
- Discussion and conclusions
- In Appendices
  - Full scenario description
  - Model descriptions

# Model Intercomparisons

- Hypothetical acute-release scenarios
  - Scenario description
  - Modelling approaches
  - Comparison of model predictions
  - Discussion and conclusions
  - Appendices containing scenario description and model descriptions

# Summary and Conclusions

- Overall Conclusions
  - We have a good conceptual understanding of the transport of tritium and C-14 through the environment
  - Model performance is better for steady-state conditions than for dynamic conditions
  - Uncertainties are at least a factor of 2 for steady-state conditions and a factor of 5 for dynamic
  - Results are scenario specific and difficult to generalize to other processes, sites, etc
  - It's difficult to identify specific causes for differences in predictions because the models and parameter values differ in so many ways
  - We know how to be conservative but not realistic
  - Model performance does not seem to have improved over time (for the reasons given at the plenary session on Wednesday)

# Summary and Conclusions
## (Continued)

- Summary of Achievements
  - Bringing together modellers and experimentalists in the same program
  - Organizing existing data into usable test datasets
  - Deriving knowledge from the analysis of the data
  - Initiating experimental studies to develop new datasets as the basis for the mussel scenarios
  - Initiating experiments to investigate the existence and magnitude of buried tritium, to help in defining OBT
  - Contributing to the revision of TRS-364

# Areas for Future Work

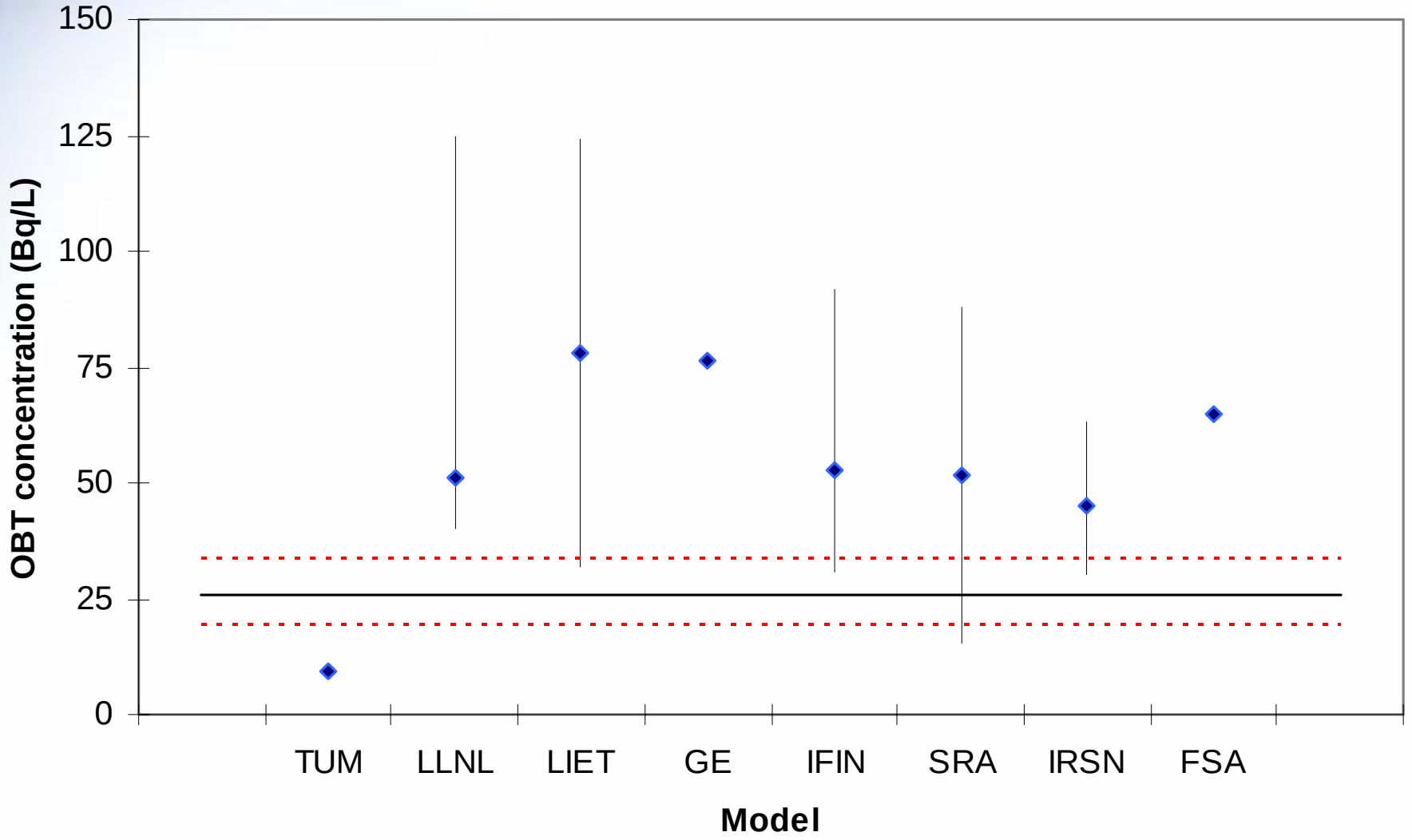
- As reported at the Wednesday morning plenary session

# Pickering Scenario

A test of models that predict steady-state tritium concentrations in chronically-contaminated agricultural ecosystems

Most models performed well in predicting HTO concentrations in soil water, milk and beef

All models significantly over-estimated OBT concentrations in plants and animal products

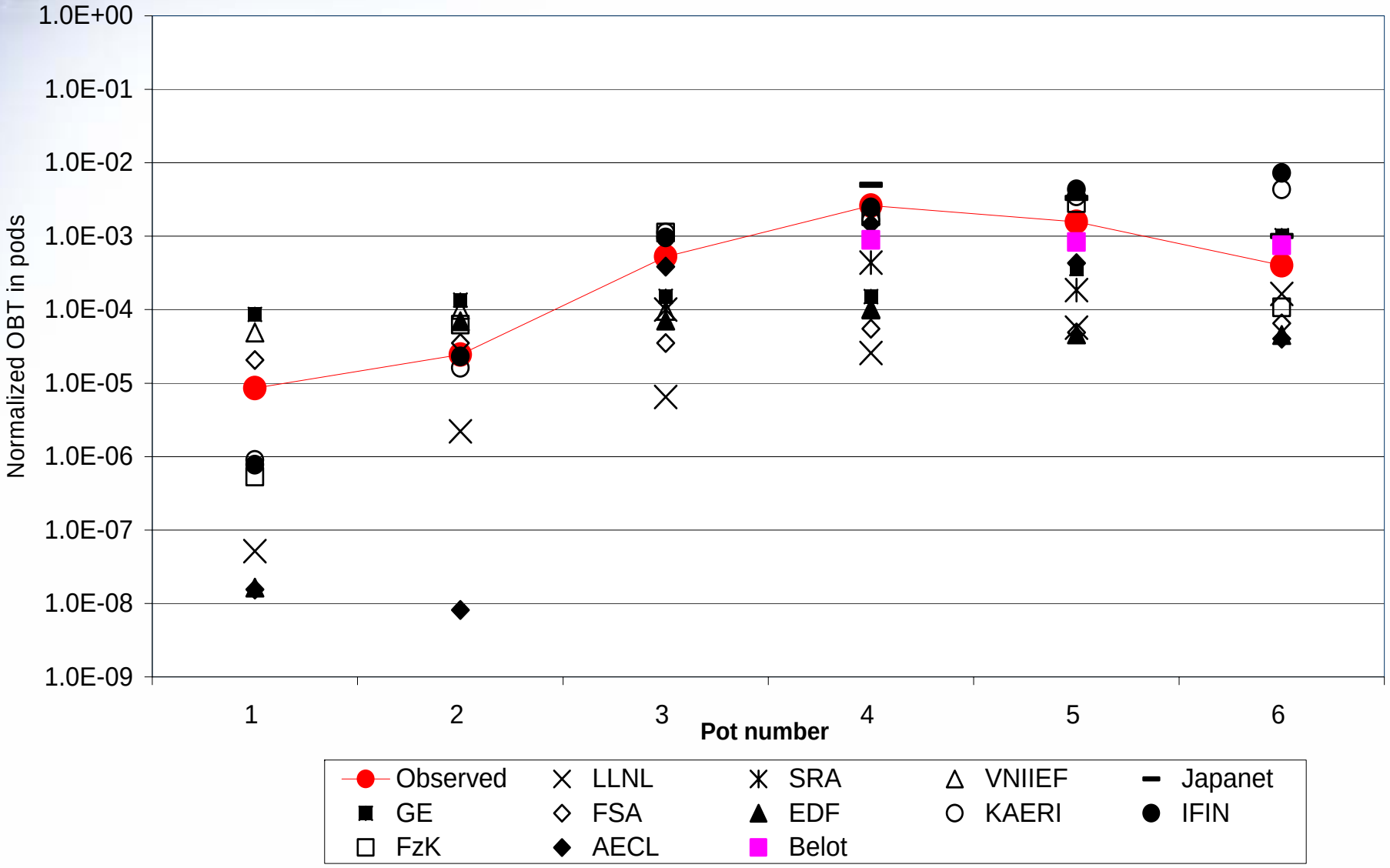

150
125
100
75
50
25
0
OBT concentration (Bq/L)
TUM
LLNL
LIET
GE
IFIN
SRA
IRSN
FSA
Model

# Soybean Scenario

A test of models that predict the time-dependent behaviour of tritium in soybeans acutely exposed to elevated levels of HTO in air

HTO concentrations were over-predicted in leaves shortly after exposure. Predictions deviated widely at later times

The models do not produce as much OBT in the pods as the plants were observed to produce in reality

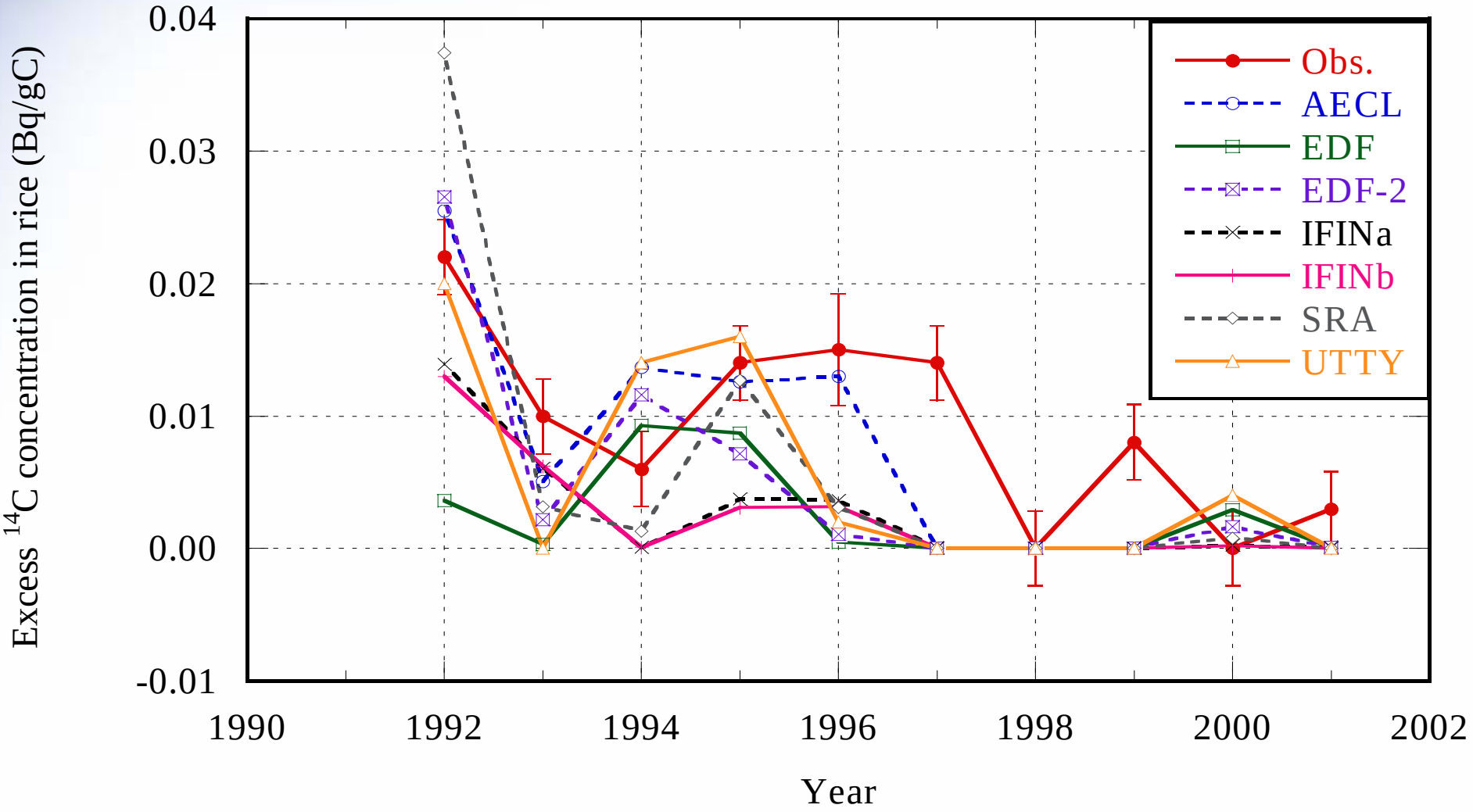

1.0E+00
1.0E-01
1.0E-02
1.0E-03
1.0E-04
1.0E-05
1.0E-06
1.0E-07
1.0E-08
1.0E-09
Normalized OBT in pods
1
2
3
4
5
6
Pot number
Observed
GE
FzK
LLNL
FSA
AECL
SRA
EDF
Belot
VNIIEF
KAERI
Japanet
IFIN

# Rice Scenario (C-14)

A test of models that predict steady-state C-14 concentrations in rice growing near a continuous atmospheric source

Predicted air concentrations differed by a factor of 3, primarily due to differences in the way lateral dispersion and plume rise were modeled

Simple specific activity models and more complex plant growth models performed equally well in predicting C-14 concentrations in rice


Excess $^{14}$C concentration in rice (Bq/gC)
0.04
0.03
0.02
0.01
0.00
-0.01
1990
1992
1994
1996
1998
2000
2002
Year
Obs.
AECL
EDF
EDF-2
IFINa
IFINb
SRA
UTTY

# Hypothetical Scenarios

- To provide the information needed to manage the dose consequences of acute atmospheric tritium releases
- Results and Conclusions
  - Ingestion is the main exposure pathway
  - OBT from the air pathways is the main contributor to dose
  - An intervention level of $10^7$ Bq/kg in leafy vegetables in the first hour after the release will avoid a dose of 5 mSv. A level of $10^6$ Bq/kg is more appropriate 2 days after the release. These results are independent of meteorological conditions.