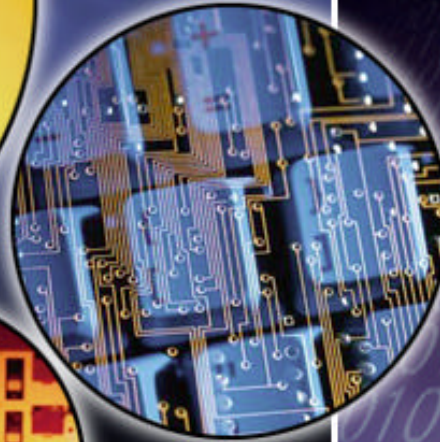


# COLLEGE OF ENGINEERING & INFORMATION TECHNOLOGY



UNIVERSITY OF  
SOUTH CAROLINA™



# **Nuclear Engineering at USC**

## **September 30, 2002**

**Ralph White**  
**Dean, College of Engineering and Information**  
**Technology**

**University of South Carolina**  
**Swearingen Engineering Center**  
**Columbia, South Carolina 29208**  
**803-777-3270, [white@engr.sc.edu](mailto:white@engr.sc.edu)**



## Background

- **Naval Nuclear Power School, Enlisted ('61-2)**
- **Engineering Laboratory Technician, USS Woodrow Wilson ('64-'68)**
- **BS, Chemical Engineering, U. of SC ('68-'71)**
- **MS, PhD, Chemical Engineering, U. of Calif., Berkeley ('71-'77)**
- **Asst. Prof. - Prof. Texas A&M ('77-'92)**
- **Chairman, Dept. of Chem. Eng., U. of SC ('93-'00)**
- **Dean, College of Eng. and Info. Tech., U. of SC (2000-present)**



## **Nuclear Power in the World**

- **434 operating plants in 31 countries**
- **France 76%**
- **Belgium 55%**
- **Sweden 46%**
- **Switzerland 41%**
- **Korea 41%, Japan 36%**
- **US 20%**

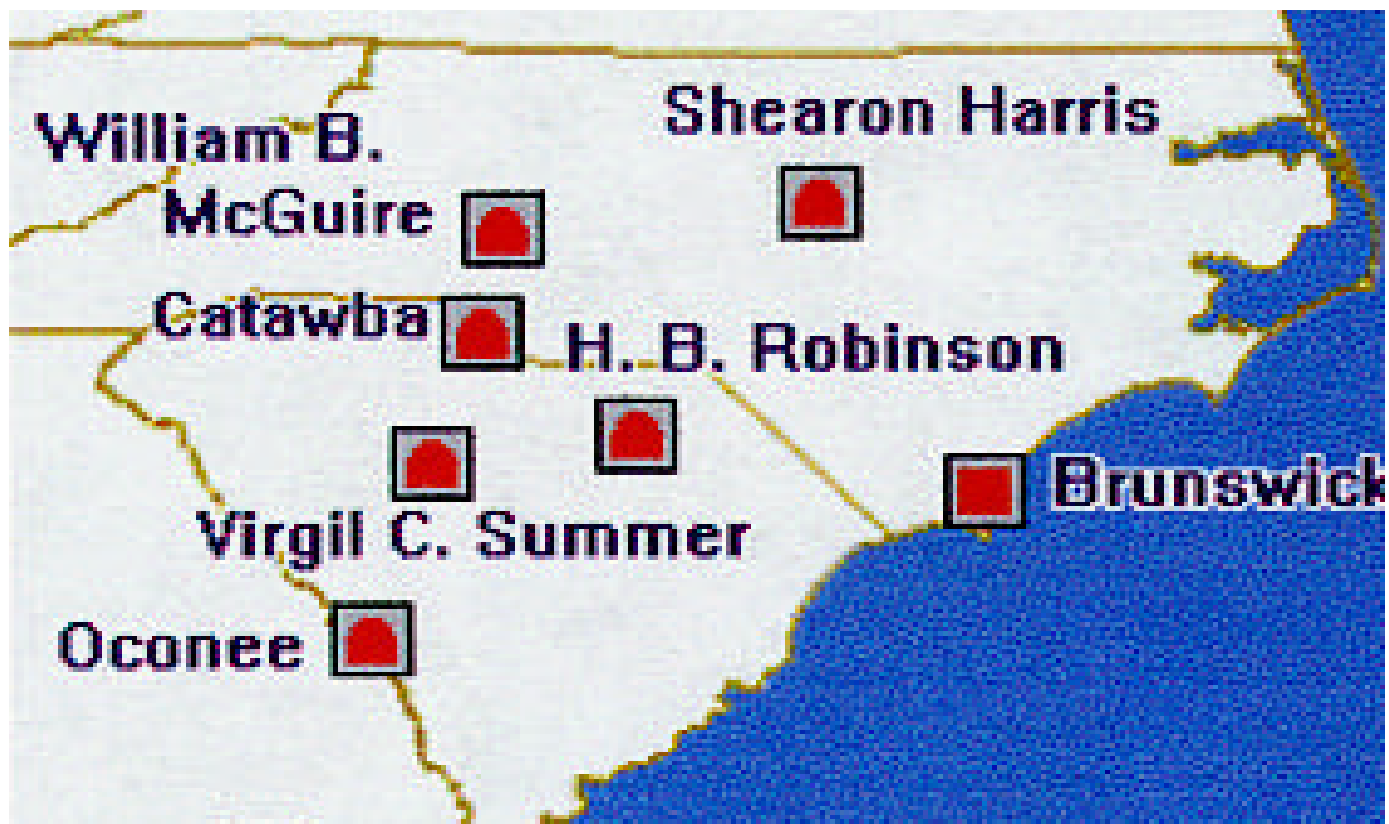


## **Nuclear Power in the USA**

- **New Jersey 74%**
- **Vermont 72%**
- **New Hampshire 50%**
- **South Carolina 50%**



## Nuclear Power Plants in the Carolinas





# Westinghouse Manufacturing Plant: Cola, SC



**Nuclear Fuel Production**



## **Projection of Needed Graduates for Nuclear Engineering\***

| <b>Year</b> | <b>BS/MS</b> | <b>Demand</b> | <b>Demand/Supply</b> |
|-------------|--------------|---------------|----------------------|
| <b>2001</b> | <b>165</b>   | <b>587</b>    | <b>3.56</b>          |
| <b>2002</b> | <b>174</b>   | <b>627</b>    | <b>3.60</b>          |
| <b>2003</b> | <b>174</b>   | <b>642</b>    | <b>3.70</b>          |

**\*Was and Martin, "Manpower Supply and Demand in the Nuclear Industry," 2000**





## **Graduate (MS/ME, PhD) Program in Nuclear Engineering at USC**

- **Formed Advisory Board (Fall 2001)**
- **Obtained State Approval (Fall 2002)**
- **Started Teaching Courses (Fall 2002)**
- **New NE faculty position approved  
(Fall 2002)**



## **Nuclear Engineering Advisory Board**

**George Davis, Chairman, Retired Vice  
Admiral**

**Nick Liparulo, Vice President, Westinghouse  
Electric Company**

**Melvin Buckner, University Programs  
Coordinator, Westinghouse Savannah River  
Site**

**Michael Tuckman, Executive VP, Chief  
Nuclear Officer, Duke Energy**



## **Nuclear Engineering Advisory Board**

**Steve Byrne, Vice President and Chief  
Nuclear Officer, SCANA**

**Scotty Hinnant, Senior Vice-President and  
Chief Nuclear Officer, Carolina Power  
and Light Company**

**J. Barnie Beasley, Jr., PE, Vice President,  
Southern Nuclear Operating Company,  
Inc.**

**James S. Tulenko, Professor, Nuclear &  
Radiological Engineering, University of  
Florida**



**Fall Semester 2002**

**One Course**

**Introduction to Nuclear Engineering, 12  
Students**

**Spring Semester 2003**

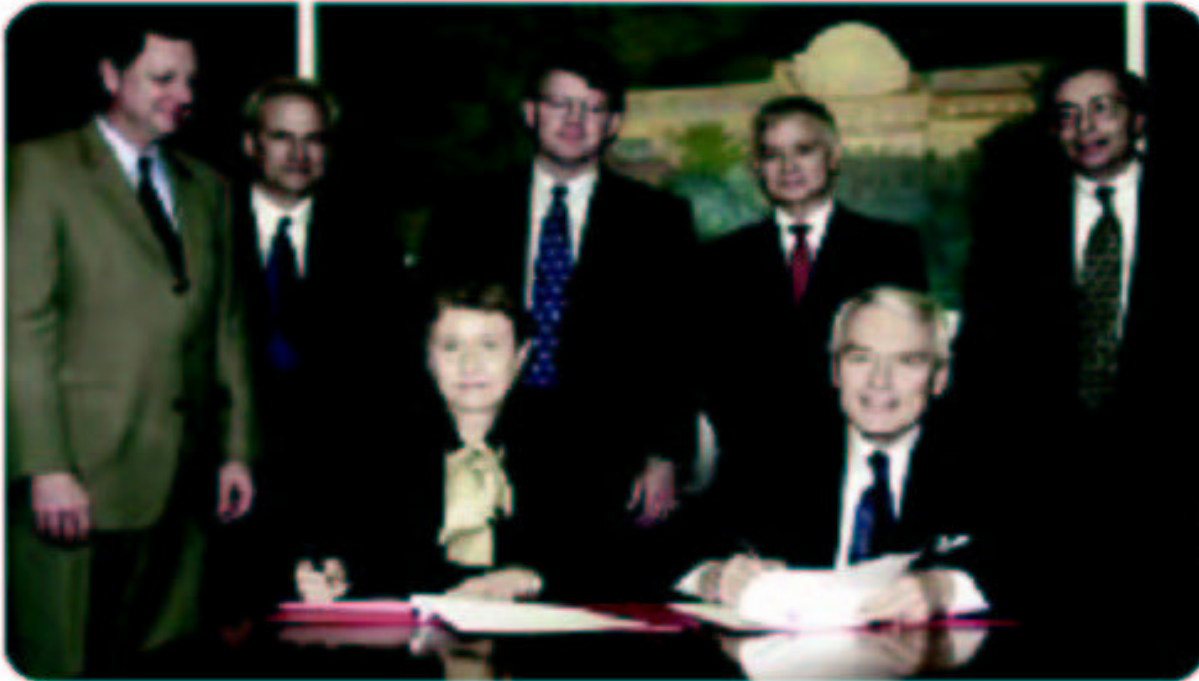
**Two Courses**

**Nuclear Materials, Nuclear Waste Management**

**(Nuclear Materials may be taught by Dr. N.  
Iyer, SRS)**



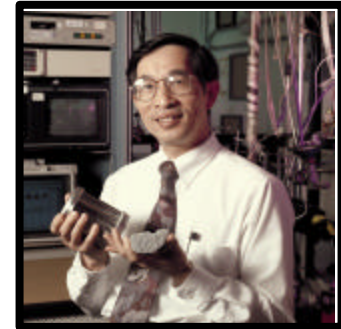
# Hydrogen from Nuclear Power



**MOA signed (January 2002) by USC President, John M. Palms, and SRTC Director, Dr. Susan Wood, to perform collaborative R&D in the area of hydrogen and fuel cell technology.**

# Hydrogen Technology at SRS

- 50+ years of hydrogen/tritium processing experience
- over 80 dedicated R&D hydrogen scientists and engineers



- world class expertise in hydrogen production, separation, purification, packaging, storage and shipment
- available hydrogen labs and hydrogen handling facilities
- Partnerships with industry, other National Labs and universities on hydrogen demonstration projects





## **Hydrogen and Energy\***

- **Leverage tritium technology to maintain critical hydrogen scientists and engineers at SRS.**
- **Support concept of “SRS as an Energy Research Park” to produce hydrogen from high-temperature gas-cooled nuclear reactors.**



## Hydrogen in South Carolina

- **BMW is developing hydrogen-powered vehicles, and fuel cell auxiliary power units.**
- **NSF Fuel Cell Center at USC.**
- **NERI: “Centralized Hydrogen Production for Nuclear Power.”**





# **NSF Fuel Cell Center Membership**

## **Executed Contracts**

**Adapco**

**BASF**

**Eastman Chemical**

**John Deere**

## **Letters of Intent**

**Dana Corporation**

**Plug Power**

**SRS**

**W. L. Gore & Associates**

## **In Review**

**DuPont**

**Naval Undersea Warfare Center**

## **Prospects**

**10 to 15 Others**

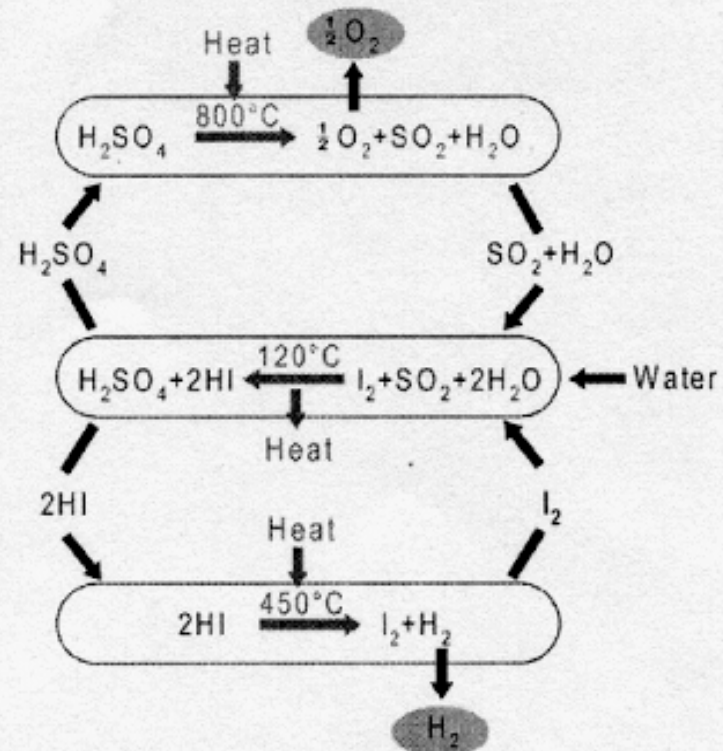


# Centralized Hydrogen Production from Nuclear Power

- **DOE Nuclear Energy Research Initiative (NERI)**
- **\$1.35M over 3 years**
- **Partners - General Atomic, Entergy, Univ. of South Carolina**
- **Phase I (2002-03) - Infrastructure Analysis including production, storage, distribution, and end-user integration of centralized nuclear hydrogen production.**
- **Phase II (2003-05) - Pre-conceptual Design and Test Case Development for Nuclear Hydrogen Production including distribution to a nearby chemical plant.**

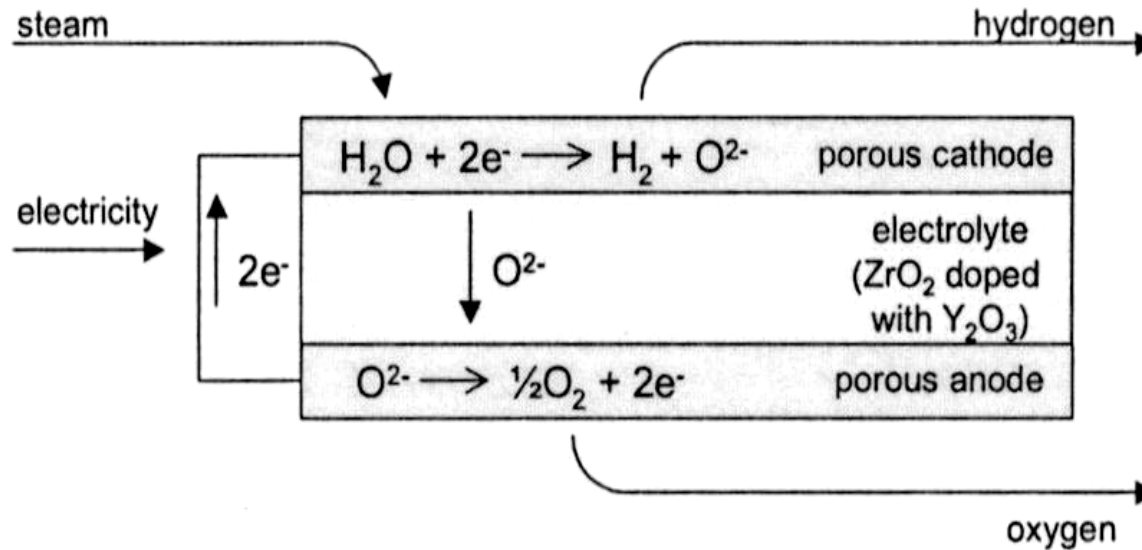


### Sulfur-Iodine Thermochemical Water-Splitting Cycle

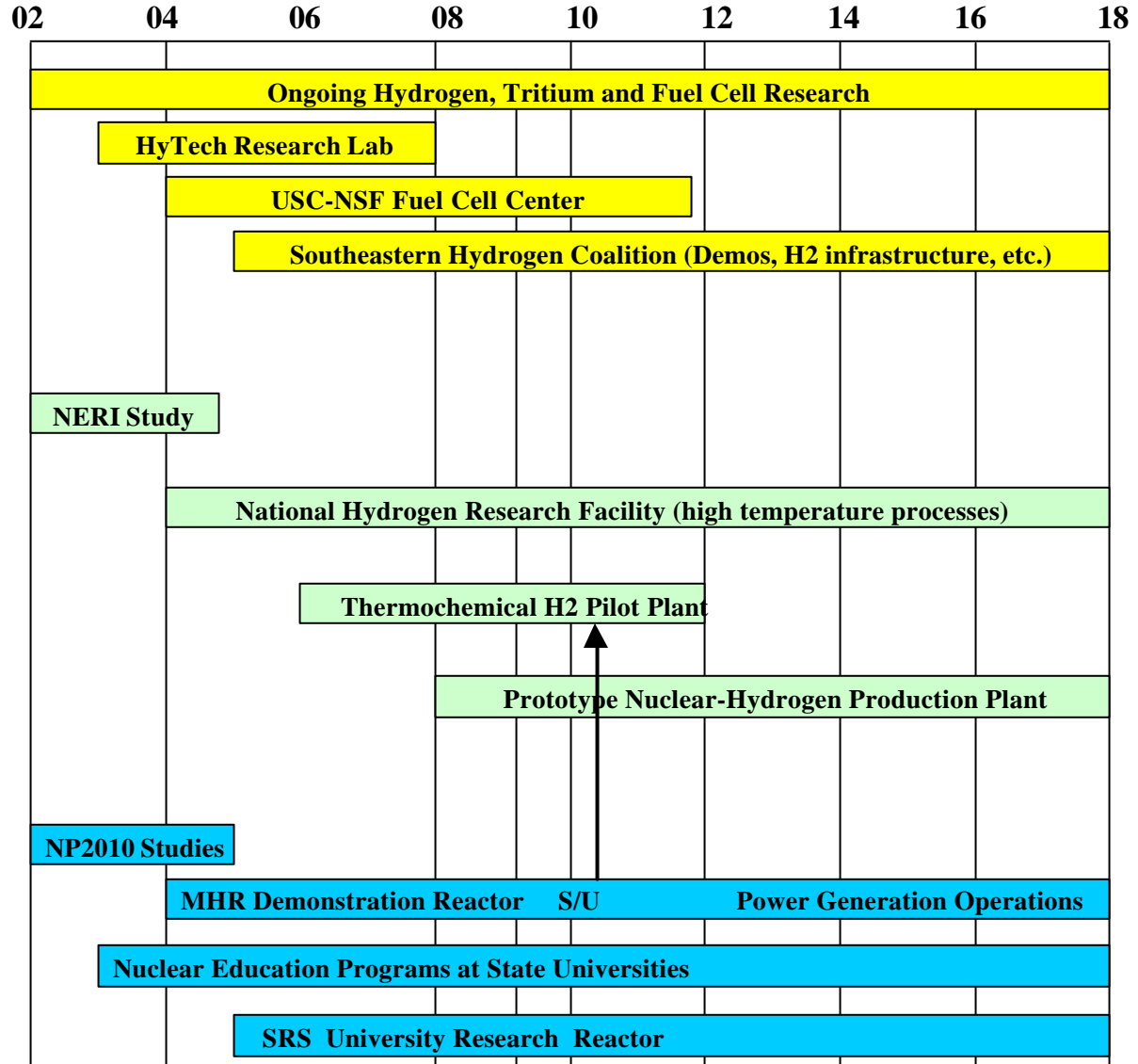




# High Temperature (1000°C) Solid Oxide Electrolysis



# Nuclear/Hydrogen Roadmap for South Carolina



**Hydrogen Programs**



**Nuclear/  
Hydrogen Programs**

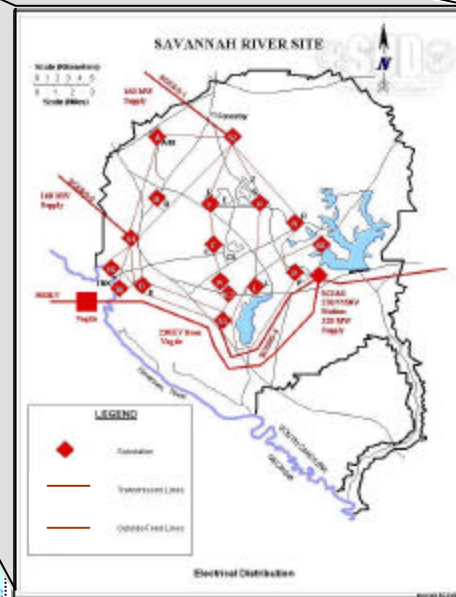
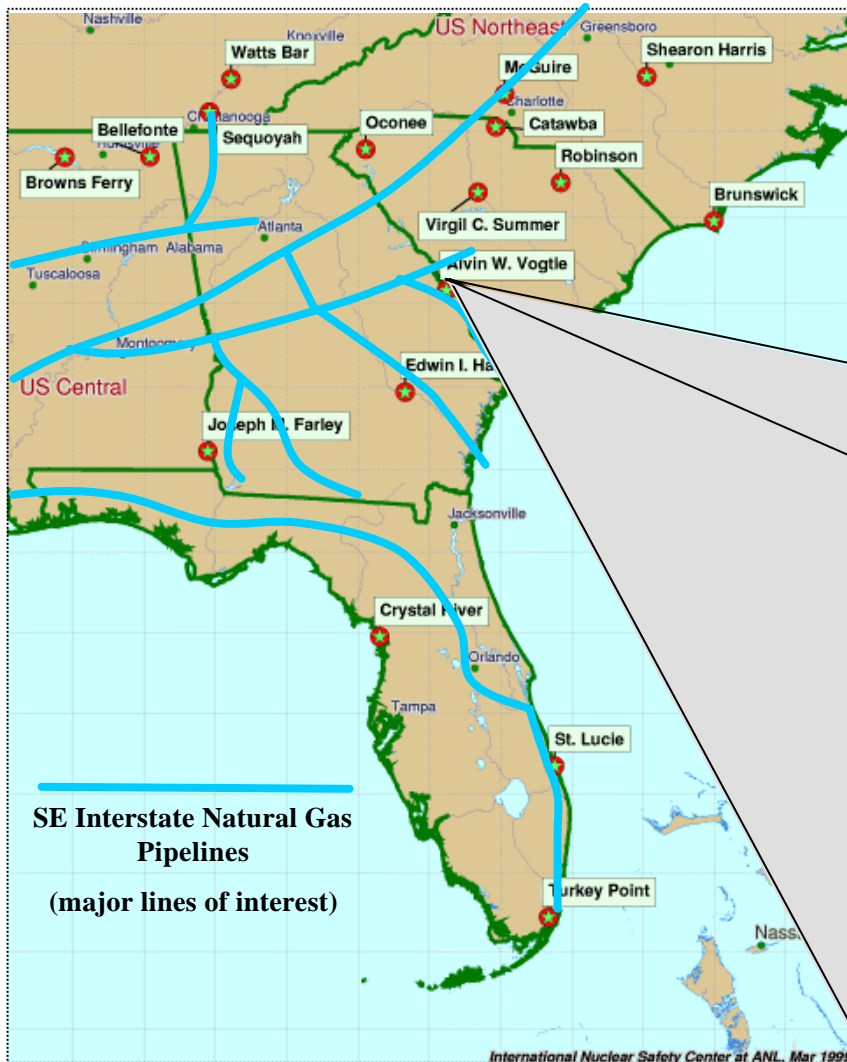


**Nuclear Programs**

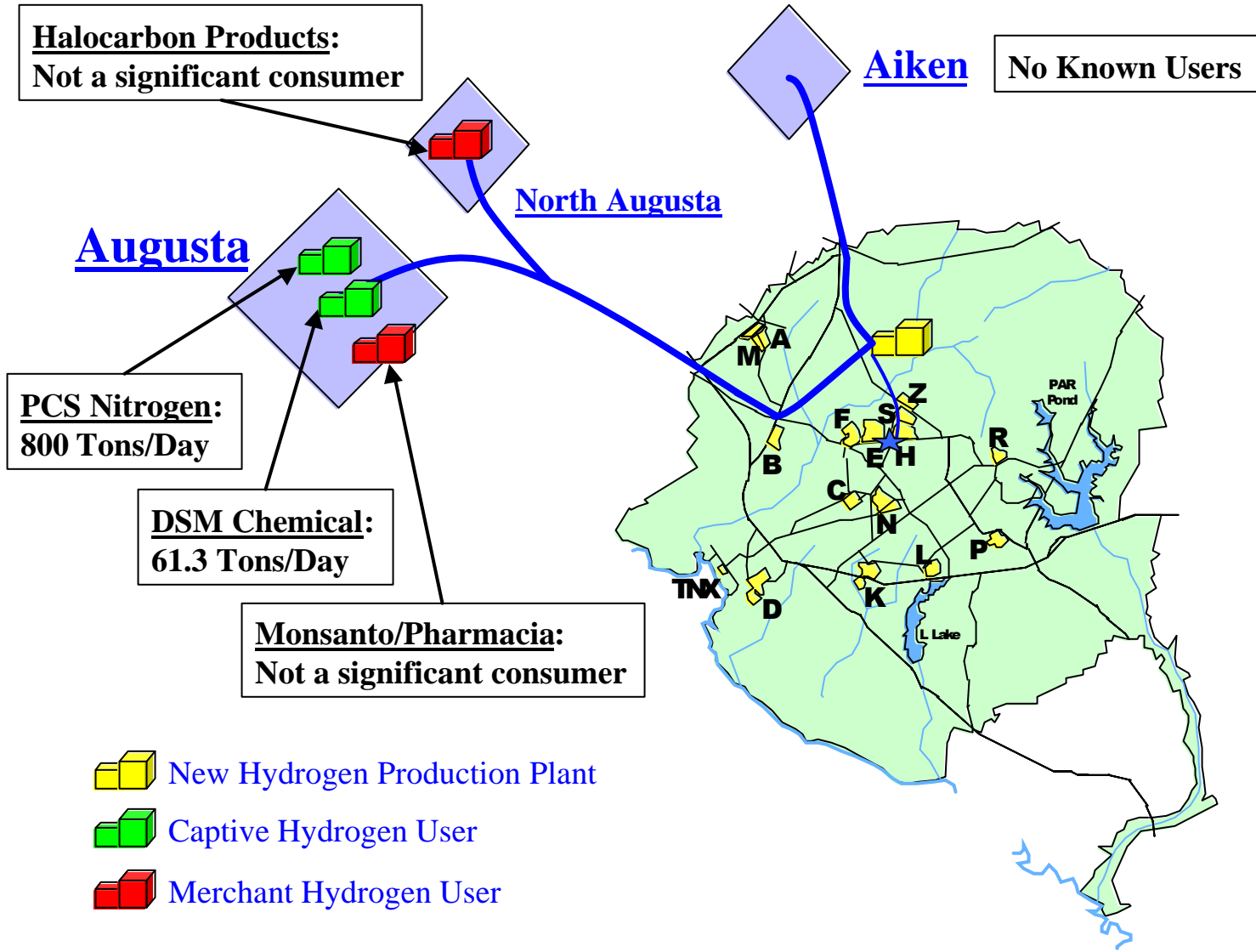


# Savannah River Site is Favorably Located

- Major eastern transcontinental natural gas pipeline passes through South Carolina
- Major interstate natural gas pipeline routed directly to Augusta, Georgia - Savannah River area



# Regional Hydrogen Users

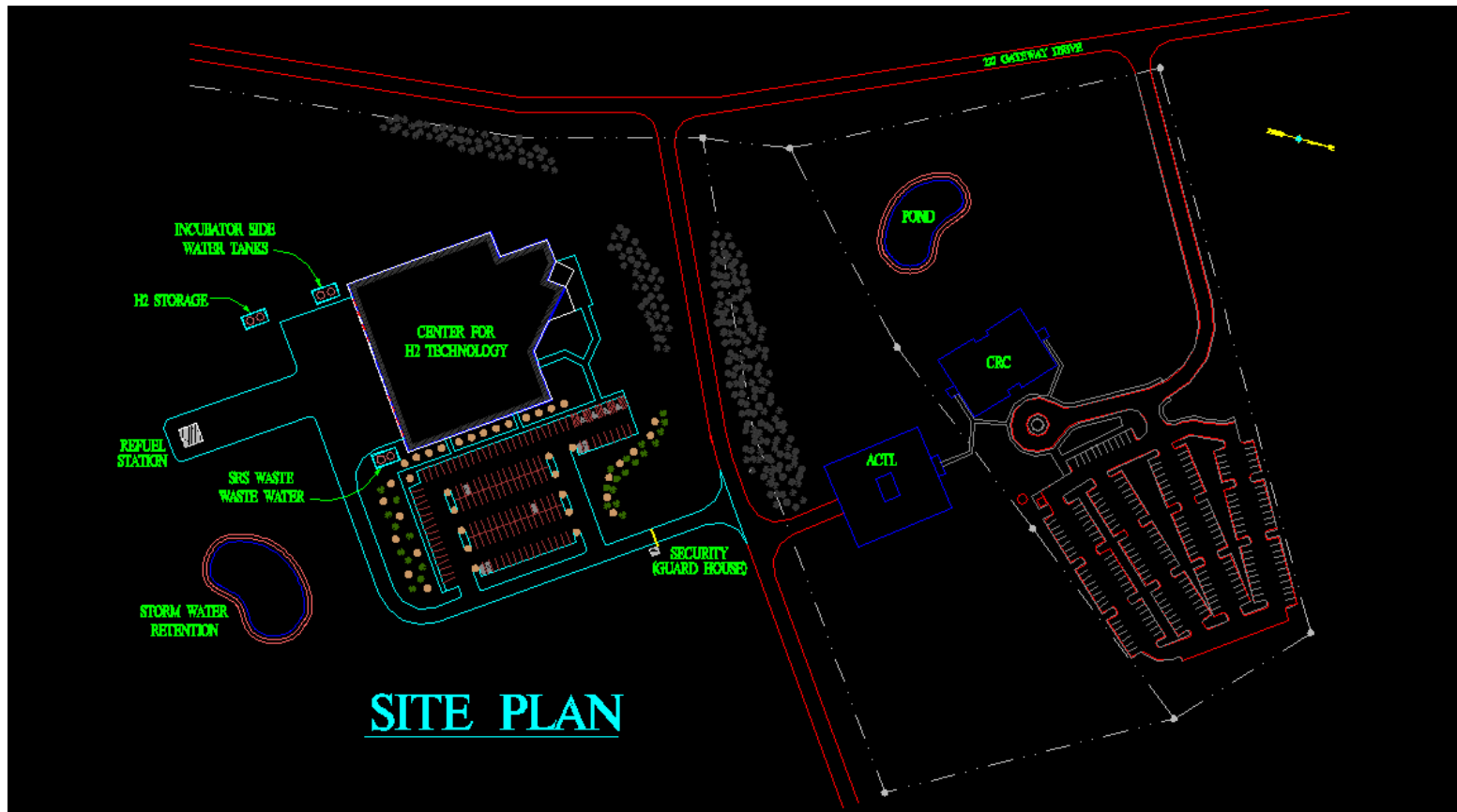






**Center for Hydrogen Technology**  
**SRS Research Campus**







## Summary

- New Graduate Programs in Nuclear Engineering at USC
- Hydrogen from Nuclear Power
- Electricity from Fuel Cells
- Energy Security through Hydrogen Economy