

A decorative border surrounds the slide content. It consists of four thick arrows forming a square. The top arrow is red and points right. The right arrow is orange and points down. The bottom arrow is grey and points left. The left arrow is cyan and points up.

# Bringing Process Analytical Chemistry to the Classroom

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J.P.Chauvel and W.W. Henslee

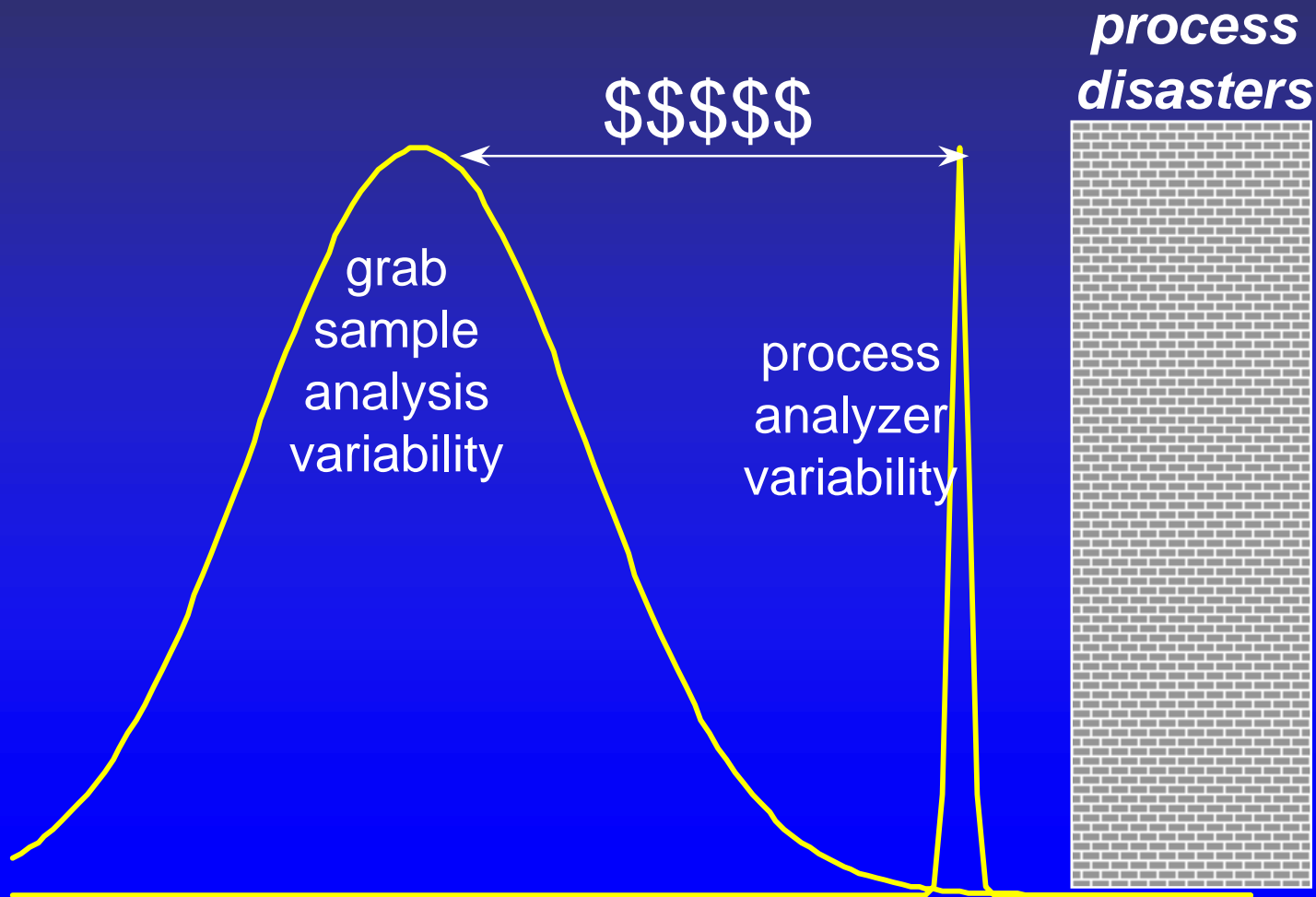
Dow Chemical Company



# What is Process Analytical Chemistry?

- ⇒ “the art and science of making rapid, online measurements for process control, safety, and environmental monitoring”
- ⇒ “the construction and operation of an unmanned analytical laboratory, which must provide reliable data >99% of the time, with 4 hours total maintenance time per month”

# Lab v. On-line Analysis



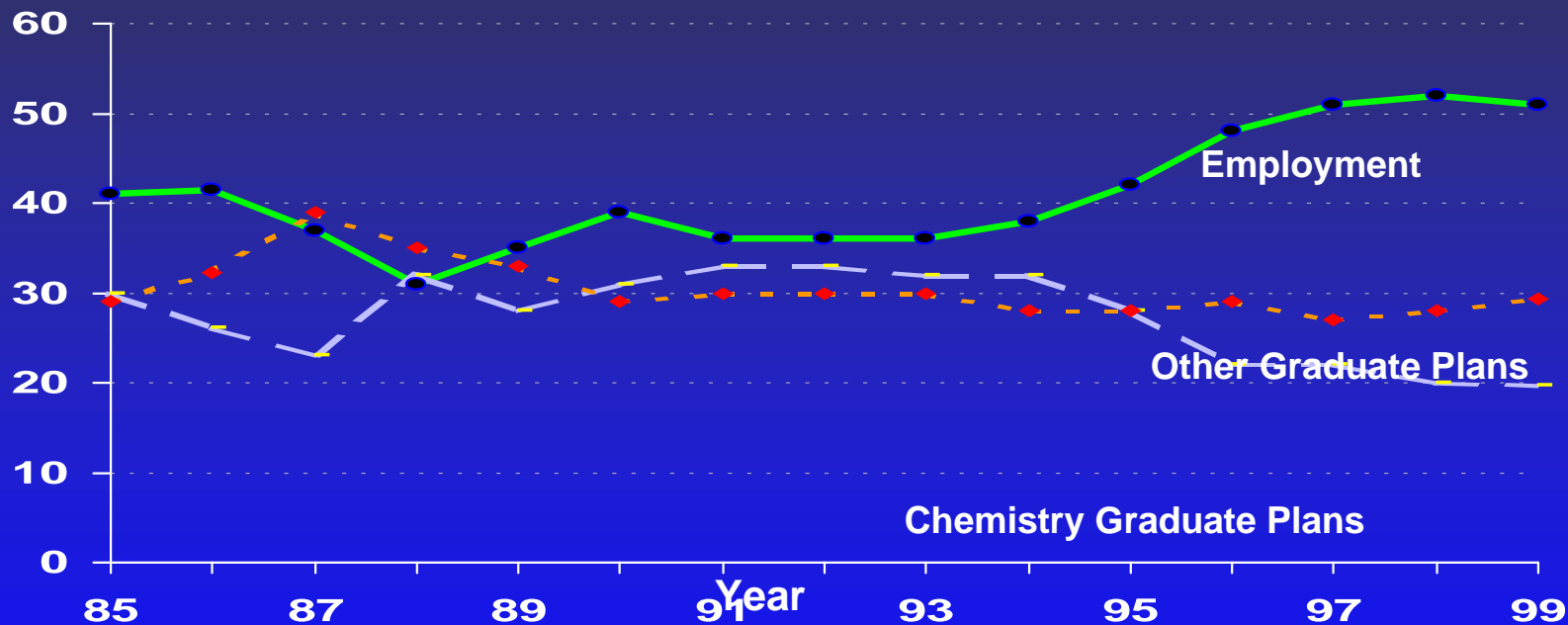
# Exterior of Analyzer House



# Interior of Analyzer House



# Post-Graduation Plans of BS / BA Chemistry Graduates



Source: ACS New Graduate Surveys  
ACS Department of Career Services





# Companies need PA Chemists

- ⇒ 2 year degree -- analyzer maintenance
- ⇒ 4 year degree -- method development and analyzer systems integration
- ⇒ Ph.D -- system design, tricky method development, instrument R&D, chemometrics



# Why consider PAC?

- ⇒ PAC is a growth area in industrial analytical chemistry; routine lab jobs are disappearing.
- ⇒ Many chemistry students (particularly from community colleges) become process operators and technicians
  - ⇒ If they have the skills to work in process analyzer maintenance, they can start at \$30-35k/ year with a two year degree.



# Practical Aspects of Process Analytical Chemistry

- ⇒ Cooperative effort between Dow Chemical Company and University of Texas at Dallas
- ⇒ Dow needed to “learn what they knew well enough to codify and teach it”.
- ⇒ UT-Dallas graduate students took the first PAPAC course in June 1999.
  - ⇒ one week, intensive, on Dow plant site, students worked in teams on realistic PAC projects



# Practical Aspects of Process Analytical Chemistry

- ⇒ It was a wonderful course, but Dow could not offer it to just a few students.
- ⇒ Next idea: Adapt the PAPAC presentation materials so that they can be used by faculty (instead of PAC professionals), and offer workshops so that faculty can learn ways they might convey PAC to their students



# Practical Aspects of Process Analytical Chemistry

- ⇒ Melton (chemist) created
  - ⇒ notes and commentary for the original materials
  - ⇒ additional presentations on industrial chemistry, near IR and chemometrics, etc
  - ⇒ prepared suggested two lecture and four lecture syllabi for chemists
- ⇒ Ricker (chemical engineer) created
  - ⇒ unit on process control
  - ⇒ prepared suggested two lecture and four lecture syllabi for chemical engineers



# Practical Aspects of Process Analytical Chemistry

- ⇒ The PAPAC materials are available on a CD-ROM and (Why carry plastic around?) a web site.
- ⇒ Instructors will have access to the original slides as well as the commentary.
- ⇒ The approach is to provide lots of support for instructors but not to demean them by making all the choices for them.

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# Practical Aspects of Process Analytical Chemistry (Topics)

- ⇒ Industrial Chemistry
- ⇒ How analyzers help make \$\$
- ⇒ Standard Analyzer technology
  - ⇒ GC, oxygen, spectroscopy
- ⇒ New Analyzer Technology
  - ⇒ Raman, tunable diode lasers, NMR, mass spectrometry, computers



# Practical Aspects of Process Analytical Chemistry (Topics)

## ⇒ Sample System Design

⇒ transport (1000 ft?)

⇒ conditioning (start with pipeline at 3000 psi?)

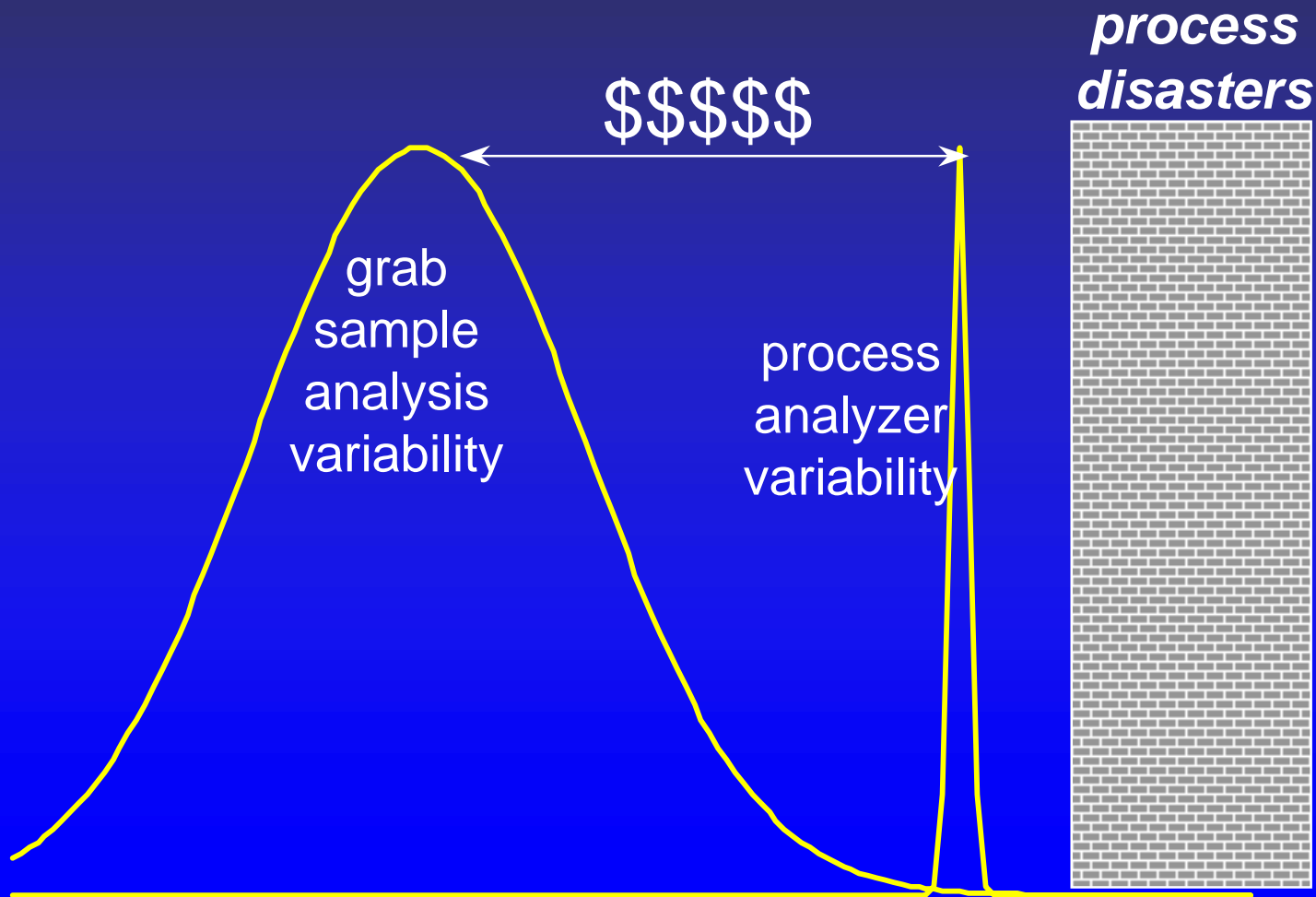
## ⇒ Analyzer Systems Integration

⇒ How does the analyzer house get designed?

⇒ What about overseas projects?

## ⇒ What is success?

# Lab v. On-line Analysis





# Practical Aspects of Process Analytical Chemistry

- ⇒ PAPAC Workshop #1 was held January 7-12, 2001 at the Dow Chemical plant in Freeport, Texas
- ⇒ 12 faculty attended -- community college, four year college, M.S. and Ph.D. universities
- ⇒ The three teams each worked on a process analytical design problem and presented their work to Dow PAC professionals on Friday.



# Practical Aspects of Process Analytical Chemistry

- ⇒ Each attendee pledged to use the PAPAC materials on campus in some way.
- ⇒ Each attendee received two “lifelines”
  - ⇒ industrial PAC people who agree to help out when students stump you with a question
  - ⇒ help arrange field trips for students to see real PAC installations
- ⇒ Each attendee has access to the web site.



# Practical Aspects of Process Analytical Chemistry

- ⇒ Dow tells me that other companies are willing to host future work shops for faculty.
- ⇒ Recruiting “lifelines” is a win-win situation.
- ⇒ If you would like to know more, or put yourself on the e-mailing list for future workshops (Jan. 2002 or later)
- ⇒ [melton@utdallas.edu](mailto:melton@utdallas.edu)



# Practical Aspects of Process Analytical Chemistry

- ⇒ Acknowledgements:
- ⇒ The wonderful people in the Freeport Process Analytical and Analyzer Maintenance groups at Dow Chemical Company
- ⇒ Financial support from Dow Chemical Company, Air Products & Chemicals, Inc., and the University of Texas at Dallas

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# Practical Aspects of Process Analytical Chemistry

## ⇒ Acknowledgements:

⇒ Dr. W.W. Henslee (Dow)

⇒ Dr. J. P. Chauvel (Dow)

⇒ Dr. F. K. Schweighardt (Air Products)