Physicochemical Processes Controlling the Source Term From Tank Residuals #81893

Pete McGrail
Bruce McNamara
Gregg Lumetta
Shas Mattigod
PNNL, Richland, WA

Scott Wallen
University of North Carolina
Chapel Hill, NC

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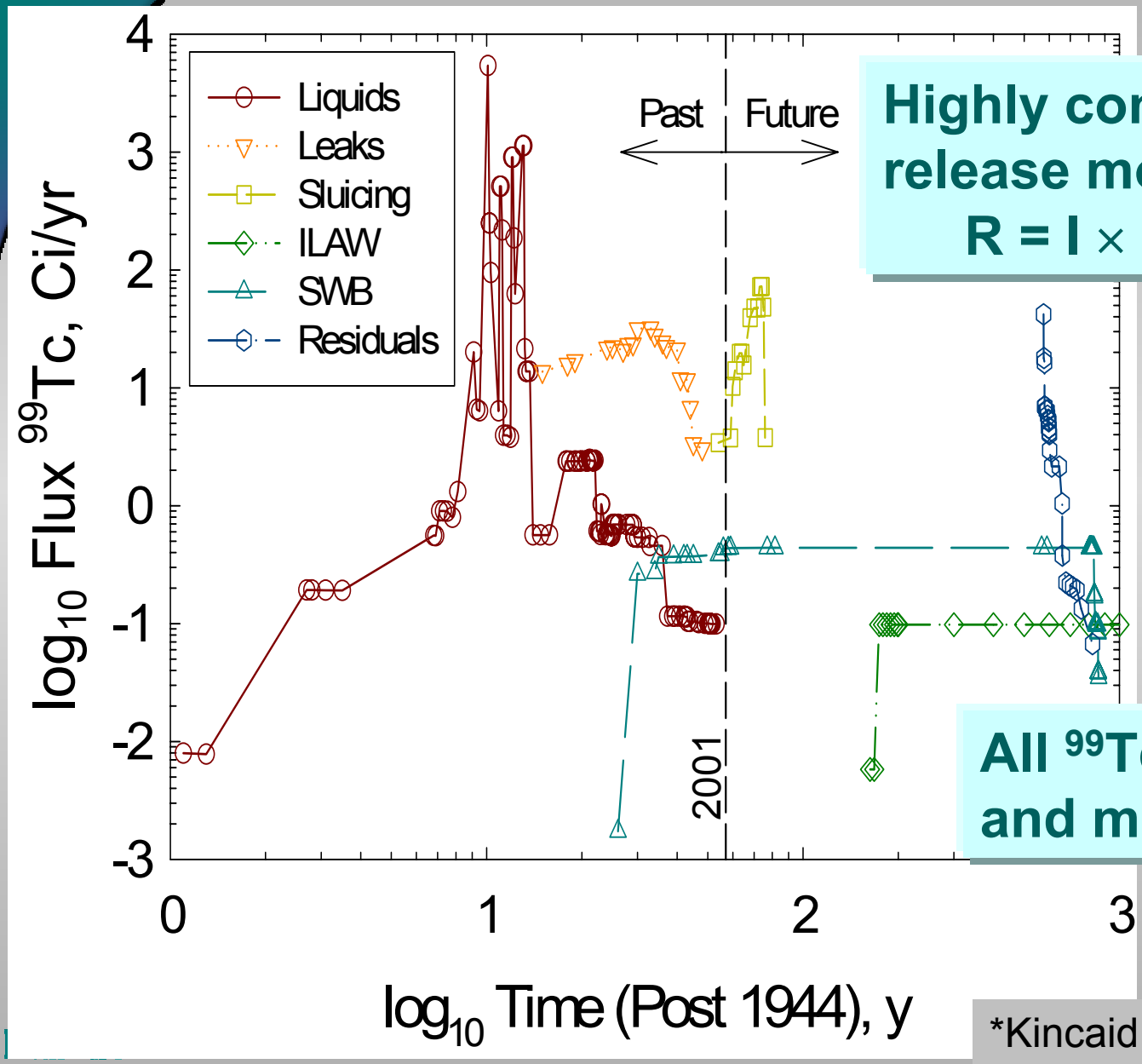
Source-Term Projections at Hanford



Highly conservative release model*

$$R = I \times S \times F$$

Effects of tank fillers – not included

All ^{99}Tc - soluble and mobile

*Kincaid et al. 1998 PNNL-11800

Alternative Balance of Mission Scenarios

Hanford cleanup: Reduce life cycle costs

$20+ billion dollars through 2028

Less "aggressive" waste removal target

< 99% Retrieval

Dispose in place for some tanks

Overall Objectives

Understand long-term processes

^{99}Tc release rates from tank sludge and hard heel

Establish a scientific basis

Predicting the radionuclide source-term for Hanford tanks post-closure

Support planning activities

Alternative Hanford cleanup scenarios

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Science Issues

Mass transport rates of H_2O and O_2 in sludge

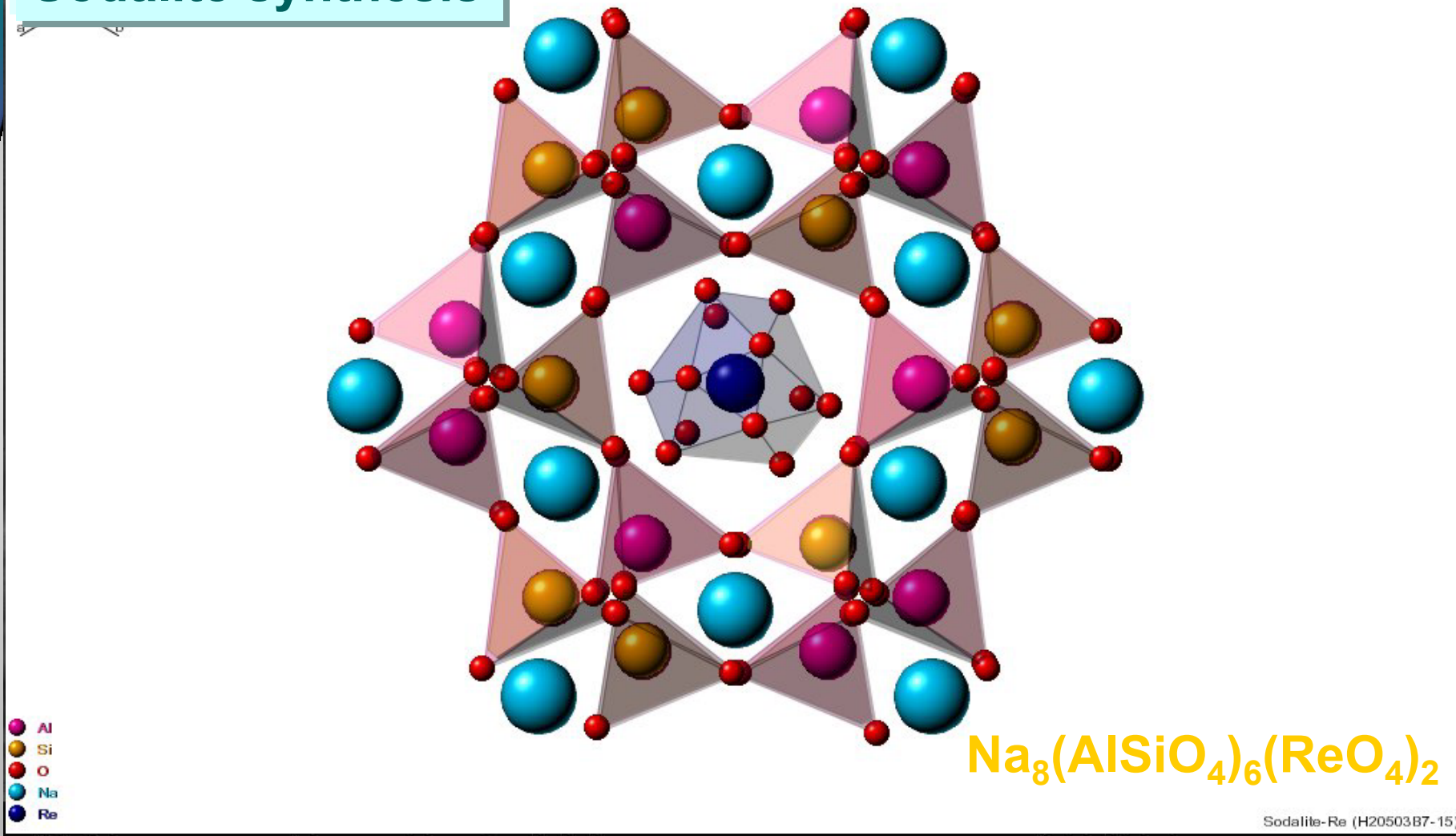
^{99}Tc Oxidation rate

Attenuation of ^{99}Tc transport – reaction with sludge solid phases

Long-term chemical aging effects ^{99}Tc release rates

Tc – Tank Residual Interaction
Enclathration in Al-Silicates

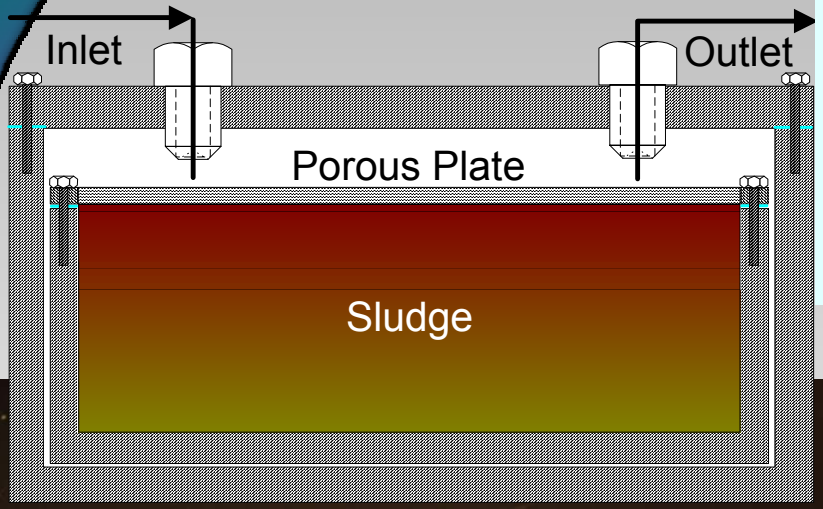
Sodalite synthesis

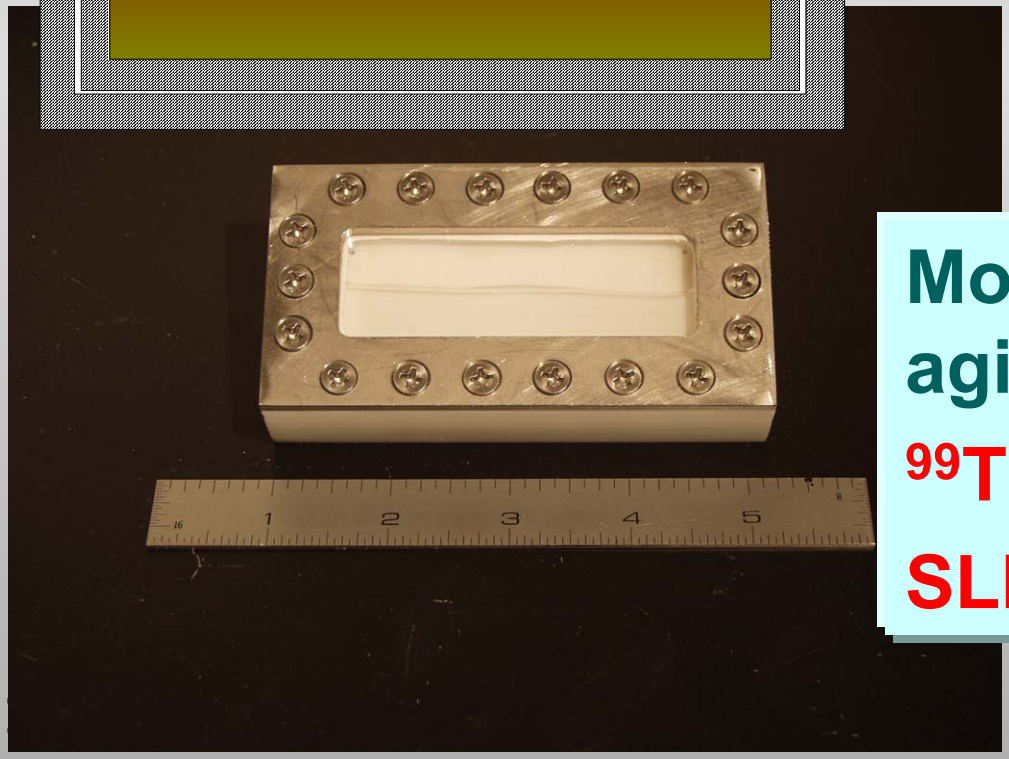


$Na_8(AlSiO_4)_6(ReO_4)_2$

#27 Re- Sodalite L2184
1024 x 960 L2184-3.TIF

Sludge Aging Studies





Mineral paragenesis

Sludge* reacted with simulated basalt and grout pore fluid

In Progress

Monitor Effects of Sludge aging on

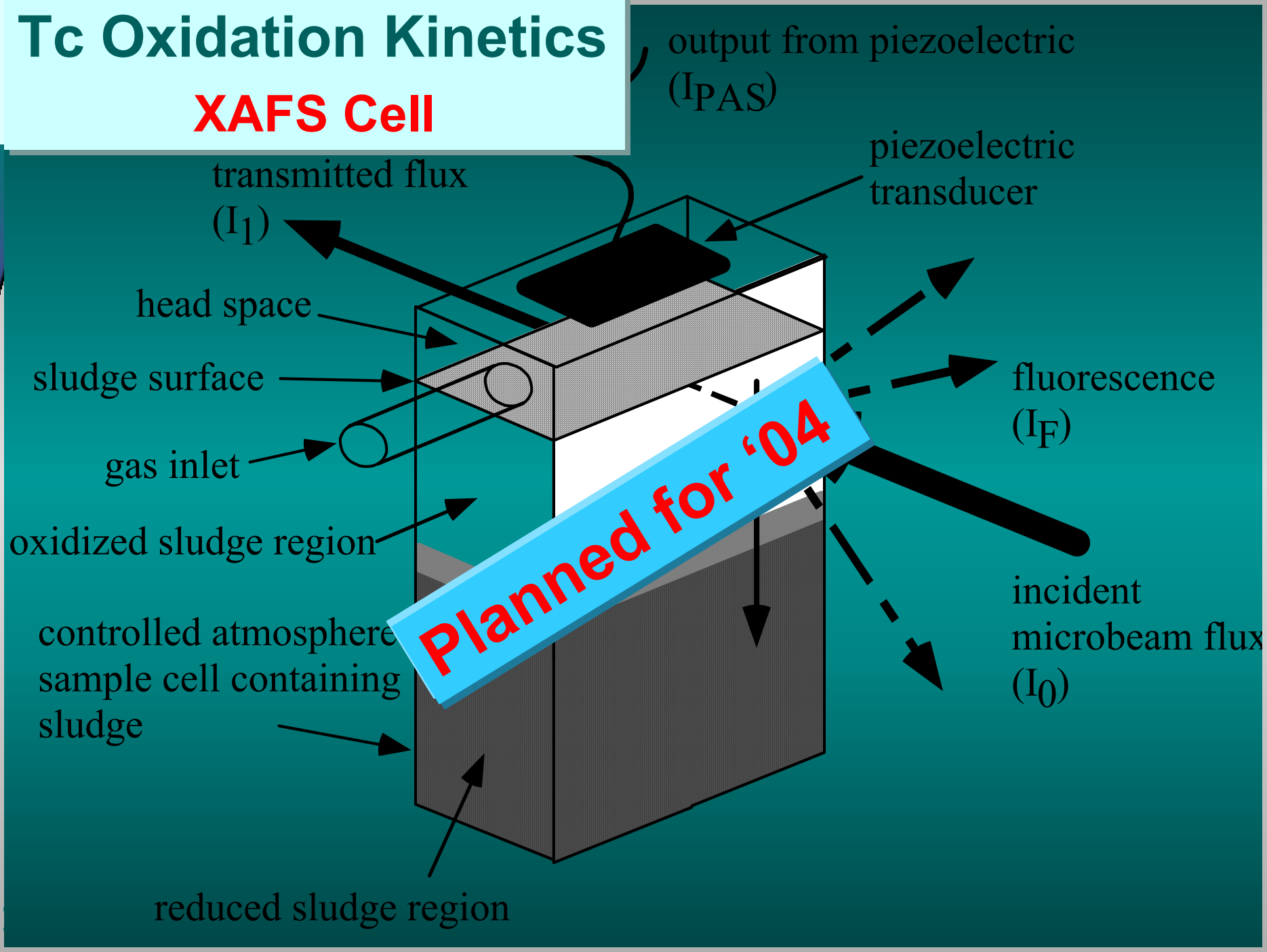
^{99}Tc release rates

SLRS, XRD, TEM, SAED

*Simulated T111

Tc Oxidation Kinetics

XAFS Cell



Summary

Experiments to address critical science needs

Water and oxygen diffusion in sludges

^{99}Tc oxidation kinetics

Sludge aging and reaction with fillers

^{99}Tc attenuation by sludge phases

Improved model for long-term ^{99}Tc release from tank residuals