

**Solvent Substitution and Destruction
at
Los Alamos National Laboratory**

John T. Whetten

**Associate Director
Energy and Technology**

LOS ALAMOS NATIONAL LABORATORY

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L S O L A

Overview

- **Los Alamos Solvent Substitution Program**
- **Broader Solvent Substitution Issues**
- **Solvent Destruction Technology Development**
- **New Technology for Solvent Substitution**
- **Summary**

Los Alamos Solvent Substitution

- **Inventory Control, Recycling, Substitution**
- **Banned Use of Solvents**
 - **Methylene chloride, acetone, 1,1,1-trichloroethane, toluene, benzene, kerosene, trichloroethylene, methyl ethyl ketone, carbon disulfide, carbon tetrachloride, tetrachloroethylene**
 - **Significant Waste Reduction Results**
- **Automated Chemical Inventory System**
 - **Targets Sources for Minimization**
- **Solvent Substitution Databases**
 - **Public and Private Sector Sources**

Broader Solvent Substitution Issues

- **Solvent Substitution by Design**
 - **DOE Complex 2000 Program**
 - **Component Design to Avoid Solvents**
- **Environmentally Conscious Mfrg Programs**
 - **Advanced Manufacturing Initiative**
 - **Industrial Waste Reduction Program**
- **Global Climate Change Program**

Advanced Manufacturing Initiative

- **Enhance US Manufacturing Competitiveness**
- **Find/Apply New Technologies & Processes**
- **Design For Production Thru Product Life-Cycle**
- **Find New, More Effective, Lower Cost Products**
- **Eliminate/Reduce Negative Impacts of Manufacturing**
- **Energy Savings Via Cost-Effective Waste Reduction**

Industrial Waste Reduction Program

The IWRP Concept is Simple...

...if waste streams can be minimized...

...energy savings will result.

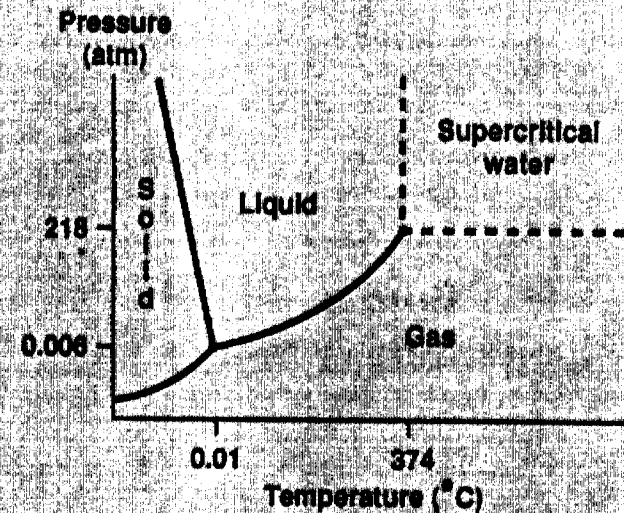
- **Industry Driven Program**
- **Industry / Government Cost Sharing**
- **Joint Industry, Laboratory, University Staffing**
- **Leverages Existing Programs, Resources and Capabilities**
- **Technology Transfer a Key Program Component**

Solvent Destruction Technology

- **Advanced VOC Oxidation Technologies**
 - **Supercritical Water Oxidation**
 - **Electron-beam Oxidation**
 - **Silent Discharge Plasma**
 - **Microwave Fluidized Bed**
- **Cost/Benefit, Life Cycle, Risk Analysis Program**
- **Joint Development with Industry / Universities**
 - **Raytheon, Auburn, Florida Int., EPRI**

GOVERNMENT SPONSORED ENVIRONMENTAL CONTROL TECHNOLOGIES CAN HELP CLEAN UP THE ENVIRONMENT WHILE KEEPING US INDUSTRY COMPETITIVE

- **Supercritical water oxidation offers low-temperature destruction of hazardous compounds**
- **Studies of fundamental chemistry have provided the basis for scaleup to commercial demonstrations**
- **Appears to be advantageous for on-site cleanup of contaminated surface or ground water, soils, explosive and propellant wastes, and mixed wastes**



Existing Pilot Plant Demonstrates Electron-Beam Treatment Technology

Electron-beam
spreader

Electron-beam
exit window

Water effluent
piping



Electron-beam
stop

Waterfall

Diagnostic
piping

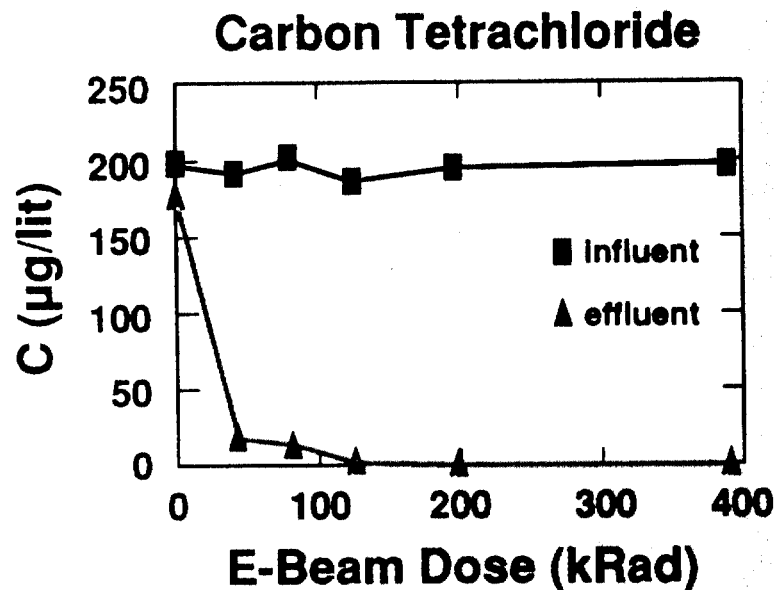


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The Existing Florida International University- University of Miami Pilot Plant Has Demonstrated The Effectiveness Of E-Beam Waste Treatment



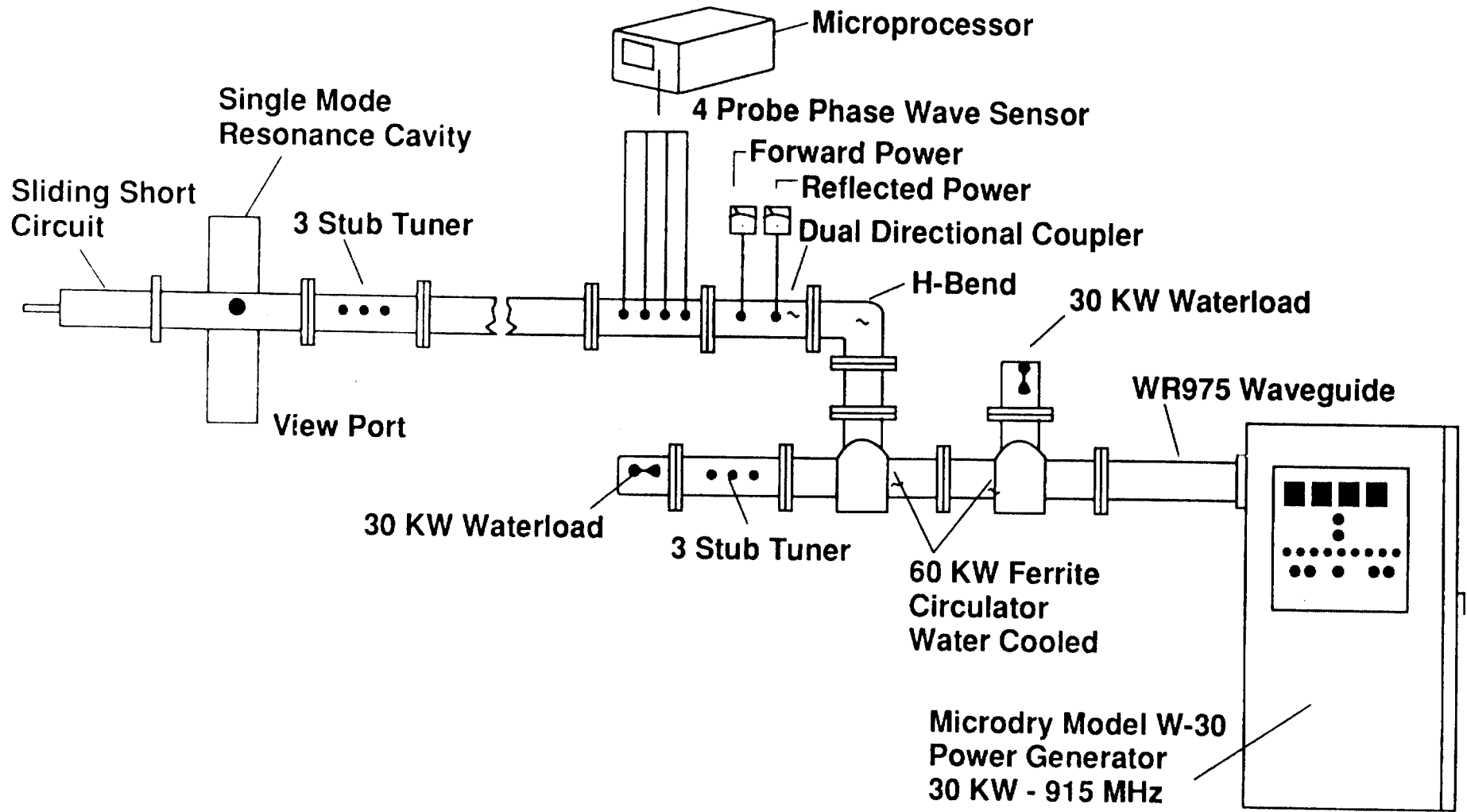
Hazardous Chemical Compound	E-Beam Dose (kRads)	Removal Effect (%)
Trichloroethylene	500	>99
Toluene	650	97
Benzene	650	>99
Chloroform	650	83
Phenol	800	88
1,1,1-Trichloroethane	650	89
Methylene chloride	800	97
Trans-1,2-Dichloroethylene	800	93
Chlorobenzene	650	97
Carbon tetrachloride	150	>99

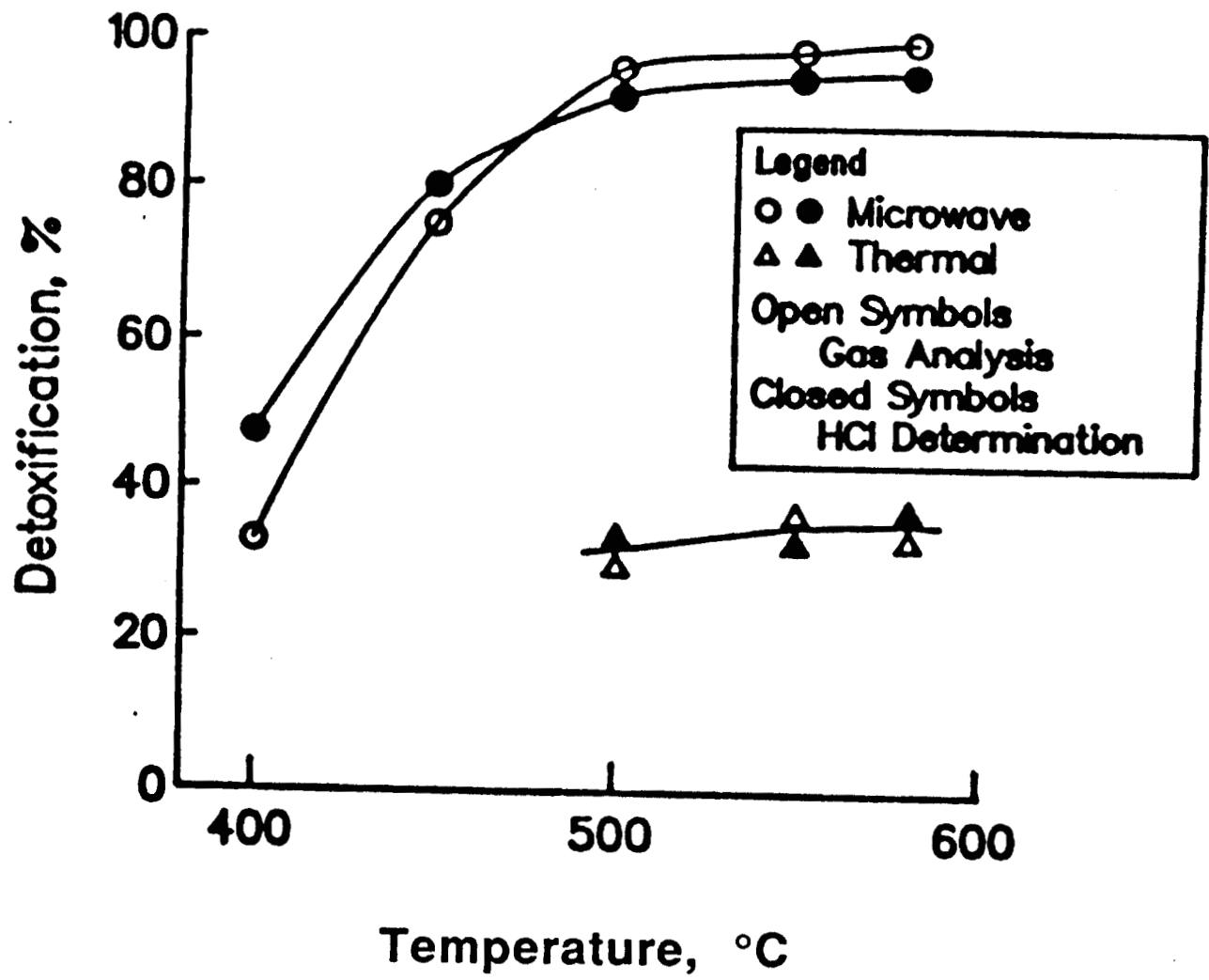


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Miami

0.915 GHz 30 KW Microwave Reactor Set Up





Detoxification of Trichloroethane as a Function of SiC-Bed Temperatures

New Technologies for Solvent Substitution

- **Leapfrog Solvents for Competitive Advantage**
 - **Supplement to Successful Alternatives**
 - **Complement to Substitution Programs**
- **Cleaning Analysis**
 - **How Clean is Clean**
 - **Surface Analysis**
- **Supercritical CO₂ Cleaning**

SCCO2 Cleaning Programs

- **Pu Parts Cleaning - LANL, RF, Mound, SNL**
- **Precision Parts Cleaning**
 - **Industrial Partnership (JAAST) - Boeing, Hughes, IBM, Autoclave Engineers, Motorola, LANL, PNL, SNL**
- **Supercritical Fluids Integrated Program**
 - **Program to Focus on DOE Complex Needs**

Summary

- **LANL Approach to Solvent Substitution**
 - Integrated into Design and Mfrg.
 - Global in Study and Modelling
 - Replace Solvent Using Processes
- **Focus on Government / Industry Cooperation**
- **National Programs in Technology Development**
 - Solvent Destruction Programs
 - SCCO2 Cleaning Programs

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