



Casting Emission Reduction Program



Foundry Processes and Their Effects on Hazardous Air Emissions

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Vice President Operations

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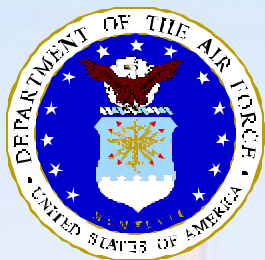
Introduction

\$50 million Government sponsored R&D Program

- Members include DoD, USCAR, AFS, EPA, foundry suppliers and California Air Resources Board
- Compliance to Clean Air Act requirements to reduce HAP's (Hazardous Air Pollutants)
- Goal is Sustainment of Foundry capacity in the U.S.



A Cooperative Approach



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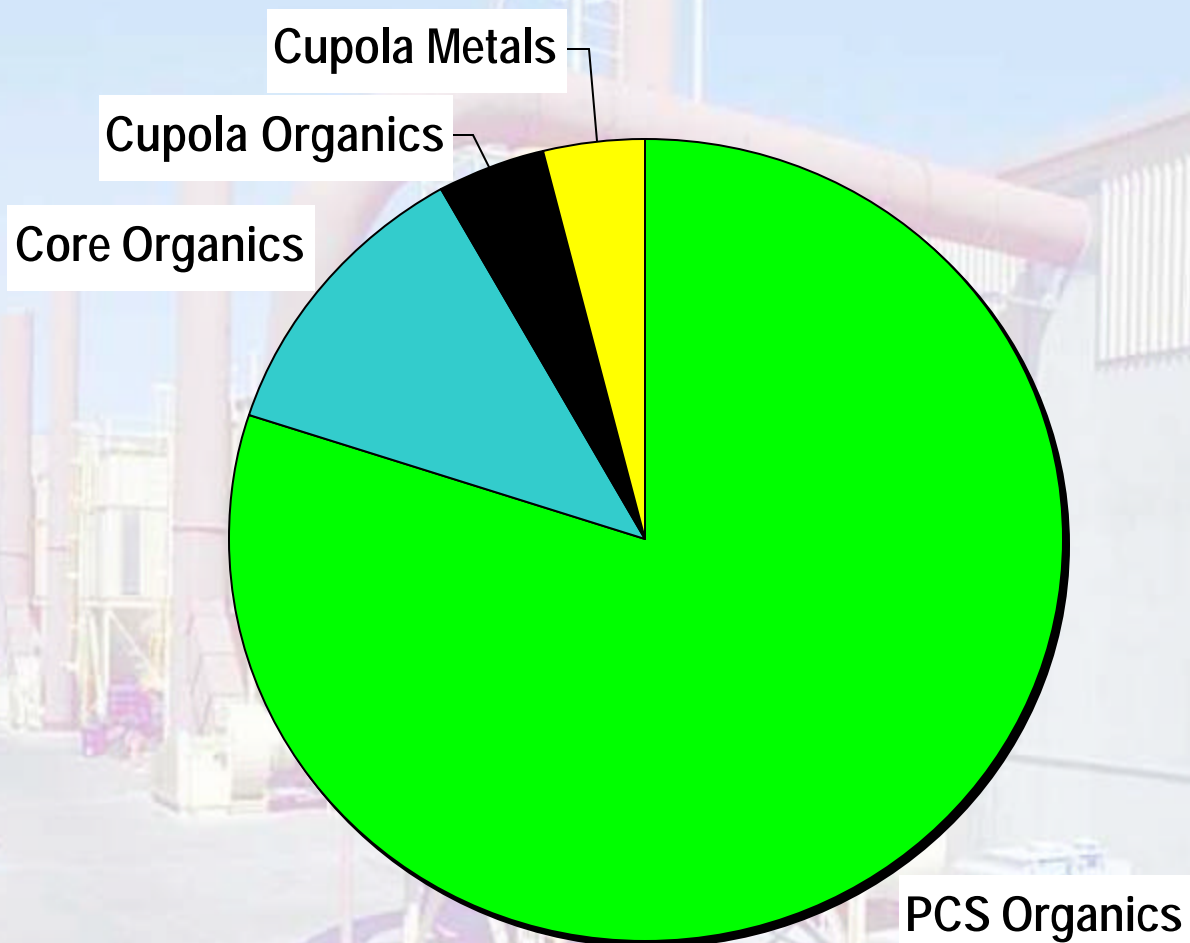


AMERICAN FOUNDRYMAN'S SOCIETY, INC.

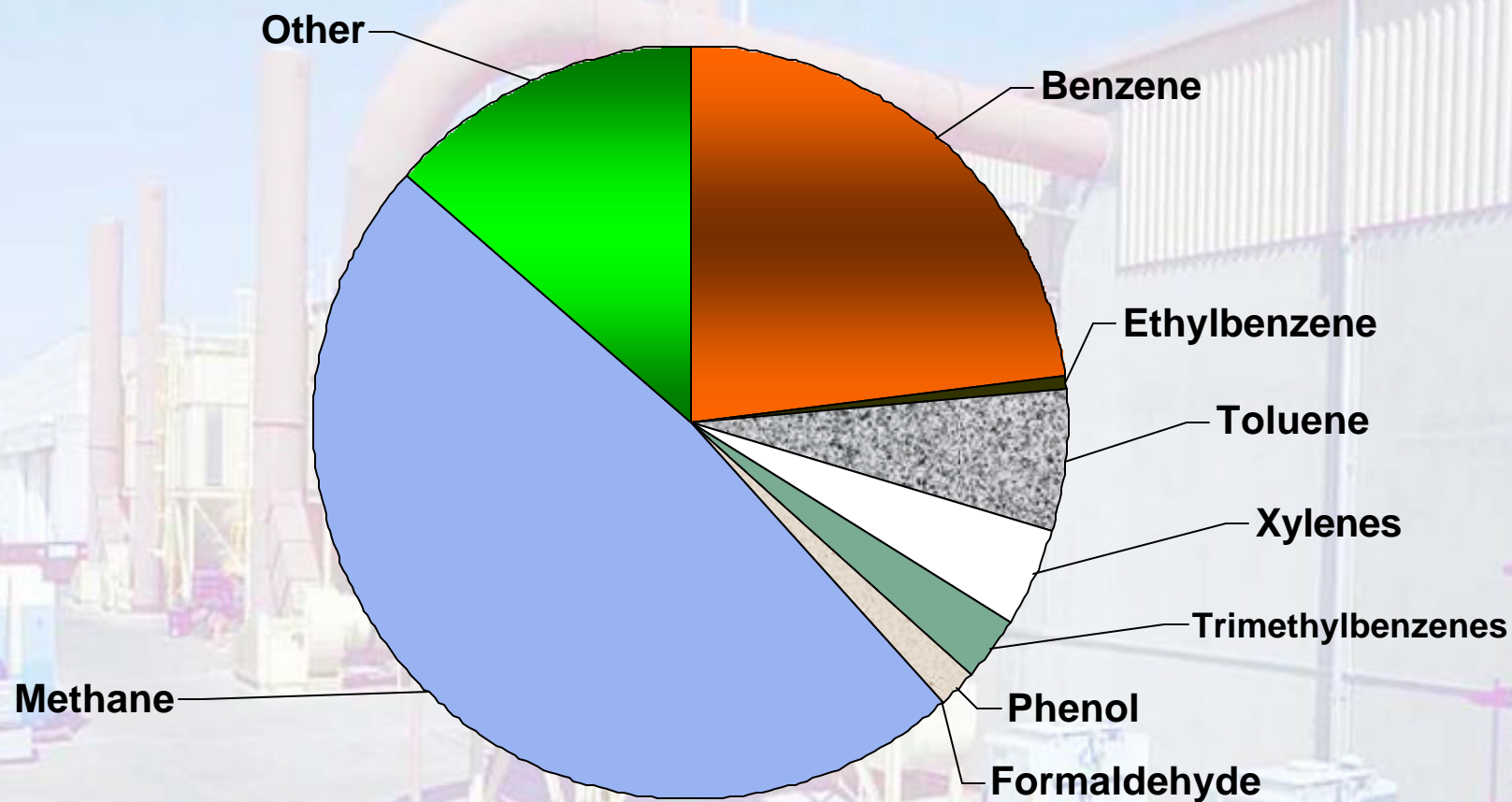
CALIFORNIA EPA
AIR RESOURCES BOARD

CERP Focus

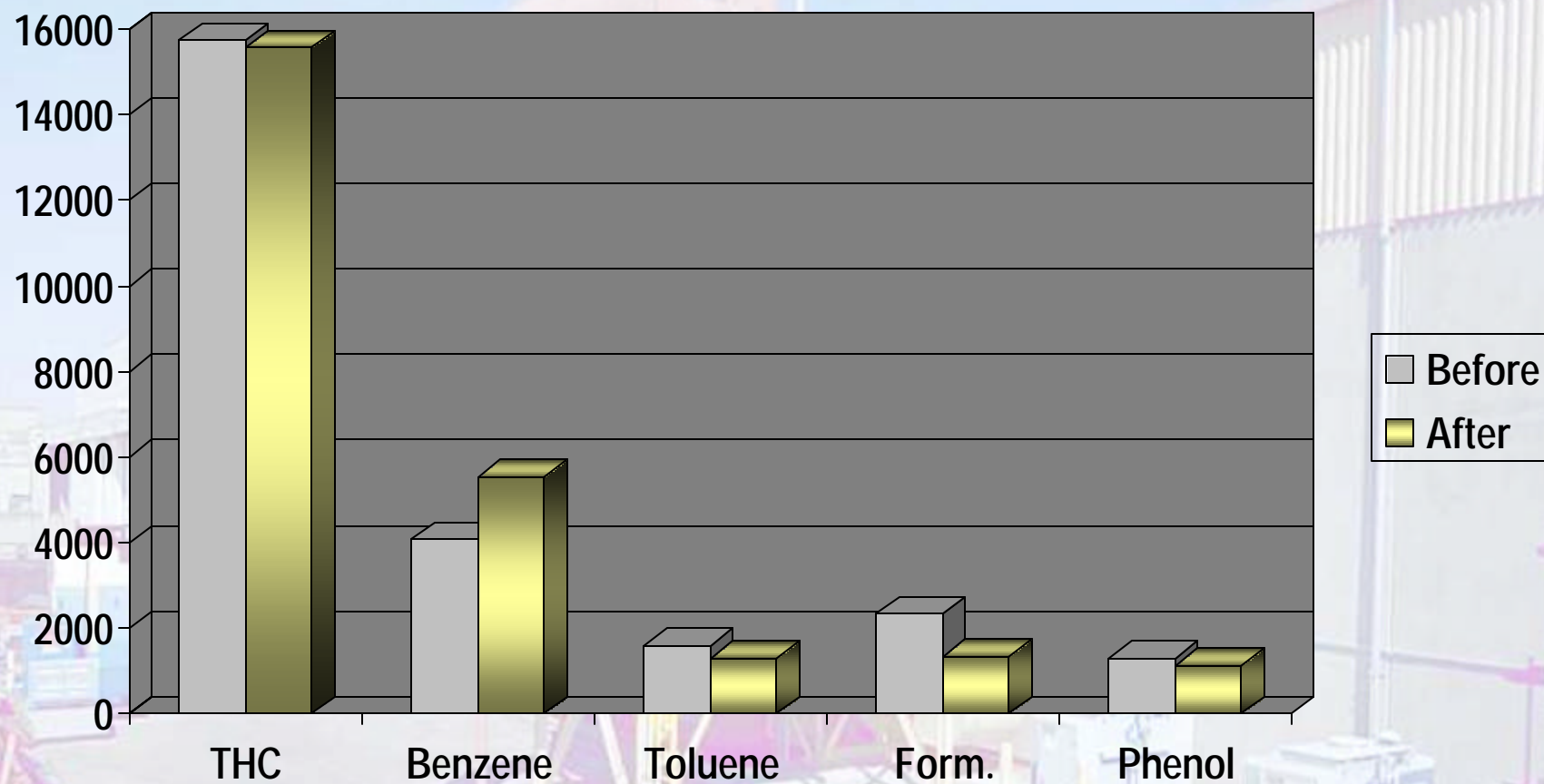
Sources of Gray Iron HAP Emissions



Production Foundry Emissions Green Sand & Cold Box Cores



Effects of a Baghouse on HAP Emissions

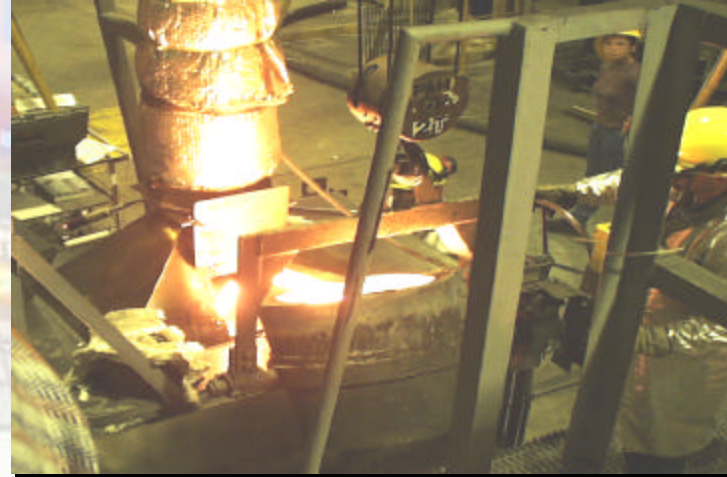


Testing Concept

- Identify viable, low-emission core binders, mold additives and processes
- Material validation process
 - Application to test materials submitted by suppliers
 - Approved applications scheduled for “Pre-Production” hooded qualification testing (9 single-mold tests)
 - Products showing significant emissions reduction reviewed for Production facility testing (Georg Fisher Impact Line)
 - Report prepared for suppliers comparing product emissions to baseline emissions

Facilities

- Dual Foundry test sites
 - Pre-Production Foundry
 - hooded single molds
 - Production Foundry
 - Impact Molding Line
 - @ 50 molds per hour
 - complete coreroom



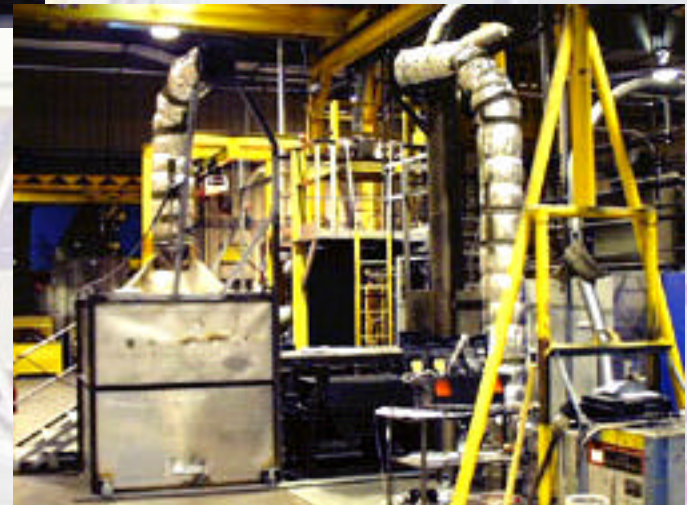
Pre-Production Method



- AFS step core (8-on) Pattern
- 1200+ single mold pours completed
- 9 single molds per typical test
- 35+ vendor supplied low emission replacement products have been tested
- 1 Process Test program in progress



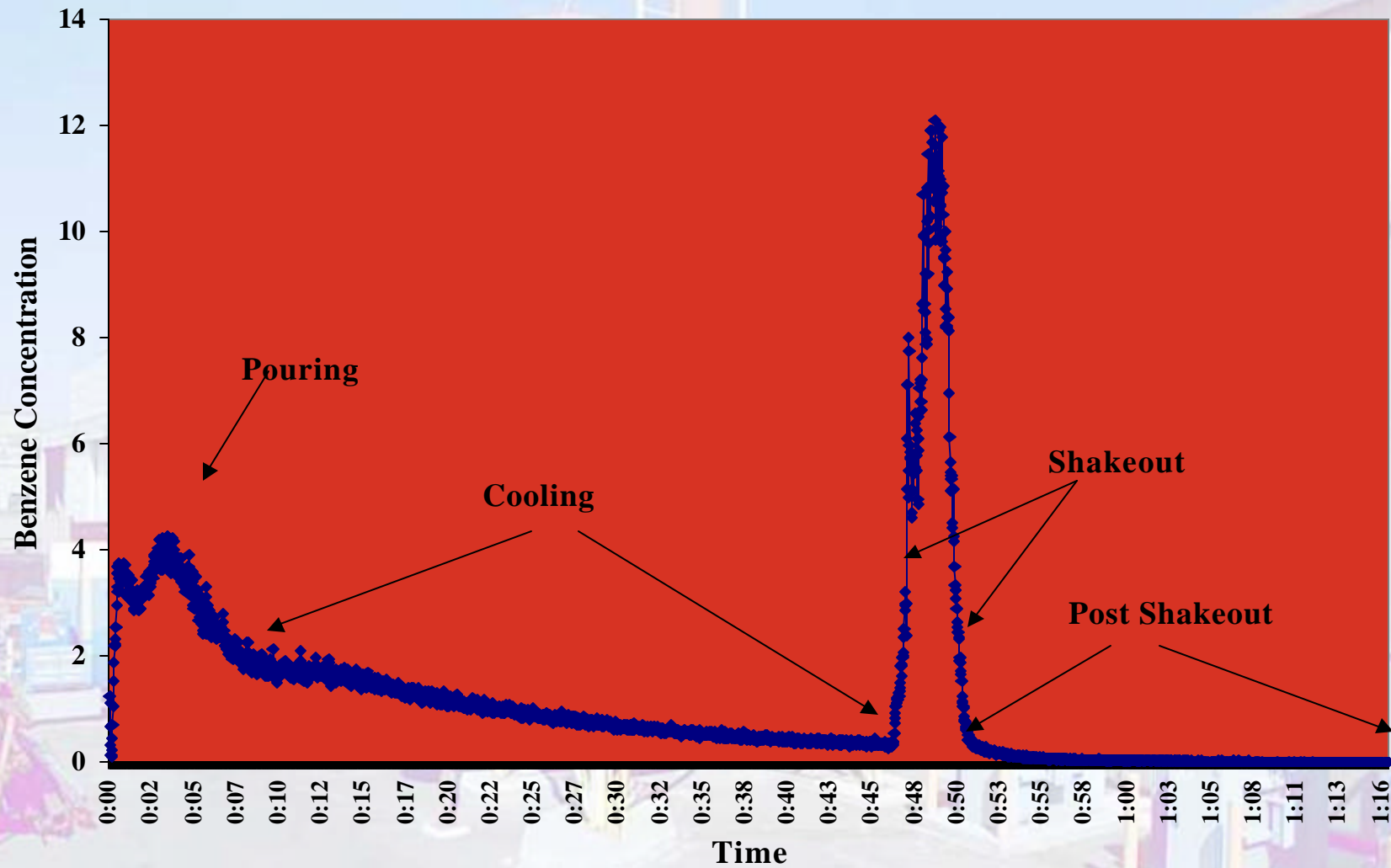
Casting Emission Reduction Program



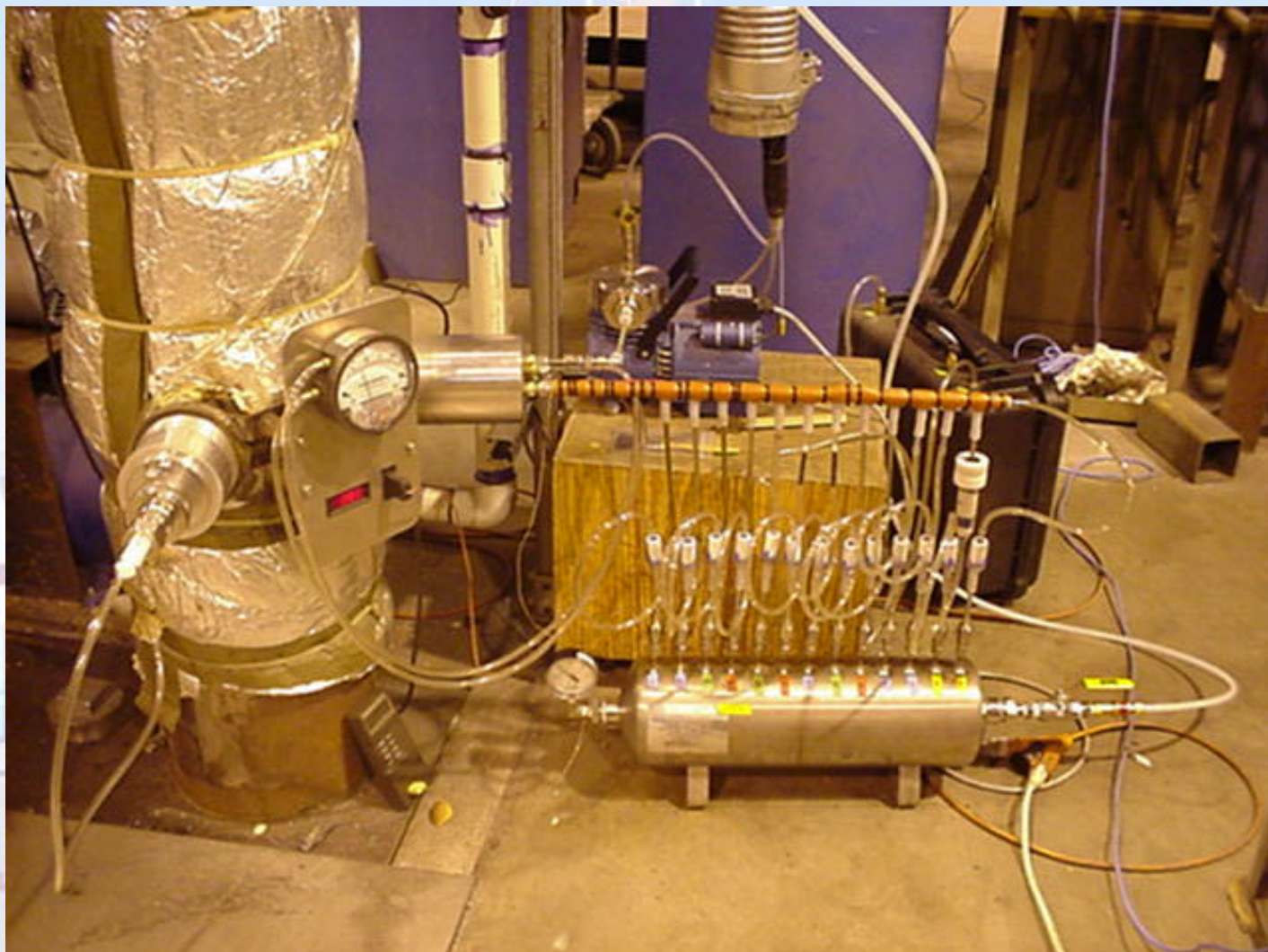
HAP Emission Results from Products Tested

- 25 low emission core binders have been tested and compared to baseline emissions
- 3 seacoal replacement systems have been tested and compared to baseline emissions
- 1 process system has been tested and compared to baseline emissions
- 7 No-Bake Systems have been tested

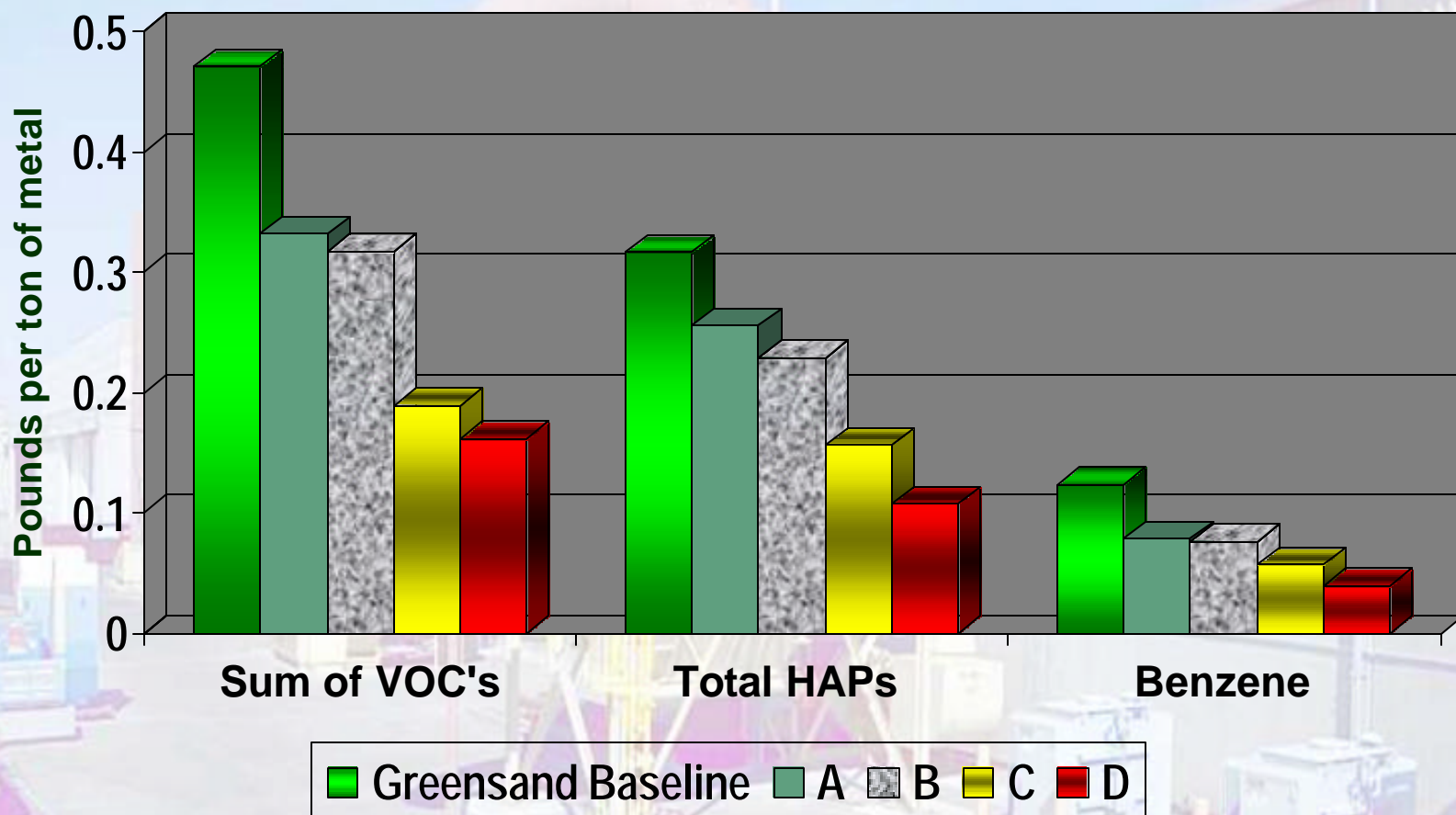
Green Sand Pre-Production Emission Curve



Vapor and "Condensable" Sample Collection

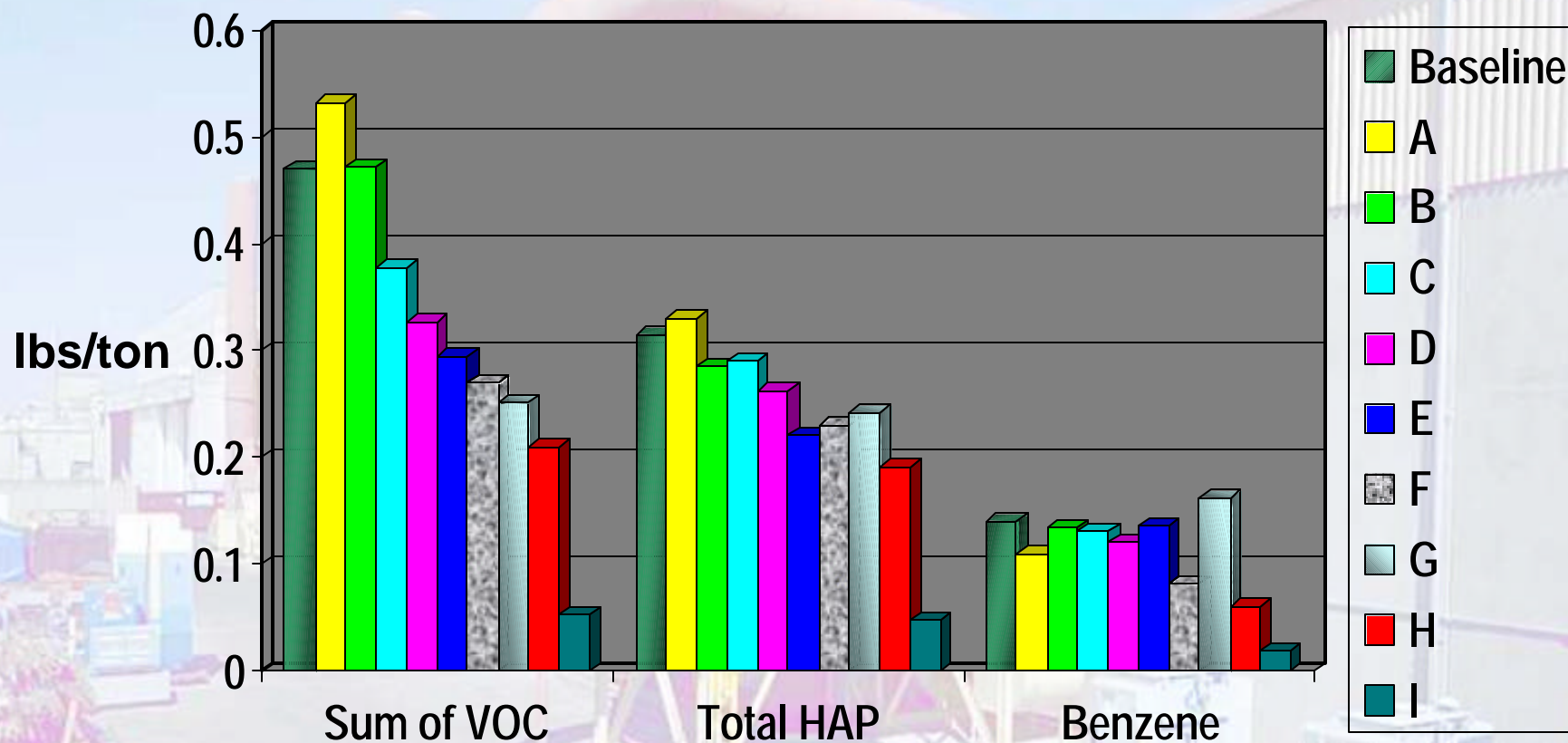


Seacoal Replacement Products Emission Comparison



Pre-Production Tests

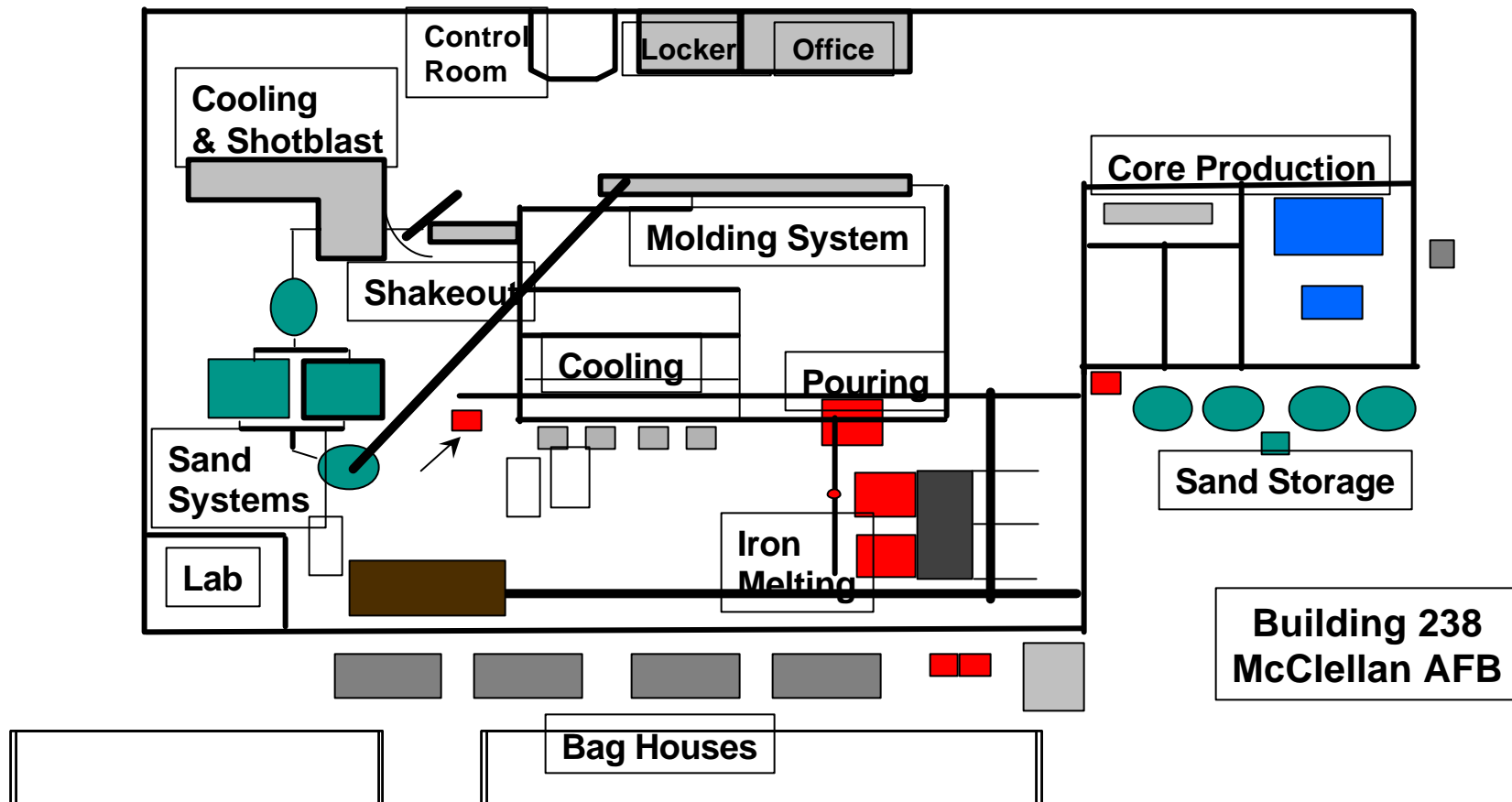
Core Replacement Product Emissions



Pre-Production Tests

Technikon, LLC

Production Foundry Layout





50 mold per Impact Molding Line



Technikon, LLC

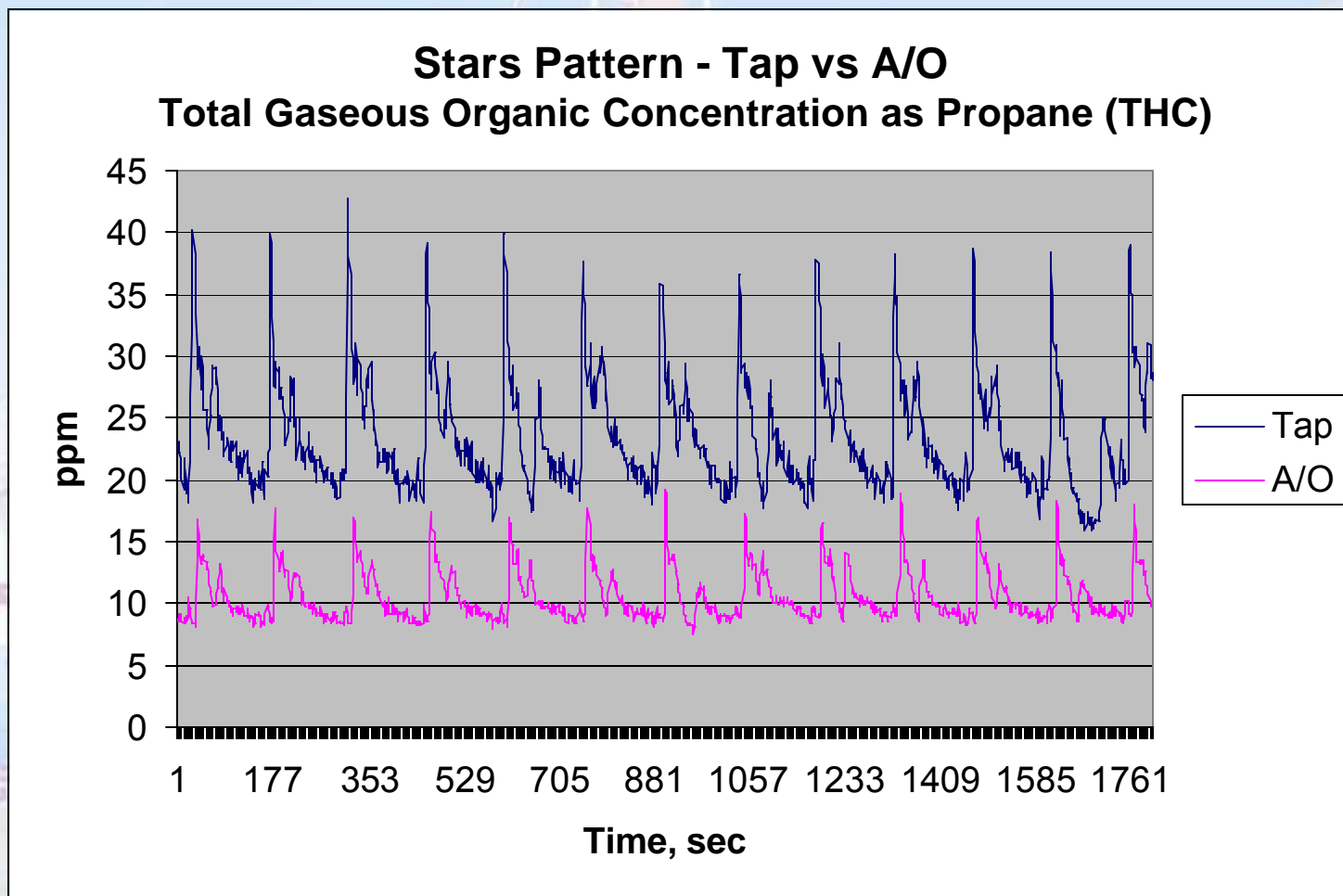
Core Room Operations



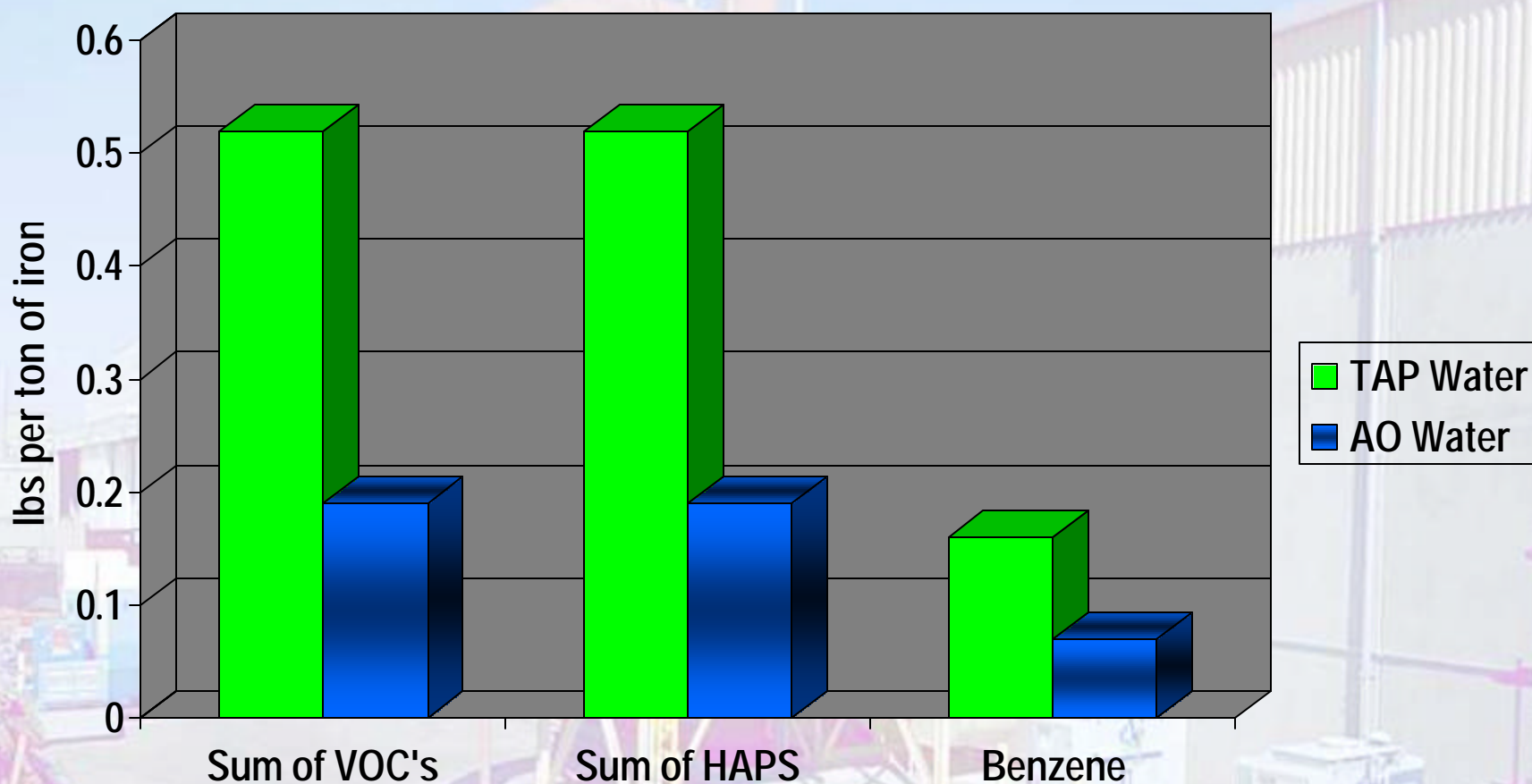
Production Facility

- Normal test is 6 hour run at 25 molds per hour that is compared to baseline testing
- I-4 Block Cold-Box Core packages
- Emissions and process data collected from:
 - Pouring, Cooling, Shakeout
 - Sand System

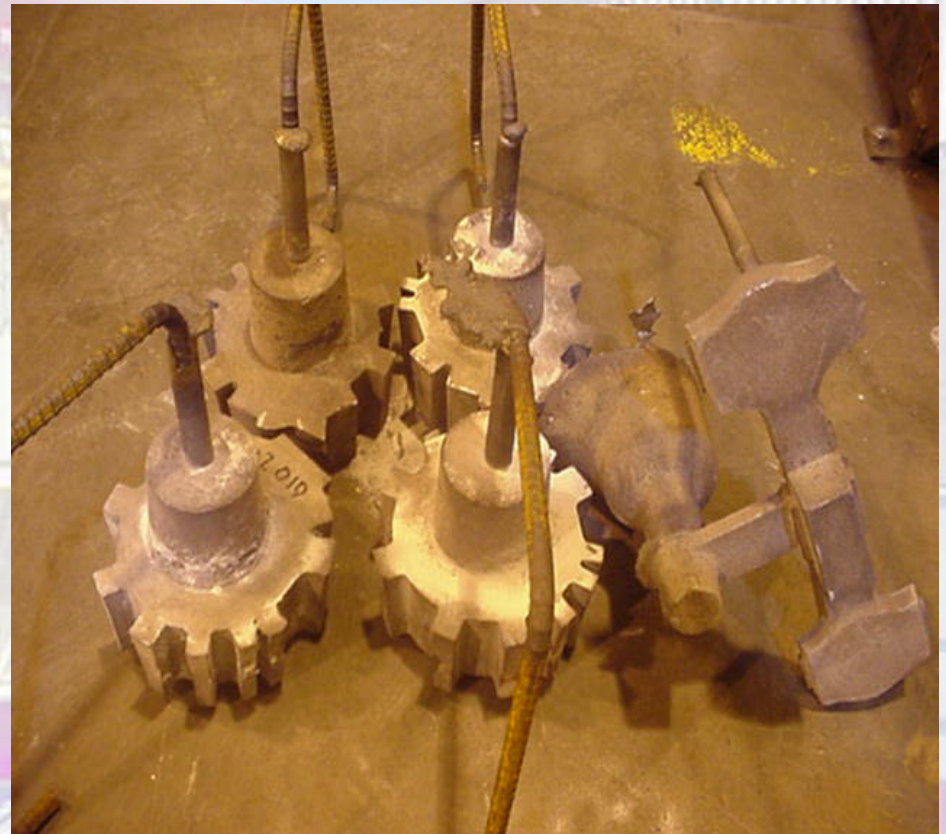
Advanced Oxidation Real Time Test Results Pouring, Cooling & Shakeout in Production Foundry



AO Star Pattern Emissions Combined PCS and Sand System



No Bake Emission Testing



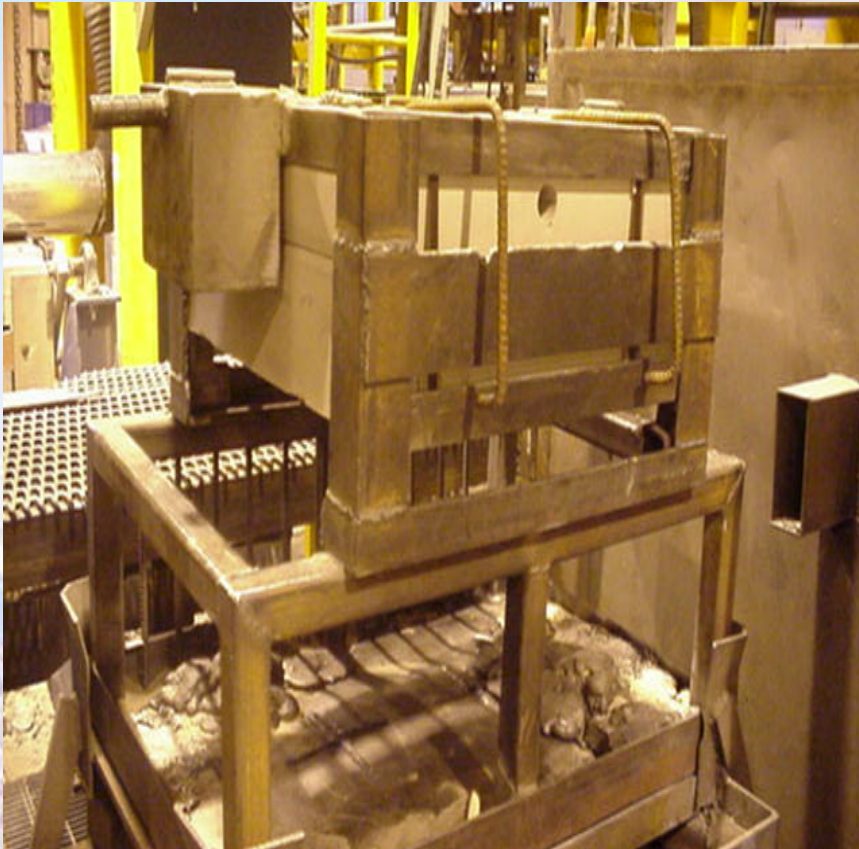
No-Bake Mold Preparation



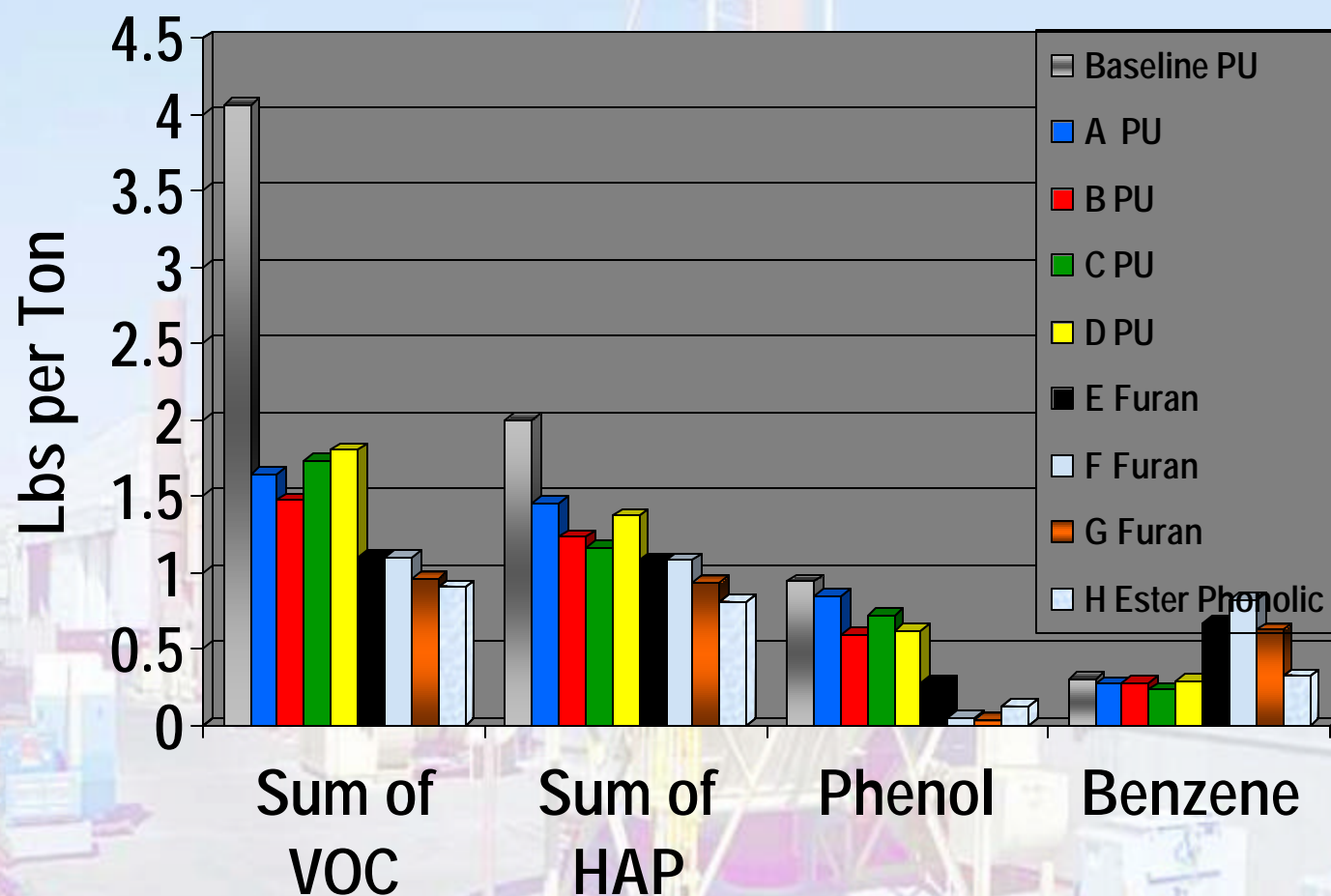
No Bake Mold Making



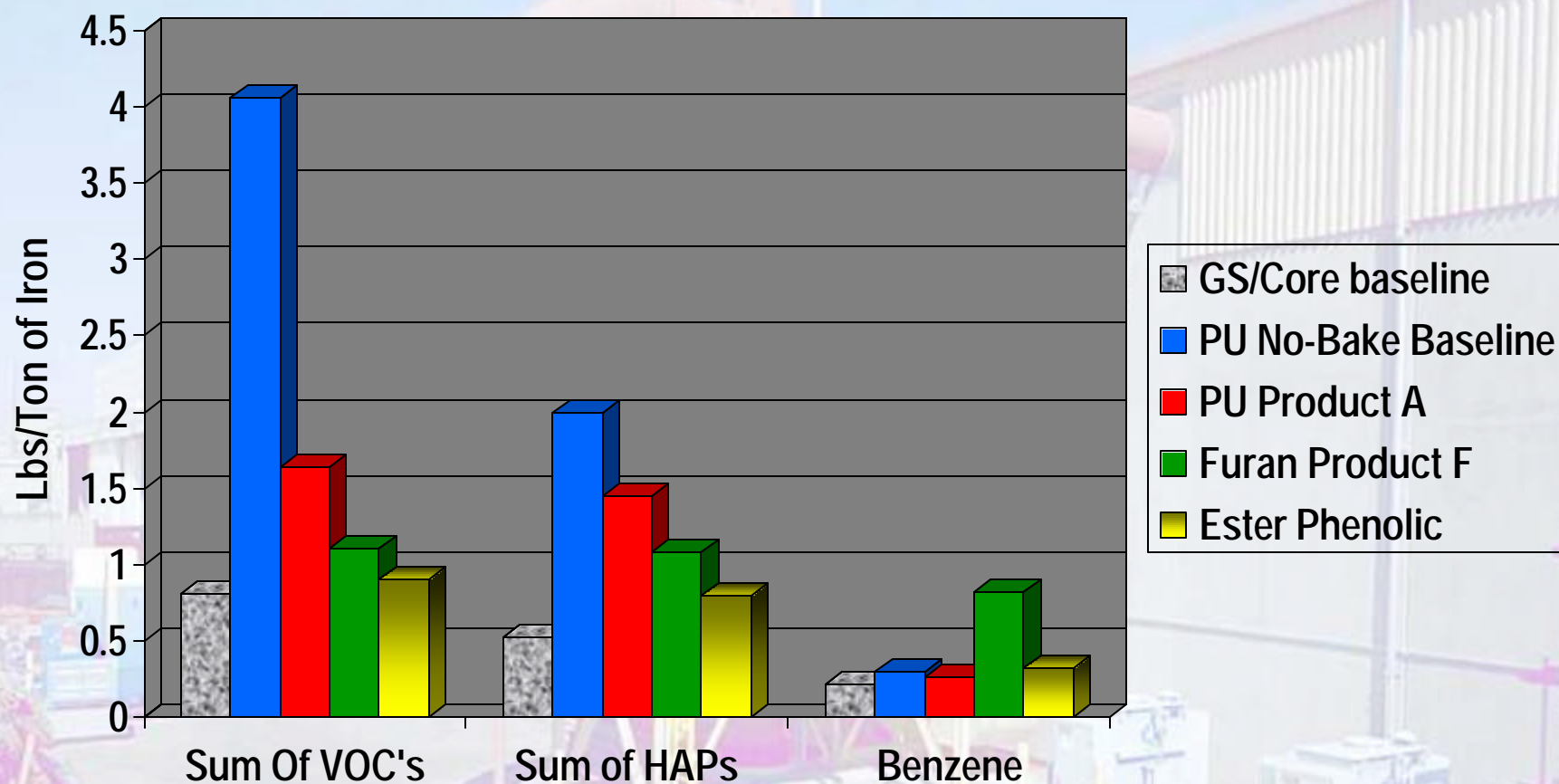
Mold Support System



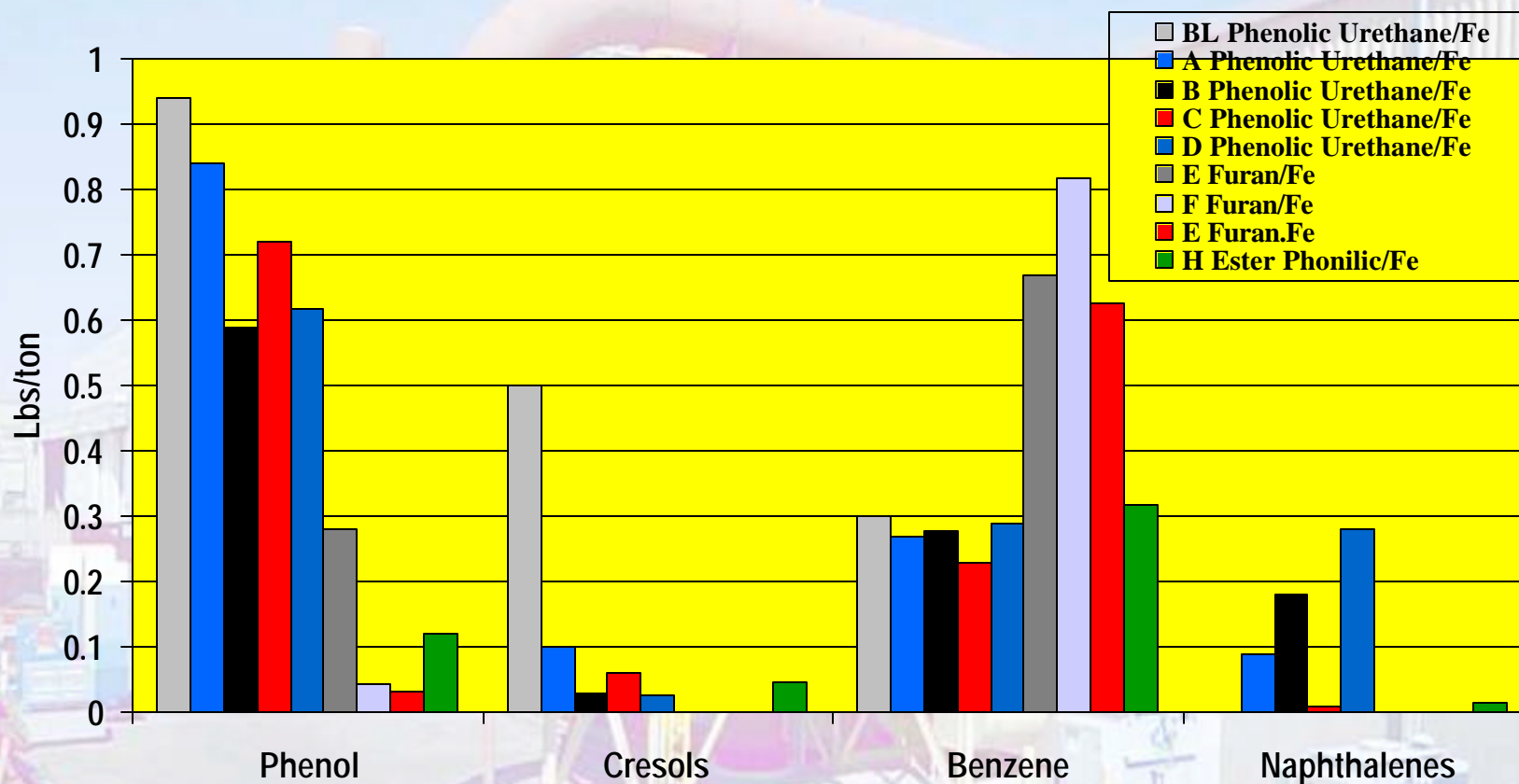
No-Bake Iron Emissions



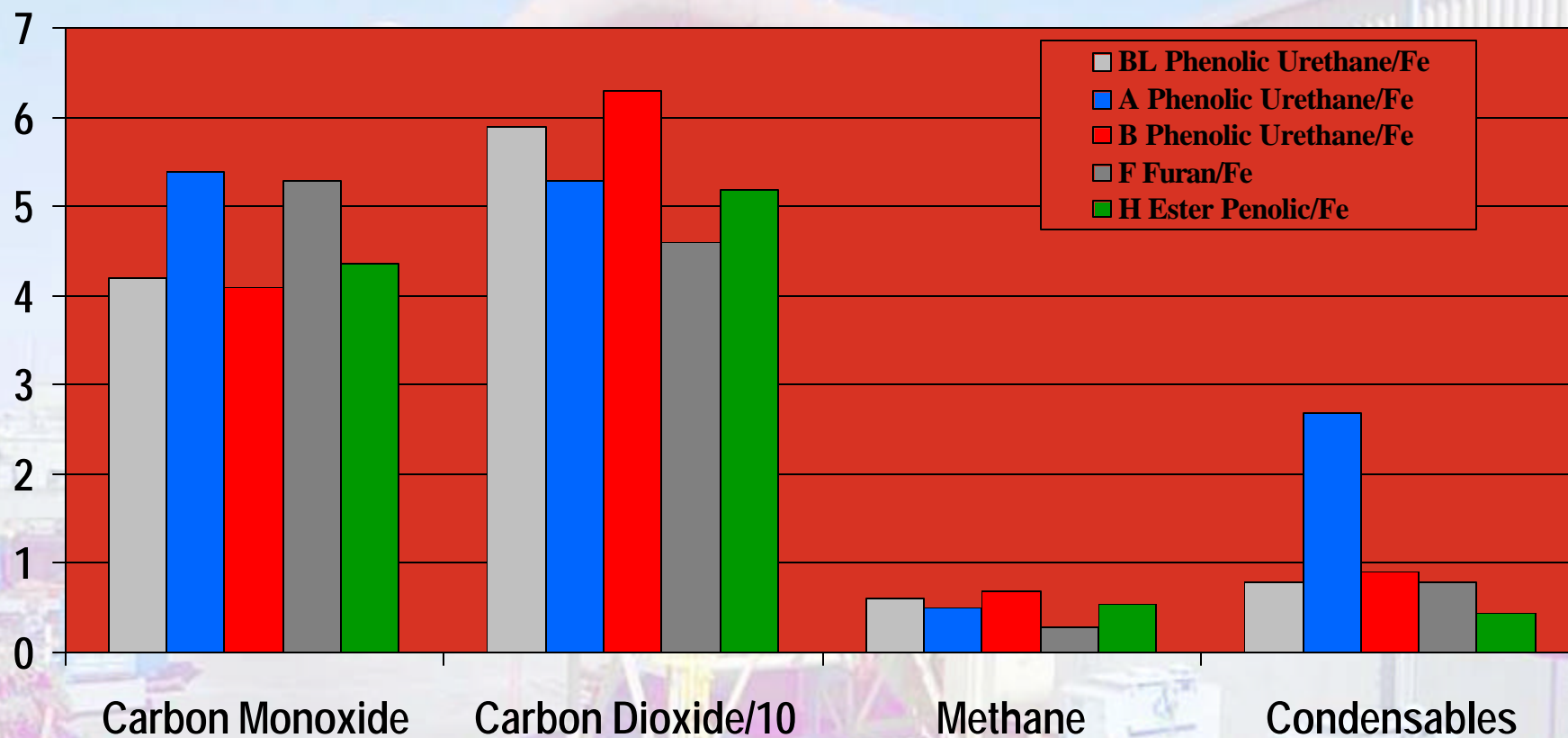
No-Bake Emissions Compared to Green Sand



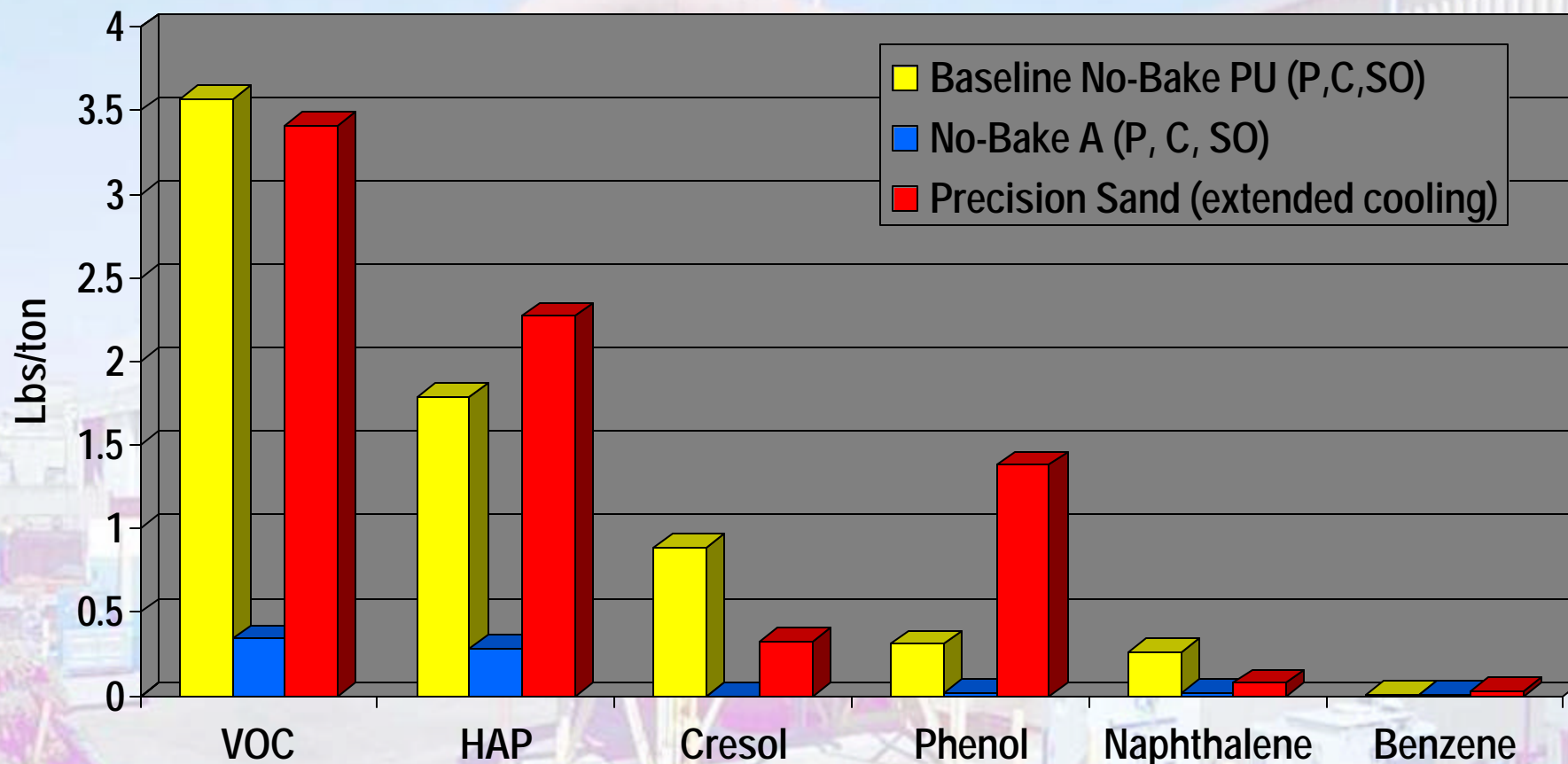
No-Bake Major HAPs (pounds per ton of metal)



No-Bake "Other" Emissions (pounds per ton of metal)



No Bake / Precision Sand Aluminum Emissions



Precision Sand Pouring & Cooling Testing

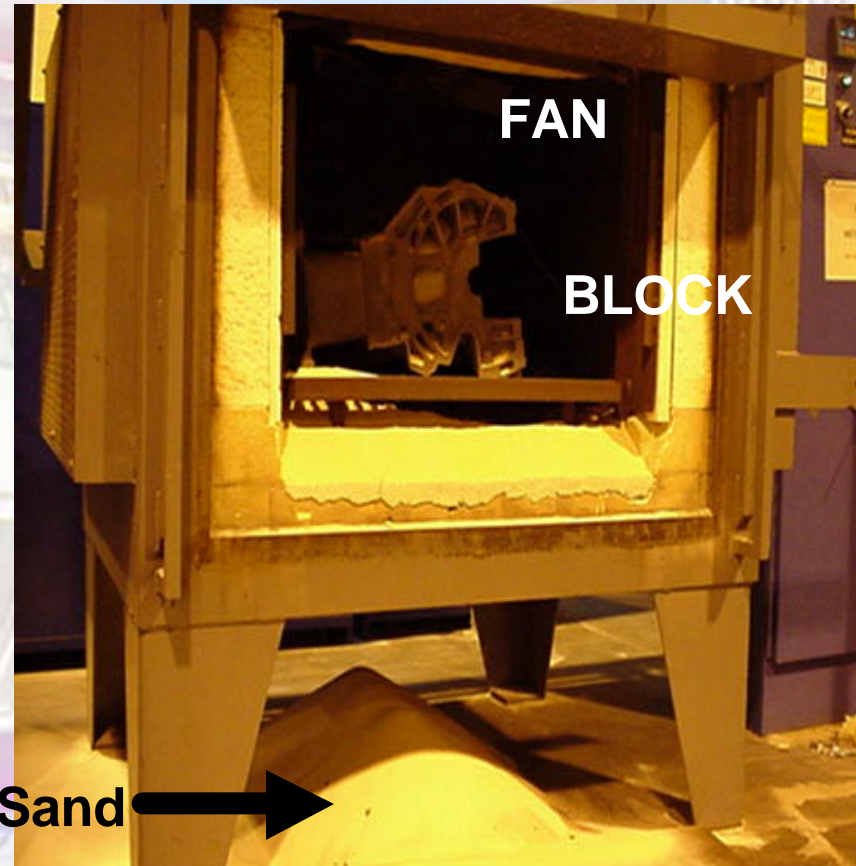


Mold Package in Hood

Casting after Reclaim

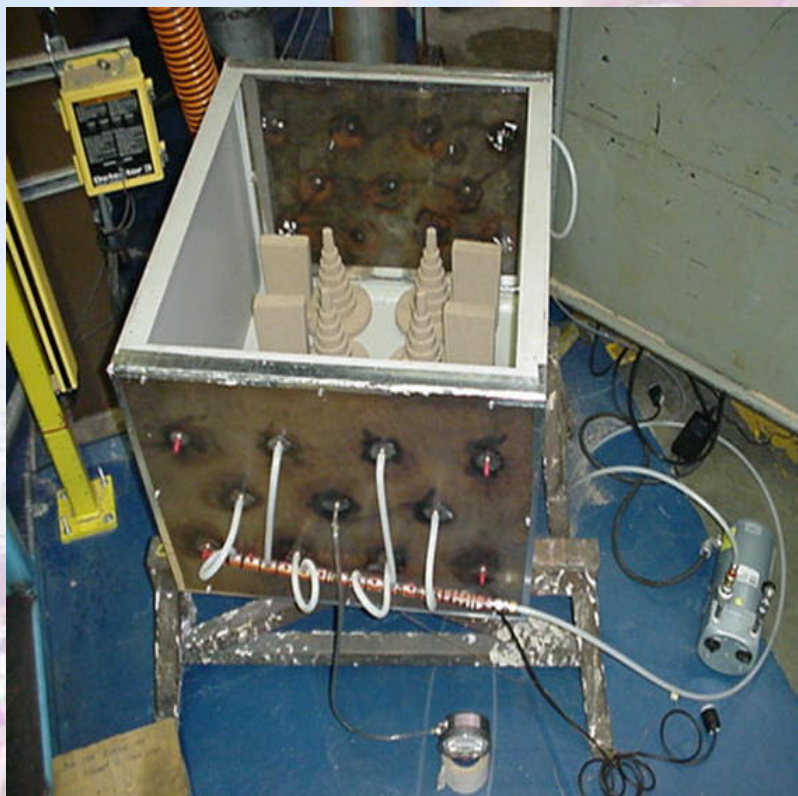


Sand Reclaim Emission Testing @ 925 F for 6 hours

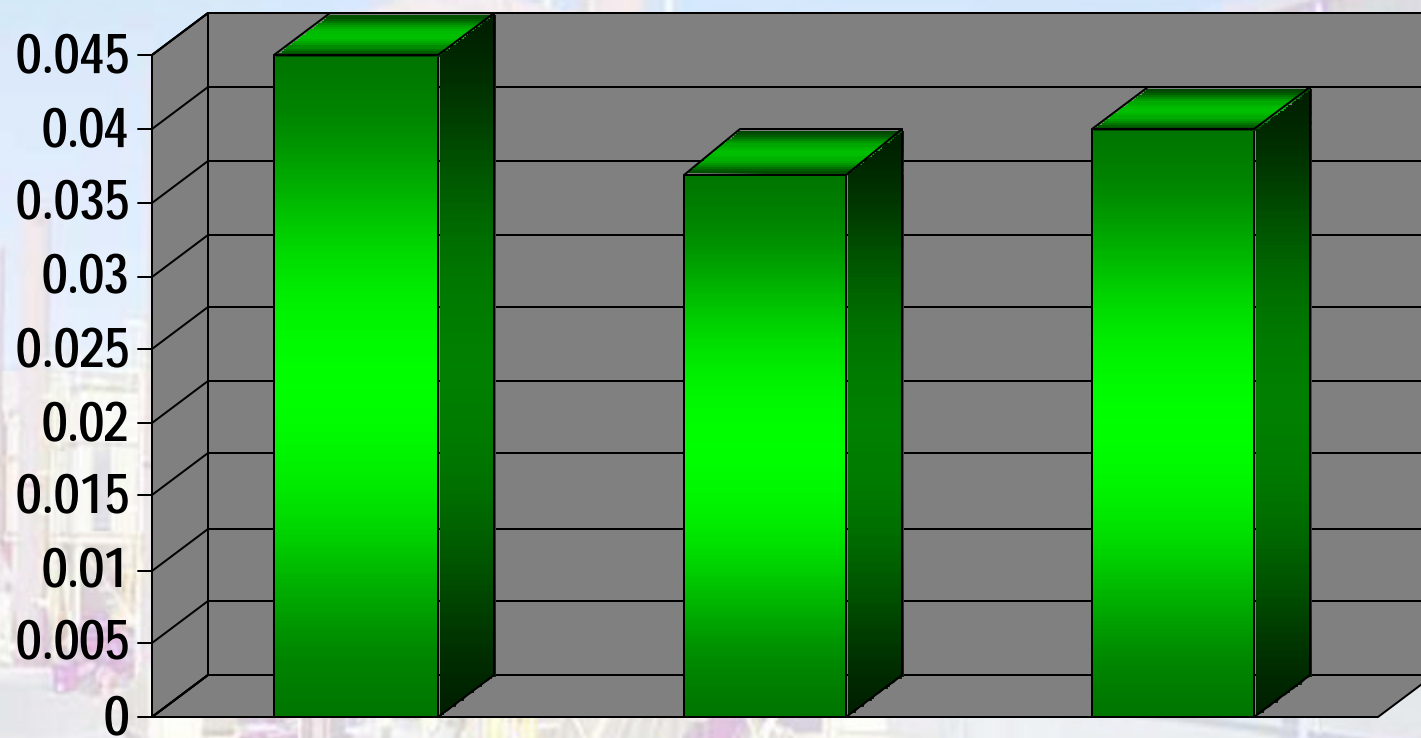


Reclaimed Sand →

Sand Mixing and Storage Testing



Core Blower Emissions



Pre Scrubber in LB HC / LB Resin

Post Scrubber in LB HC / LB Resin

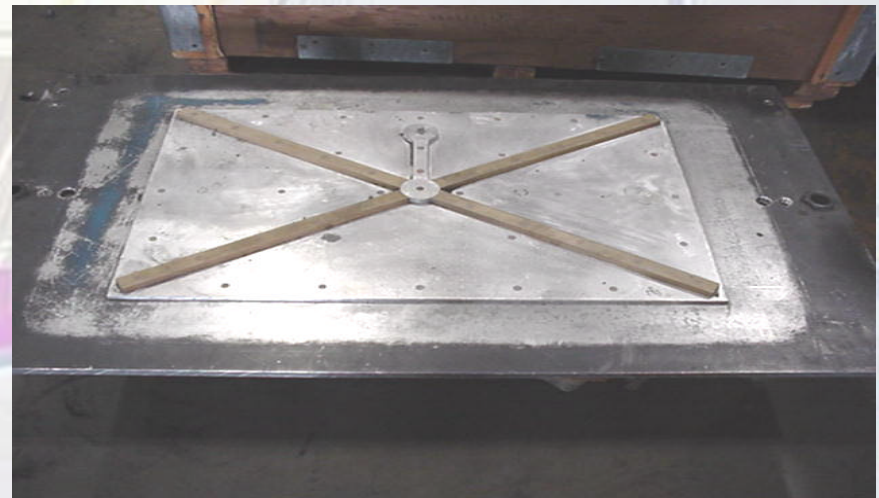
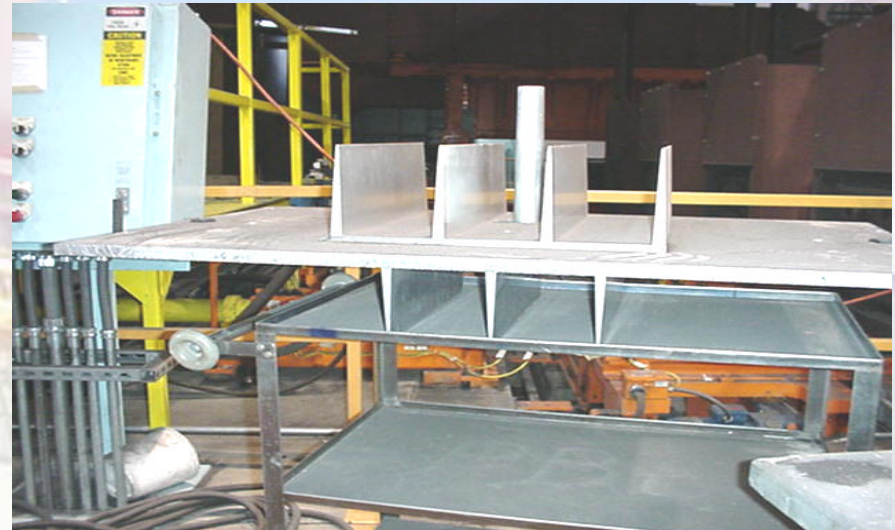
MAX TEA Post Scrubbr in PPM

***Major HAP Source Thresholds based only
on Pouring, Cooling & Shakeout
Emissions from CERP Testing***

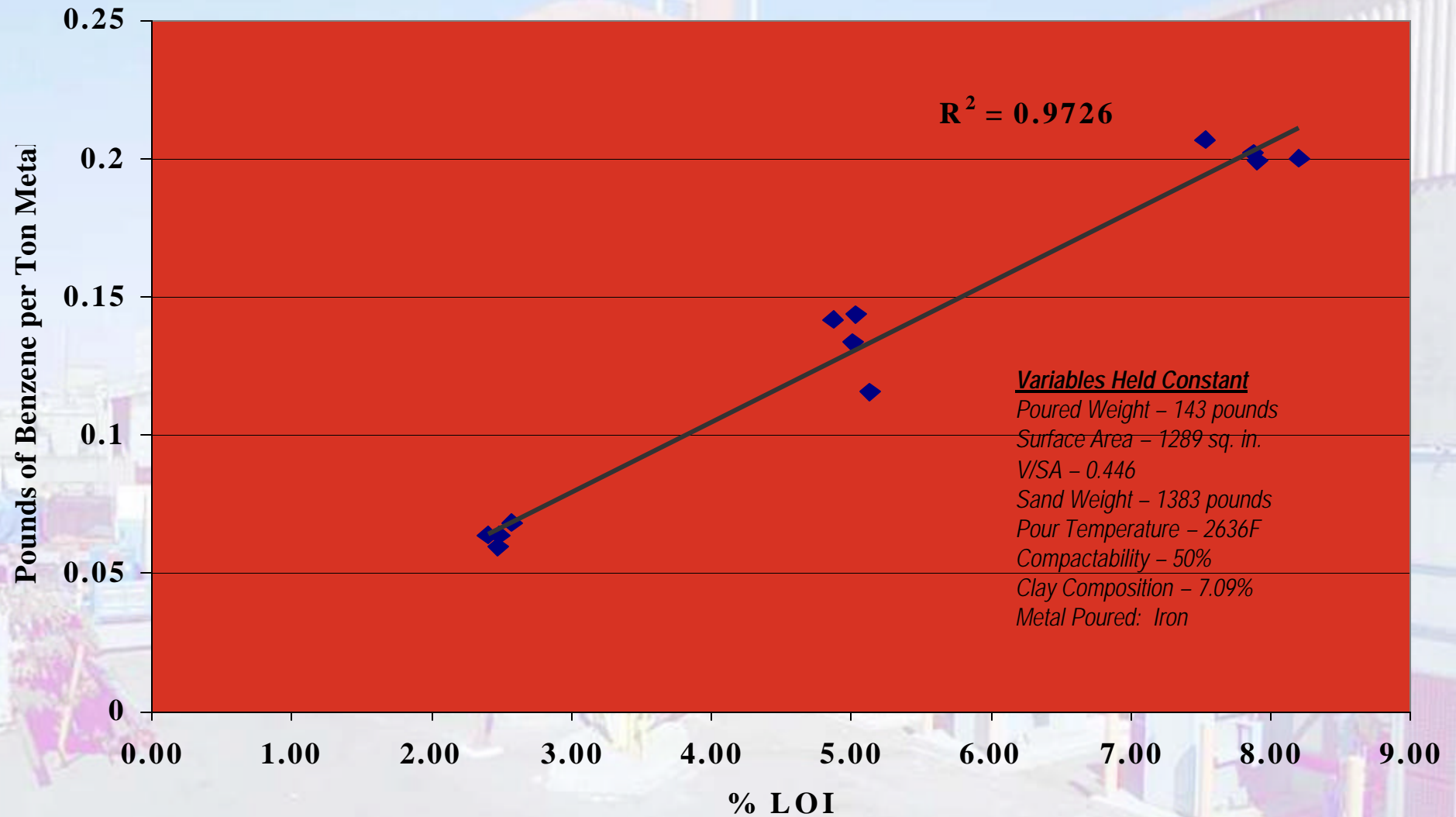
Metal/Process	Emission Factor	Tonnage per year
Iron – Greensand with block core loading	.97 lbs/ton	51,400
Iron – Greensand with no core loading	.36 lbs/ton	139,000
Iron – No-Bake	2.00 lbs/ton	25,000
Aluminum – No-Bake	1.79 lbs/ton	28,000

Process Variable Study

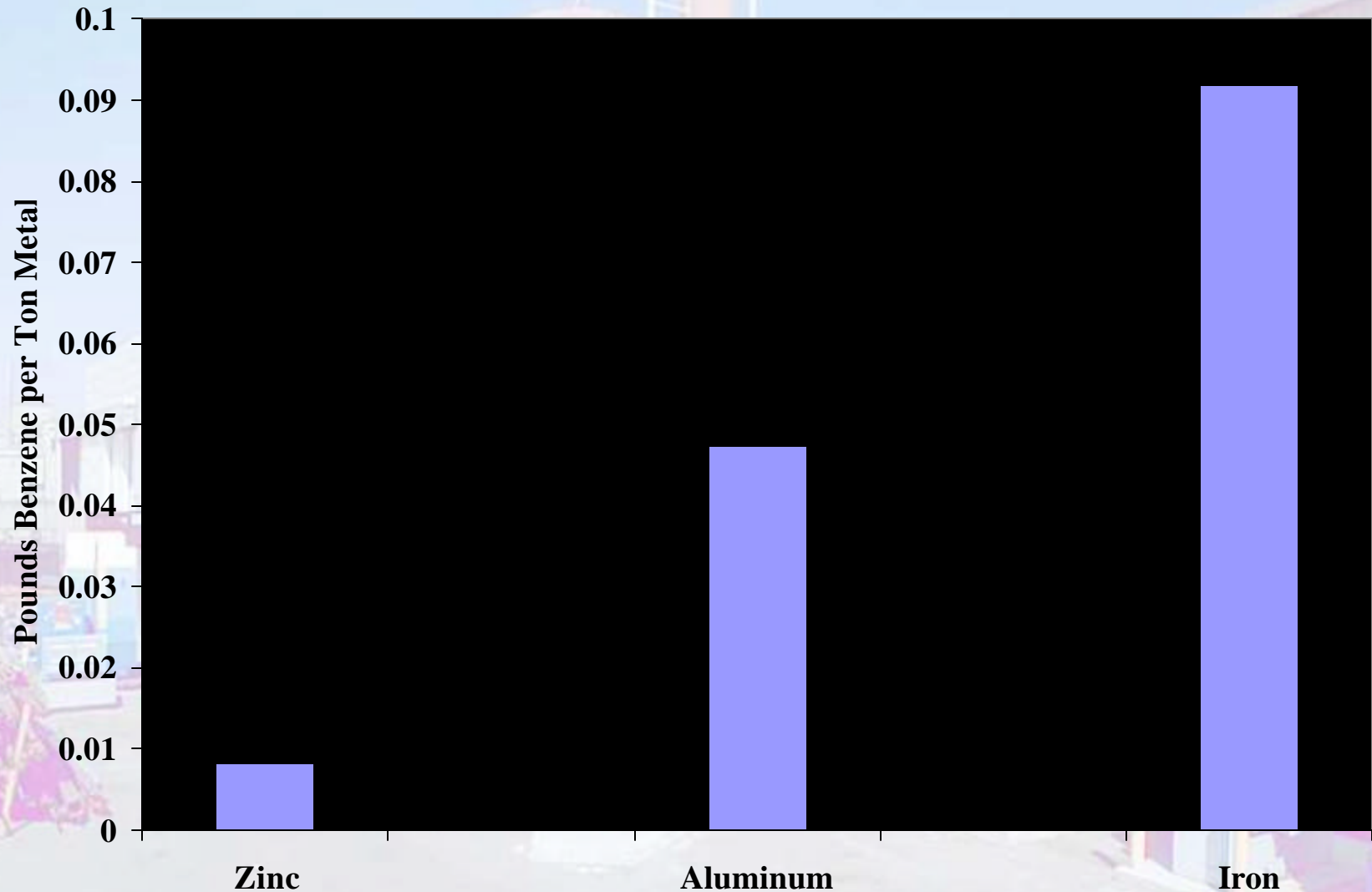
- Goal was to determine the main drivers of air emissions in greensand molding
- Items having major affects
 1. Combustibles in system
 2. Pouring Temperature
 3. Surface Area of casting
- Sand to Metal Ratio is just an indicator of above



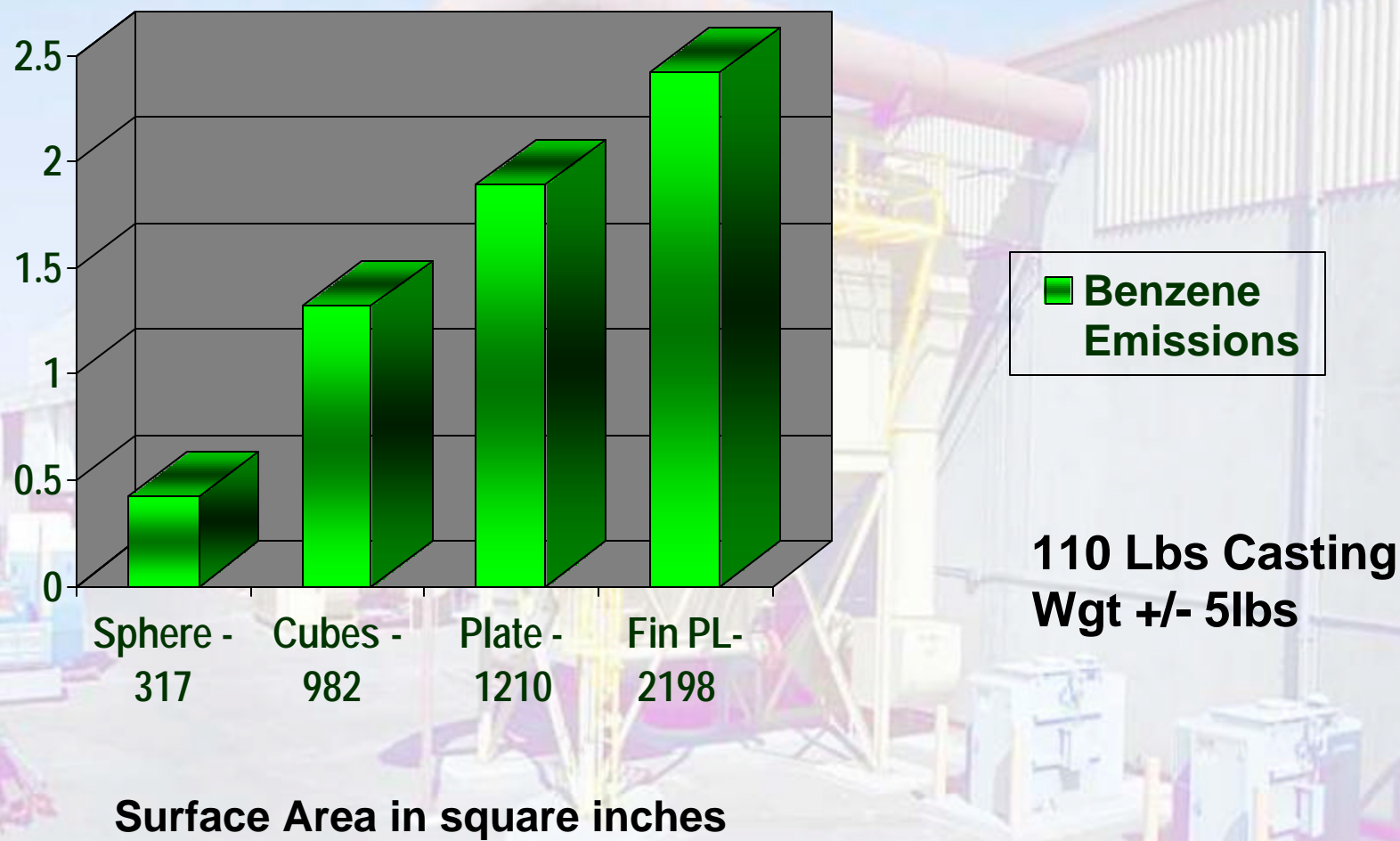
Benzene Emissions for Variable % LOI



Average Benzene Emissions for Various Metals at Varying Pour Temperatures(Finned Plate Test Pattern)



Surface Area comparison



Conclusions To Date

- Testing is showing replacement products are available with the potential to reduce emissions by up to 50%
- Casting Surface Area, LOI levels and type of metal poured can have major effects on emissions – no catch all emission factors
- Foundry suppliers are working hard to develop the next generation materials

Value to the Industry

- Only full scale research foundry in U.S.
- Source of Emission Data for Permit issues- MACT, PSD, NSR
- New Process Validation prior to introduction into Production
- Air Emission Test Protocol Expertise for accurate field testing

