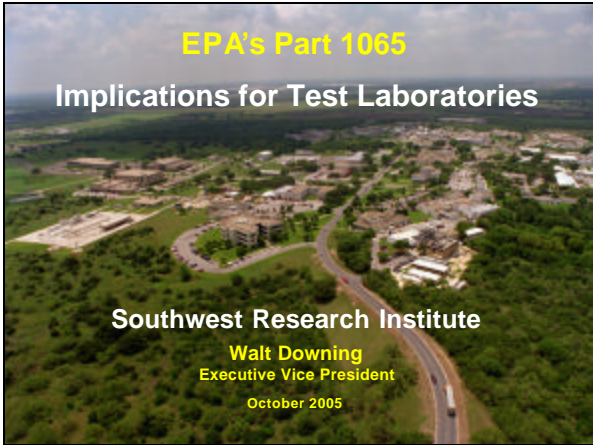


## EPA's Part 1065


### Implications for Test Laboratories



**Southwest Research Institute**  
**Walt Downing**  
 Executive Vice President  
 October 2005

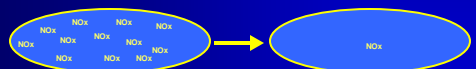
## What is Part 1065?

- For 30 years EPA has periodically implemented new emission standards and procedures for determining compliance in a variety of applications and conditions:
  - on-road
  - off-road
  - fuel type
  - dilute exhaust
  - raw exhaust
  - steady-state cycles
  - transient cycles
- These procedures are described in the US Code of Federal Regulations (CFR) as "Parts" (e.g. 86, 89, etc)
- Part 1065 consolidates and standardizes measurement procedures




## Part 1065 Measurement Challenges

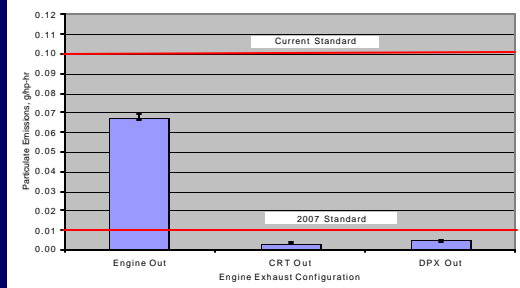
- Part 1065 also addresses the measurement of extremely low levels of NOx and particulate emissions that are allowable in 2007 and beyond
  - NOx emissions at 0.20 g/bhp-hr
  - Particulate emissions at 0.01 g/bhp-hr
  - NMHC emissions at 0.14 g/hp-hr
- Test cells require significant equipment and facility upgrades in order to be Part 1065 compliant




Pre-2007 - 2.4 g/bhp-hr NOx      2007 - 0.20 g/bhp-hr NOx



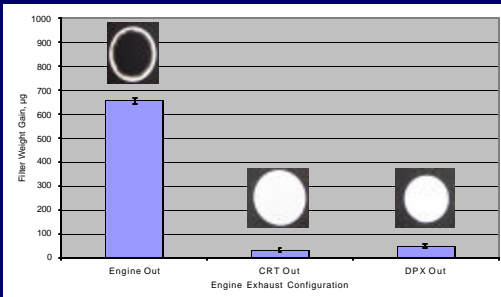
## Comparative Allowable Particulate Emissions



Engine Exhaust Configuration	Particulate Emissions (g/bp-hr)	Standard
Engine Out	~0.07	Current Standard (0.10)
CRT Out	~0.005	2007 Standard (0.01)
DPX Out	~0.005	2007 Standard (0.01)



## FTP CVS filter weight gain before and after (TX-40 Filter Media)



## Impact of Part 1065

- Part 86
  - dictates emission measurement requirements
  - is being replaced with the new Part 1065 Procedure
  - will be illegal to use after Part 1065 phases in
- Part 1065
  - specifies analyzer accuracy, quench checks, etc.
  - will be useable as an option in 2005
  - will be **REQUIRED**, for on-hwy 2010 model year
  - for non-road, need will begin in 2008 and be required in 2011
- Demand for Part 1065 capable test cells will increase from 2005 on

## Southwest Research Institute (SwRI®)

- SwRI is an independent research, development, test and evaluation laboratory that serves many clients, including the transportation and energy industries and regulatory agencies.
- Basic Facts about SwRI
  - Founded in 1947 in San Antonio, Texas
  - Nonprofit 501(c)(3) Corporation
  - Expertise in Physical Sciences & Engineering Disciplines
  - 3,000 employees
  - 1,200 acre (4.8 km<sup>2</sup>) facility
  - 170 Buildings
  - 200,000 m<sup>2</sup> of laboratory/office space
  - \$399 million research volume (FY'04)


## SwRI Technical Divisions

Automotive engineering represents 1/3 of SwRI's business

- Office of Automotive Engineering
  - Engine, Emissions and Vehicle Research Division
  - Fuels and Lubricants Research Division
- Aerospace Electronics and Information Technology
- Applied Physics
- Automation and Data Systems
- Chemistry and Chemical Engineering
- Geosciences and Engineering
- Mechanical and Materials Engineering
- Signal Exploitation and Geolocation
- Space Sciences
- Training, Simulation and Performance Improvement

## SwRI Technical Breadth

### From Automotive Engineering to Space Science



**Road-to-lab-to-math: a new path to improved product**

**SAICOR Future Road**


**Exploring the boundaries of our solar system**

**SAICOR Future Road**

*(Note: The text in the image is partially obscured and difficult to read, but the layout shows a transition from automotive to space science.)*

## SwRI Campus

### Automotive Business is Capital Intensive



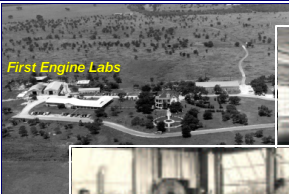
**On Road Area**

**Test Track**

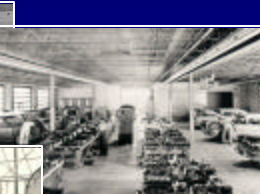
**Labs**

## 1949 - The Early Years


### Metal Buildings and Army Surplus Equipment



**First Engine Labs**



**First Fleet Lab**



**First Dynamometer Installation**

## 56 Years Later

### Continuous Investment in New Facilities and Equipment



**Office of Automotive Engineering**



**Petroleum Products Lab**



**Component Test Facility**



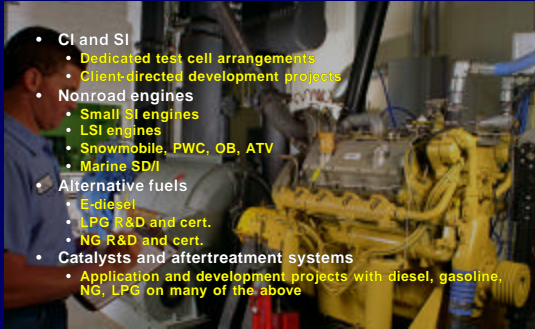
**Engine & Vehicle Research**



**Emissions Research**

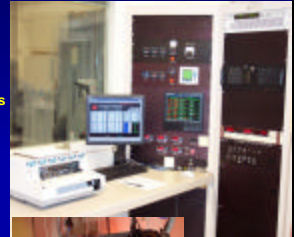
## Emission Certification and Audit Programs

- CI and SI
  - Dedicated test cell arrangements
  - Client-directed development projects
- Nonroad engines
  - Small SI engines
  - LSI engines
  - Snowmobile, PWC, OB, ATV
  - Marine SD/I
- Alternative fuels
  - E-diesel
  - LPG R&D and cert.
  - NG R&D and cert.
- Catalysts and aftertreatment systems
  - Application and development projects with diesel, gasoline, NG, LPG on many of the above



## Heavy Duty Engine Test Facilities

- 20 HD transient and steady-state emission test cells
  - On-highway and nonroad engines
  - Diesel, gasoline, LPG, NG and other alternative fuels
  - Computer controlled
  - Automated data acquisition
- 31 developmental test cells



## High Altitude Simulation

- Altitude to +10,000 ft (3,000m)
- Vehicle or Loose Engine
- Steady-State and Transient Performance, Compliance, and R&D
  - Component and Sensor Sensitivity
  - FTP and NTE
  - Fuel, Additive, Device Interactions
- No Lab-to-Lab Confounding



## Heavy-Duty Vehicle Chassis Testing

- All Electric Dyno, 48-inch Rolls
- Inertia to 120,000 lbs. for Tandem-axle Vehicles
- Transient or Steady-state Tests
- Drive Cycle or Route Mode
- Analog and CAN Data Acquisition
- Assess Emission Control Devices
- Hybrid-Electric Vehicle Testing
- In-use Emission Studies
- Thermal Management Studies



## Facilities & Equipment Challenge

- Clients need Part 1065 compliant cells to evaluate their systems
  - Some clients have begun to upgrade their test cells
  - Most are deciding how many to upgrade and when
  - All are expecting independent test labs to provide this capability
- SwRI needs this capability to support engine design work as well
- By mid-2005 only 6 of SwRI's test cells were being upgraded to Part 1065
- Emissions benches require 6 – 8 months (or more) lead time for delivery
- Test cells cannot be upgraded simultaneously due to business interruption



## Facility & Equipment Upgrade Estimate

- Upgrade 11 Existing Transient Test Cells - \$4,000k
- Convert 3 Additional Test Cells to Transient Capability - \$3,000k
- Additional Equipment - \$2,400k



Total above = \$9.4M

## Why Independent Labs?

- Independent labs, such as SwRI, remain critical in supporting the research, engineering, development, and qualification needs of the transportation and energy industries by providing a cost effective alternative which reduces the demand for duplicate dedicated facilities thereby keeping overall costs down



## Conclusion

- Part 1065 facility & equipment upgrades represent more than 75% of the total annual capital equipment budget for SwRI
- On-going business demands for test cells prohibit removing more than 20% from service at any time, which dictates a five-year upgrade program to meet 2011 target
- Emissions lab must generate additional business to offset increased depreciation costs of Part 1065 upgrade
- Past experience indicates the investment will be recovered
- SwRI is committed to this upgrade program

