# Comparison of direct exposure of human lung cells to modern engine exhaust particles

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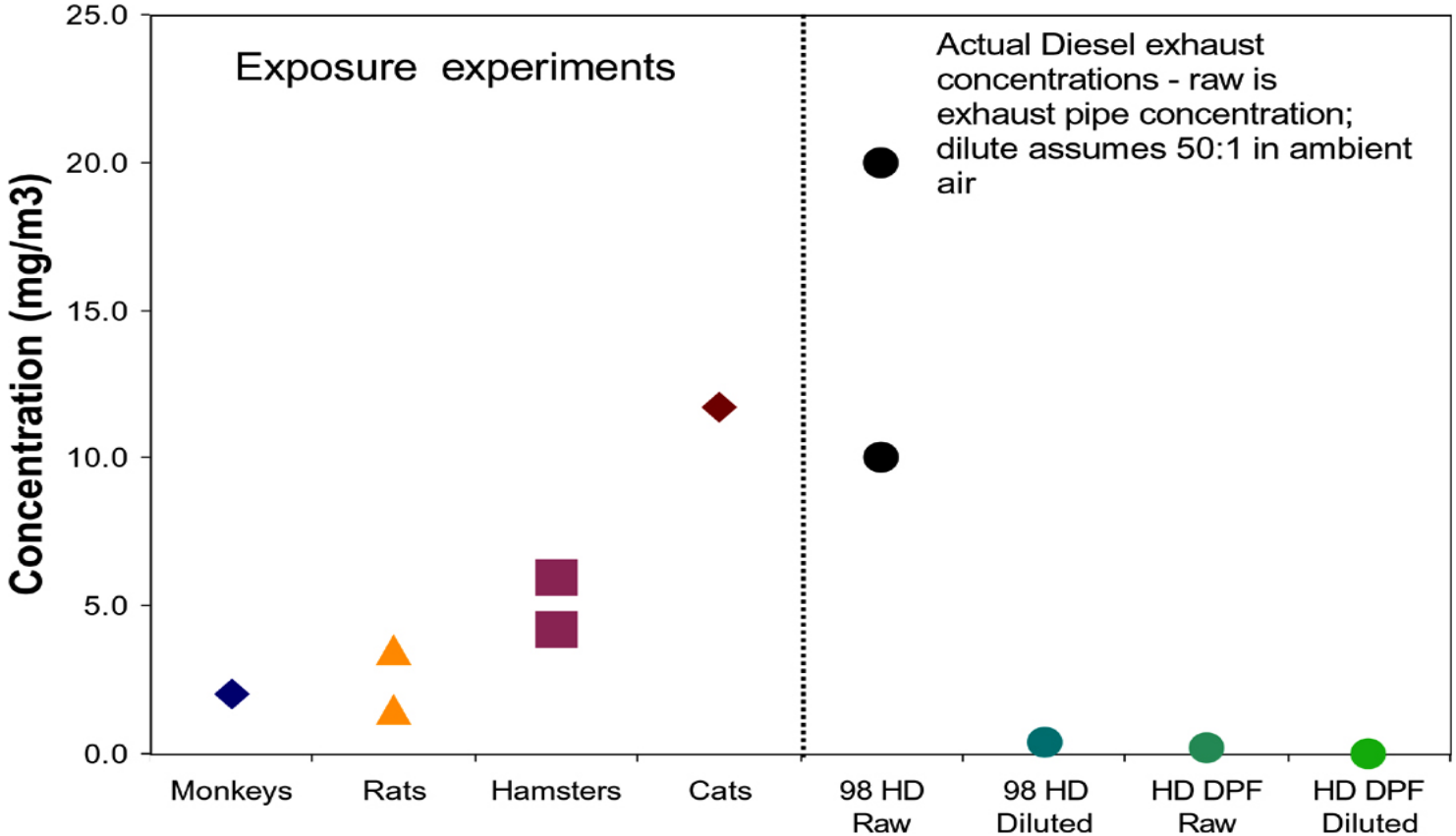
# We saw need to move beyond studies using unrealistic exposure levels and "old-tech soot"*...lung cell assay seemed well-suited

*relatively high SOF and larger size distribution



# Objectives

- **To continue experiments with cellular exposure/response to particles from vehicles *using new engine/exhaust emissions control***

- **To observe difference in the response of cells, normal or primed, to particles**

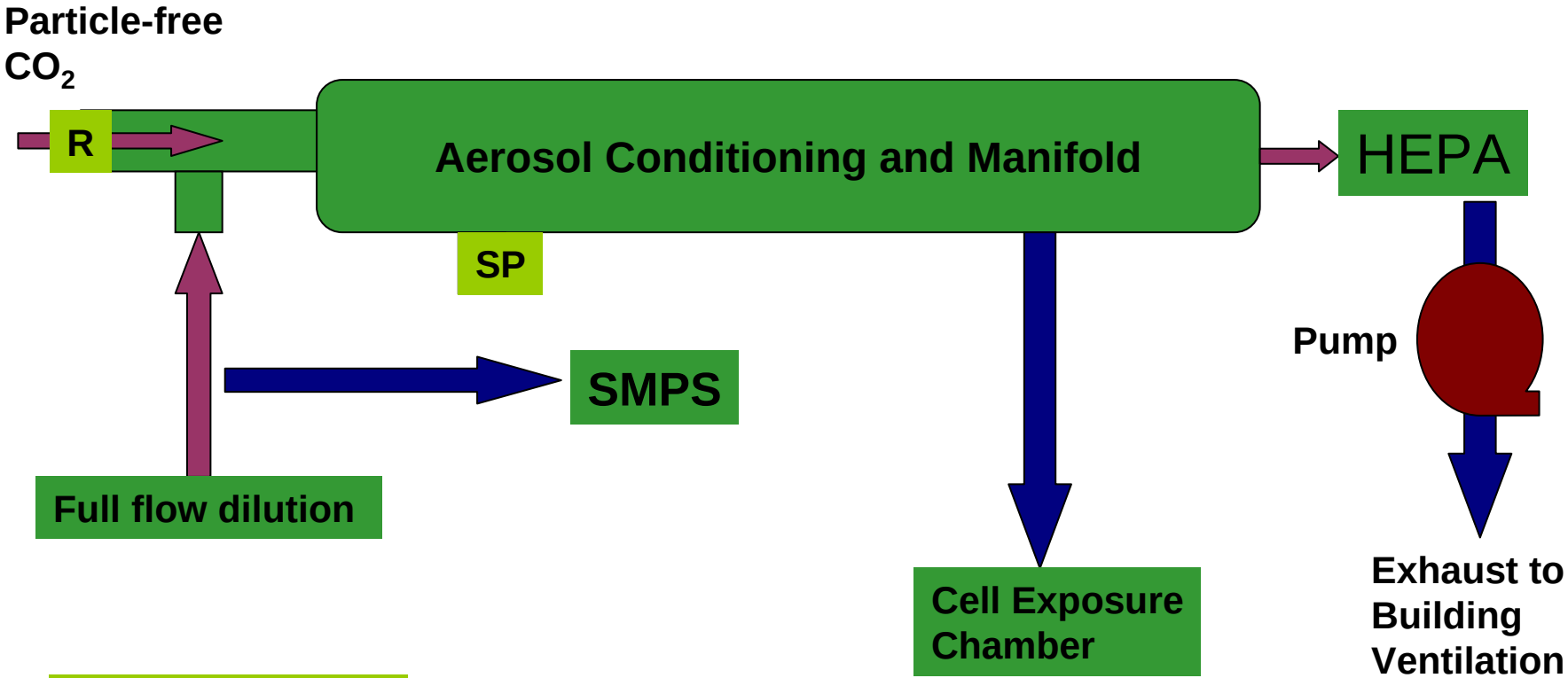
# Materials and Methods

- **Cells**
  - Human lung carcinoma cell line, A549, epithelial from ATCC
  - Density - 80,000 cells per each transwell membrane
  - Incubation period before exposure: 48 hours
  - Primed cells: add 25 ng/cc Human Tumor Necrosis Factor (TNF)-$\alpha$ agent for 24 hours before replacing medium for exposure experiments
  - Placed on top of a COSTAR transwell filter membrane with medium underneath in a well throughout exposure experiment
  - Number of cells counted right before an exposure experiment

# Materials and Methods (cont.)

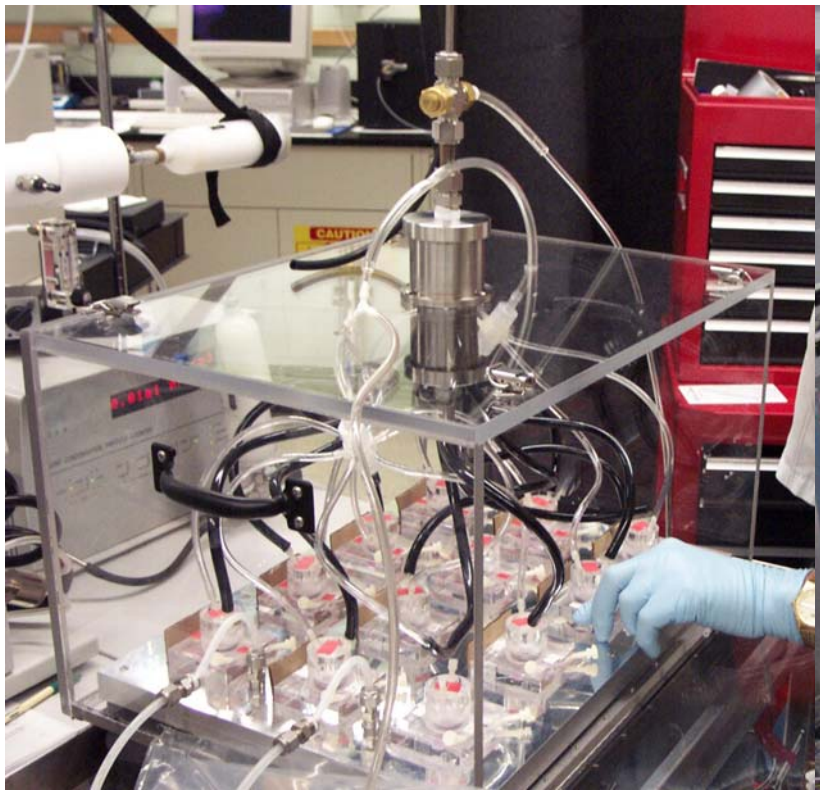
- **Vehicle Generated Particles**
  - 1999 Chevrolet Sierra gasoline, three-way catalyst
  - 1999 Mercedes-Benz A170 CDI equipped with a CDPF, ECD-1 fuel
  - Cold LA4 + 6 Hot LA4/US06
- Measured by scanning mobility particle sizer
- **ELISA - IL 8**
- **Lactate dehydrogenase (LDH)**
- **Electrical resistance measured**

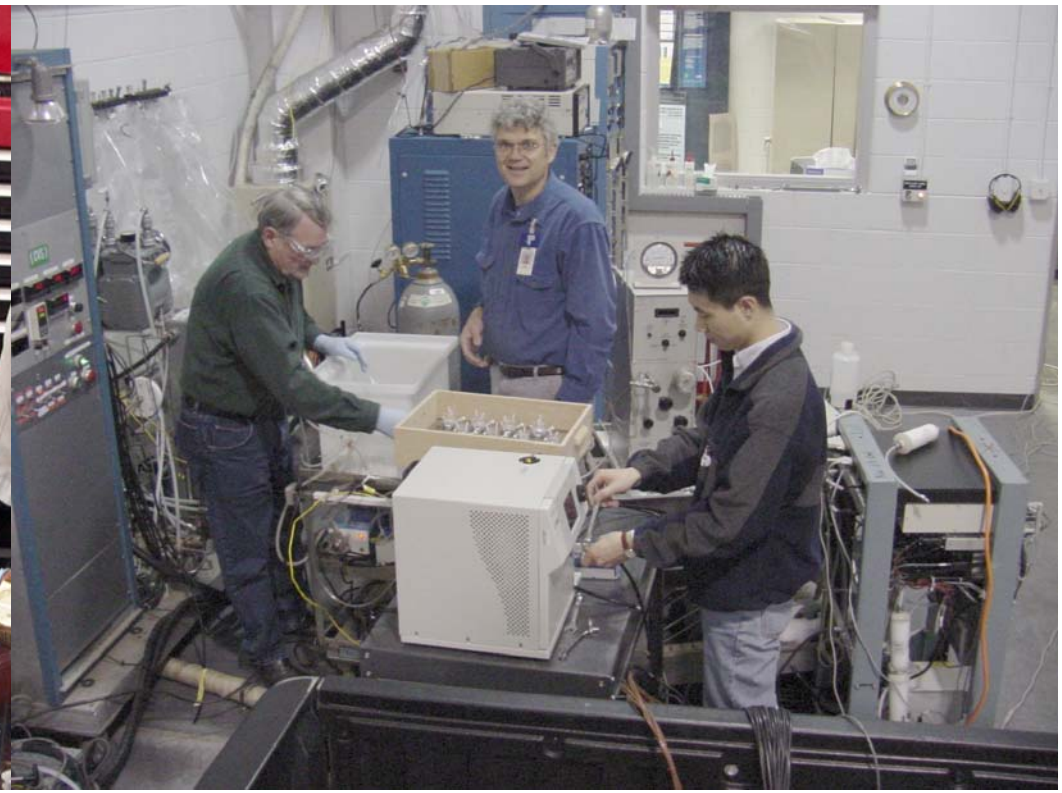
# Block Diagram of Cell Exposure




R: Flow Regulator
SP: Spare port

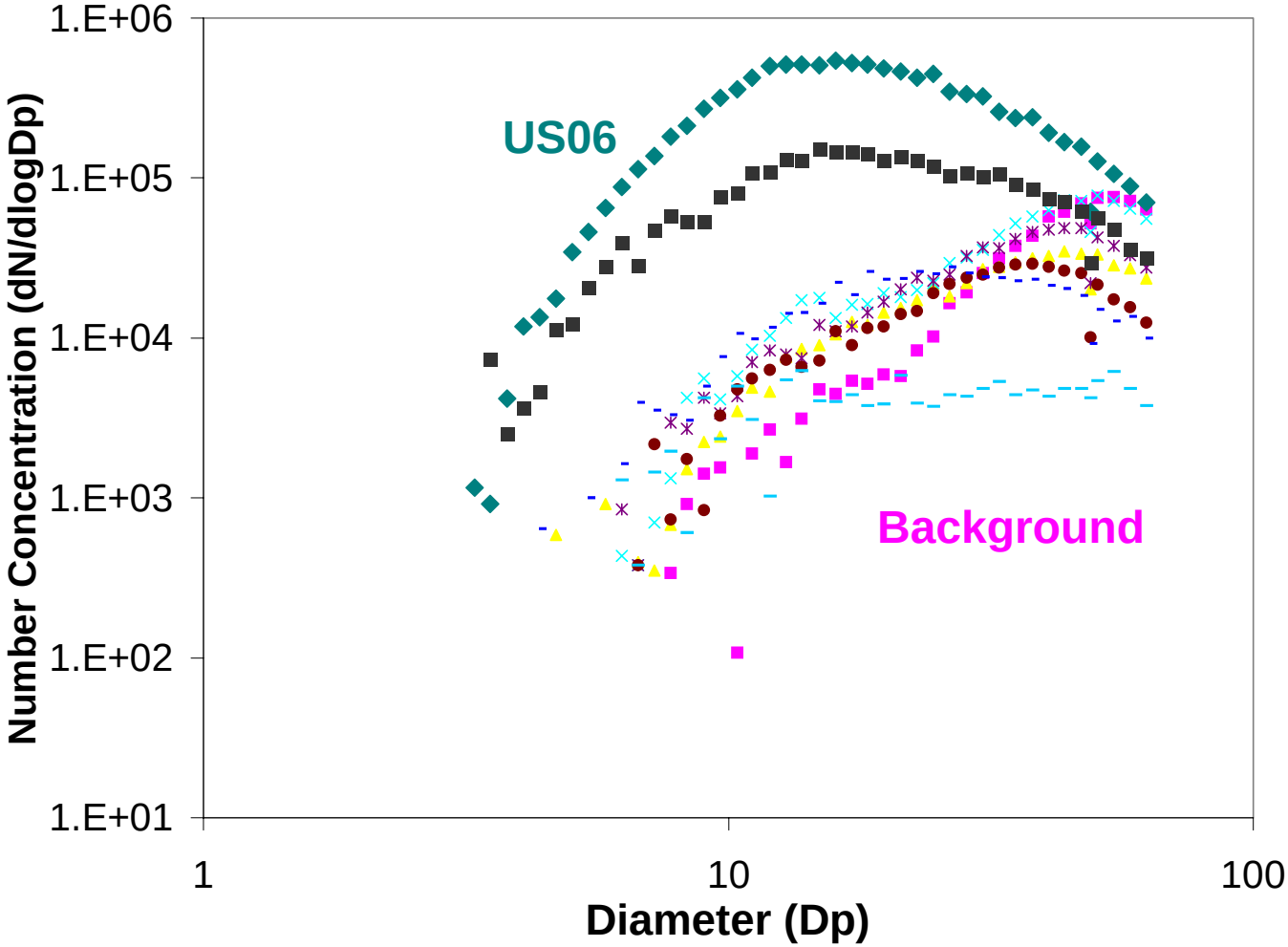
# Apparatus can do 12 exposures



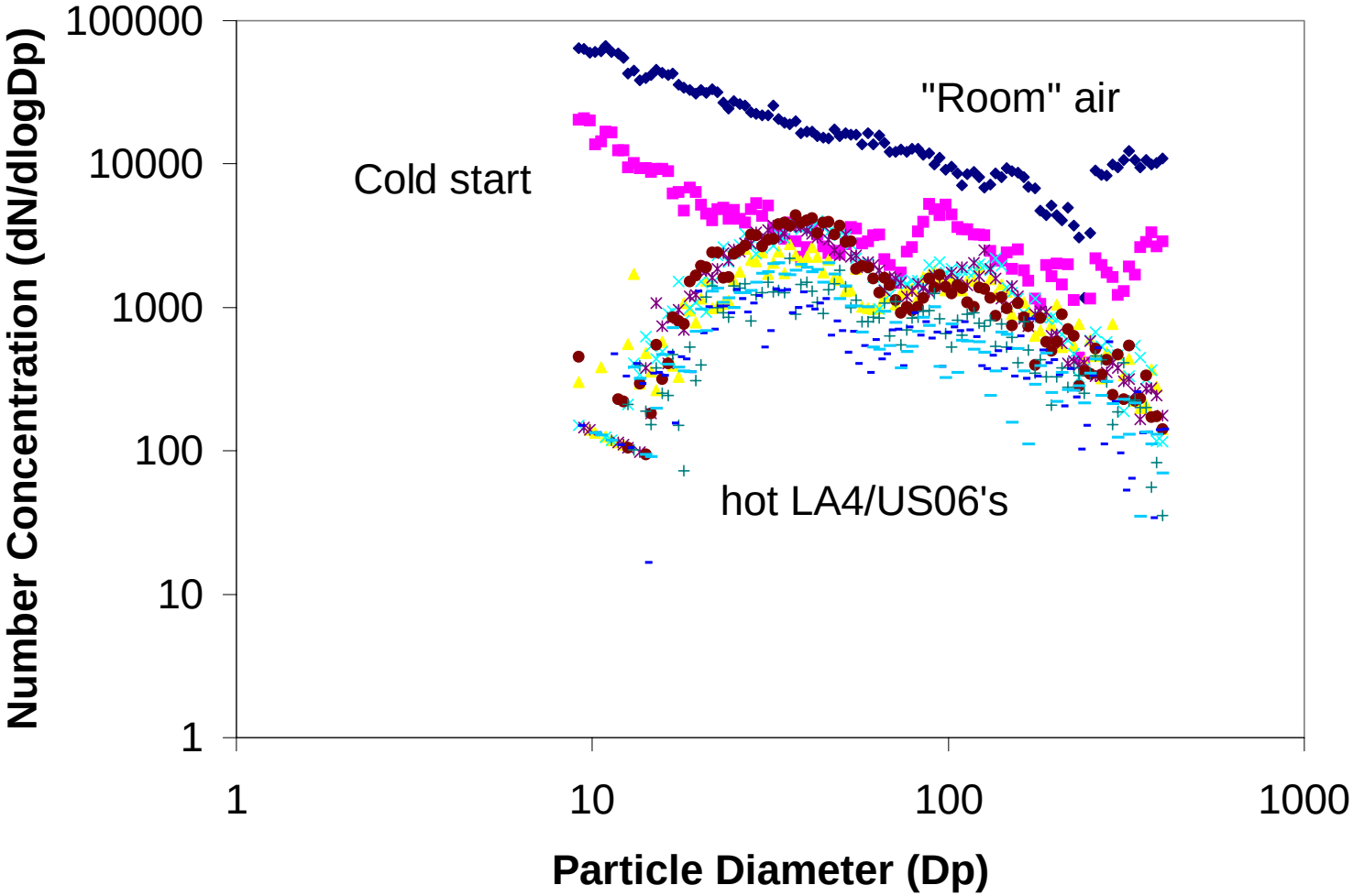


# Results

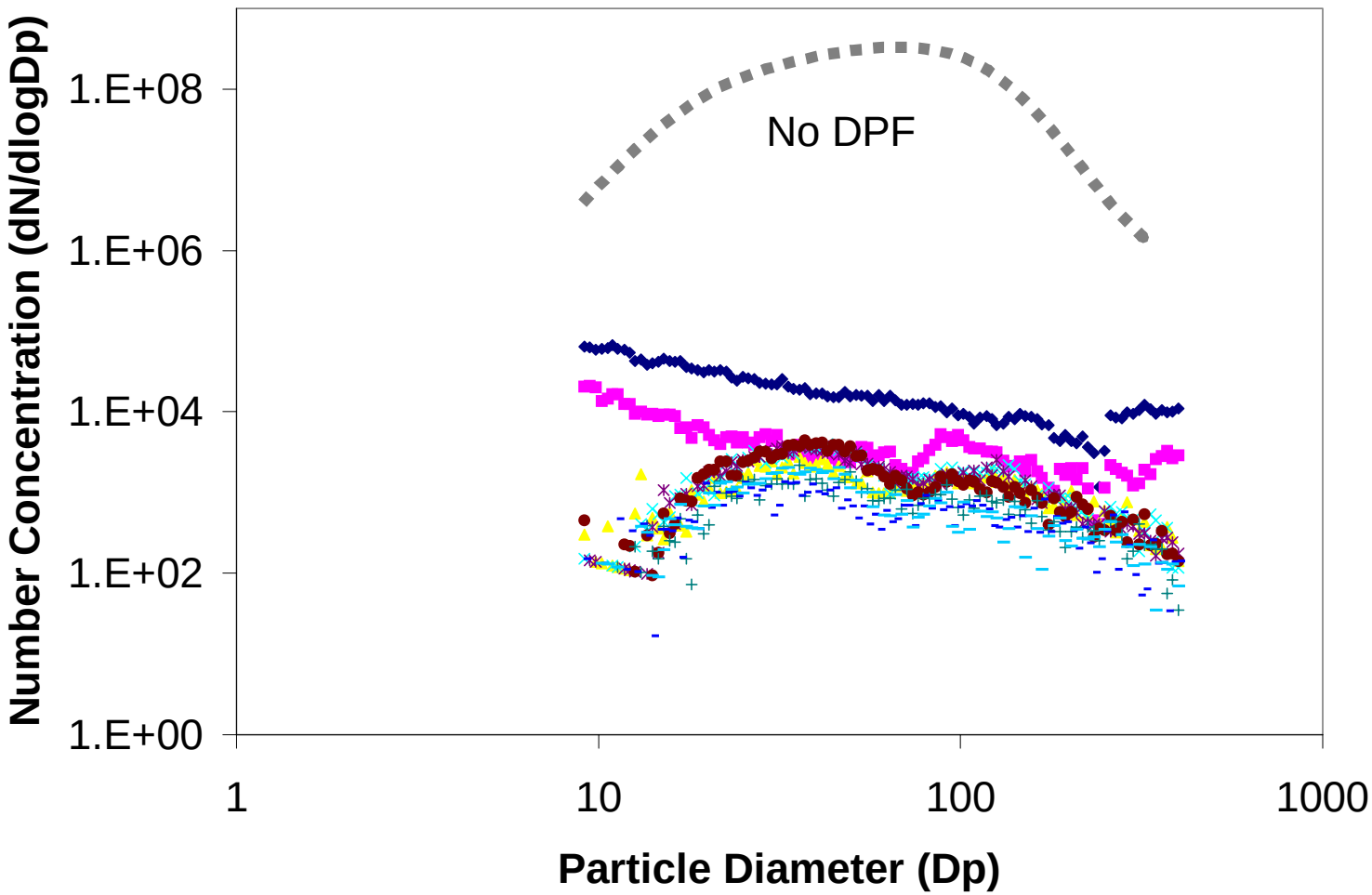
# Cold start leads to aerosol formation during US06



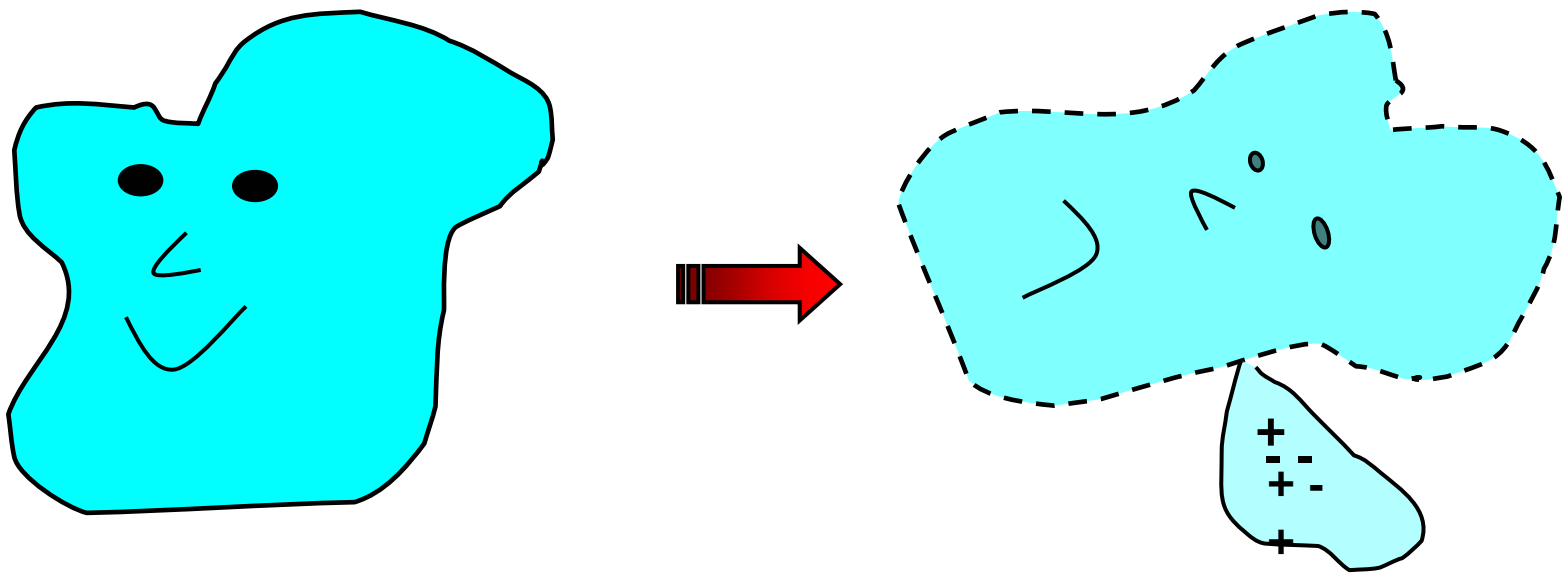
# DPF "cleans" room air



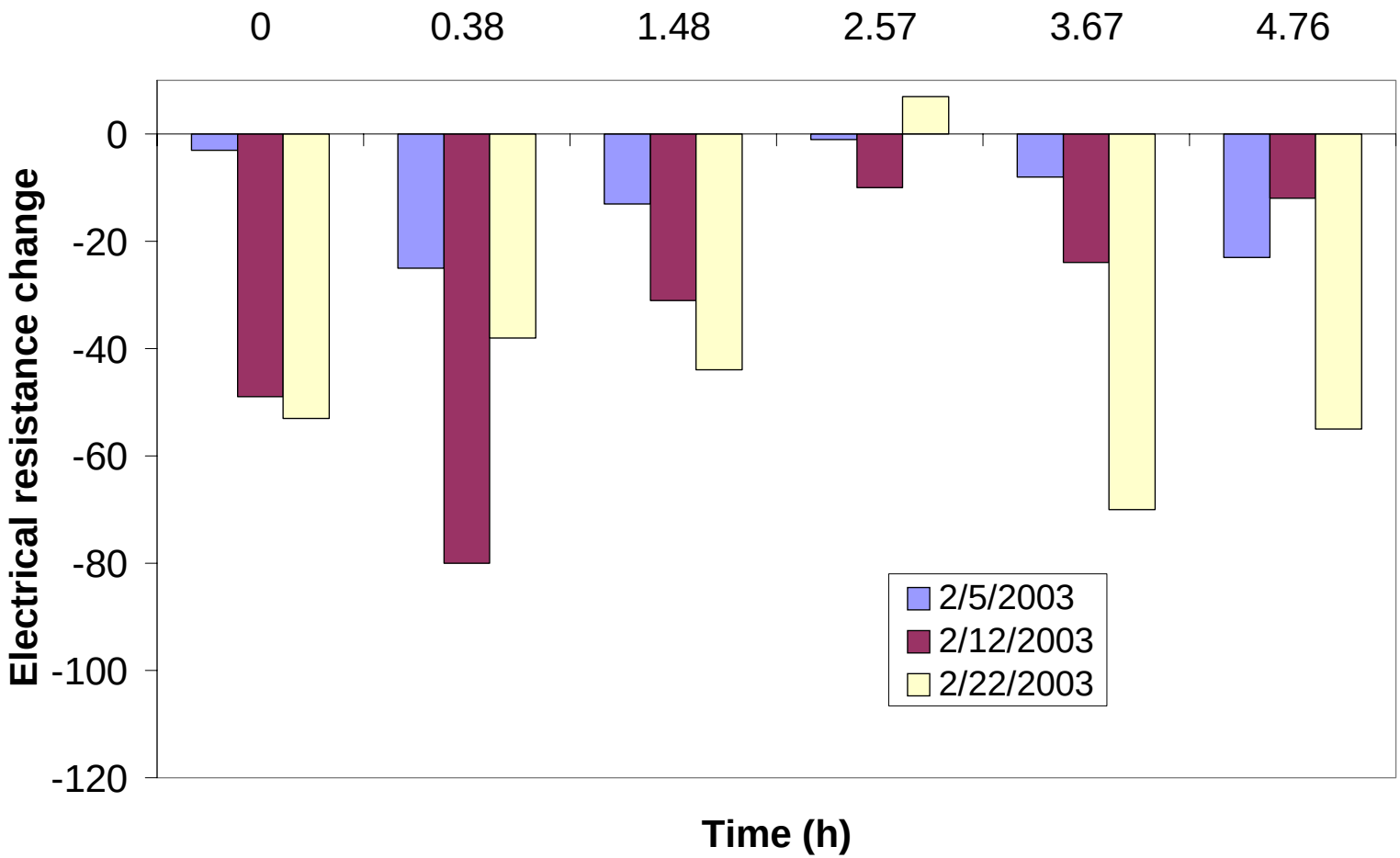
# DPF removes most particles



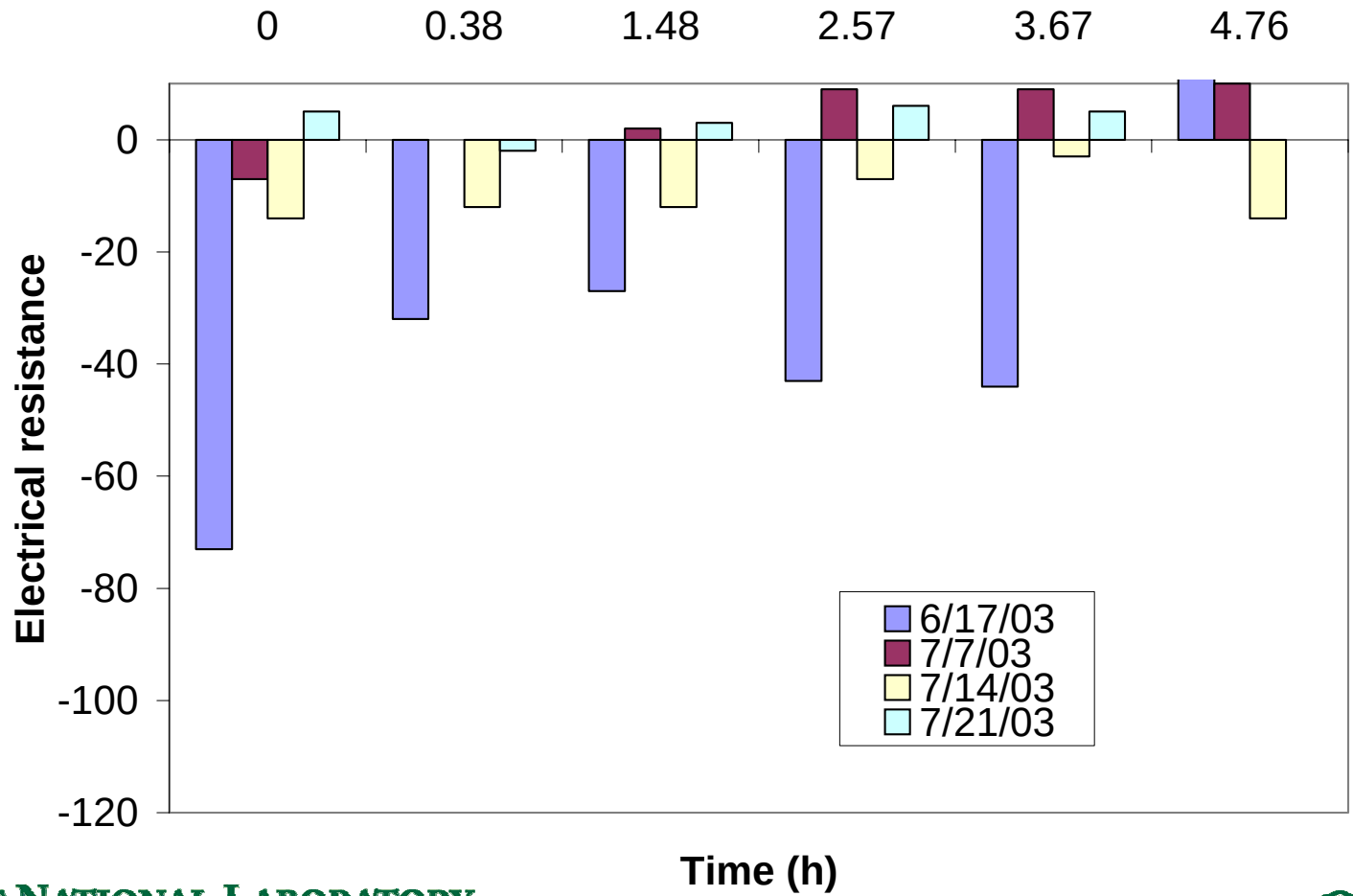
# Electrical resistance decreases as cells die or lyse, also lose contact



# Change (>20%) in Electrical resistance indicates possible cell loss after exposure – gasoline SI , primed



# Change in electrical resistance indicates some cell growth after exposure, some loss of cells – diesel unprimed



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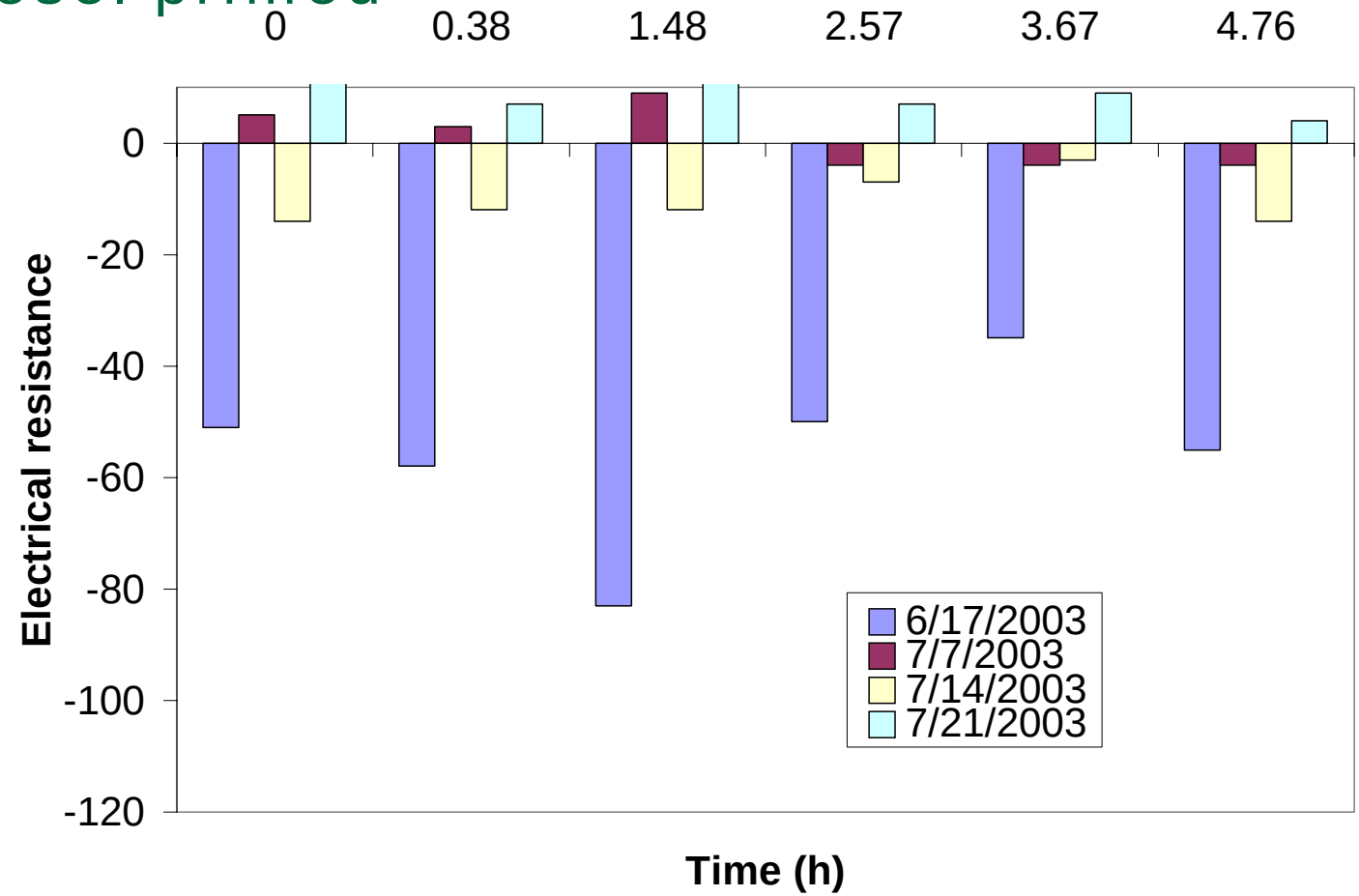
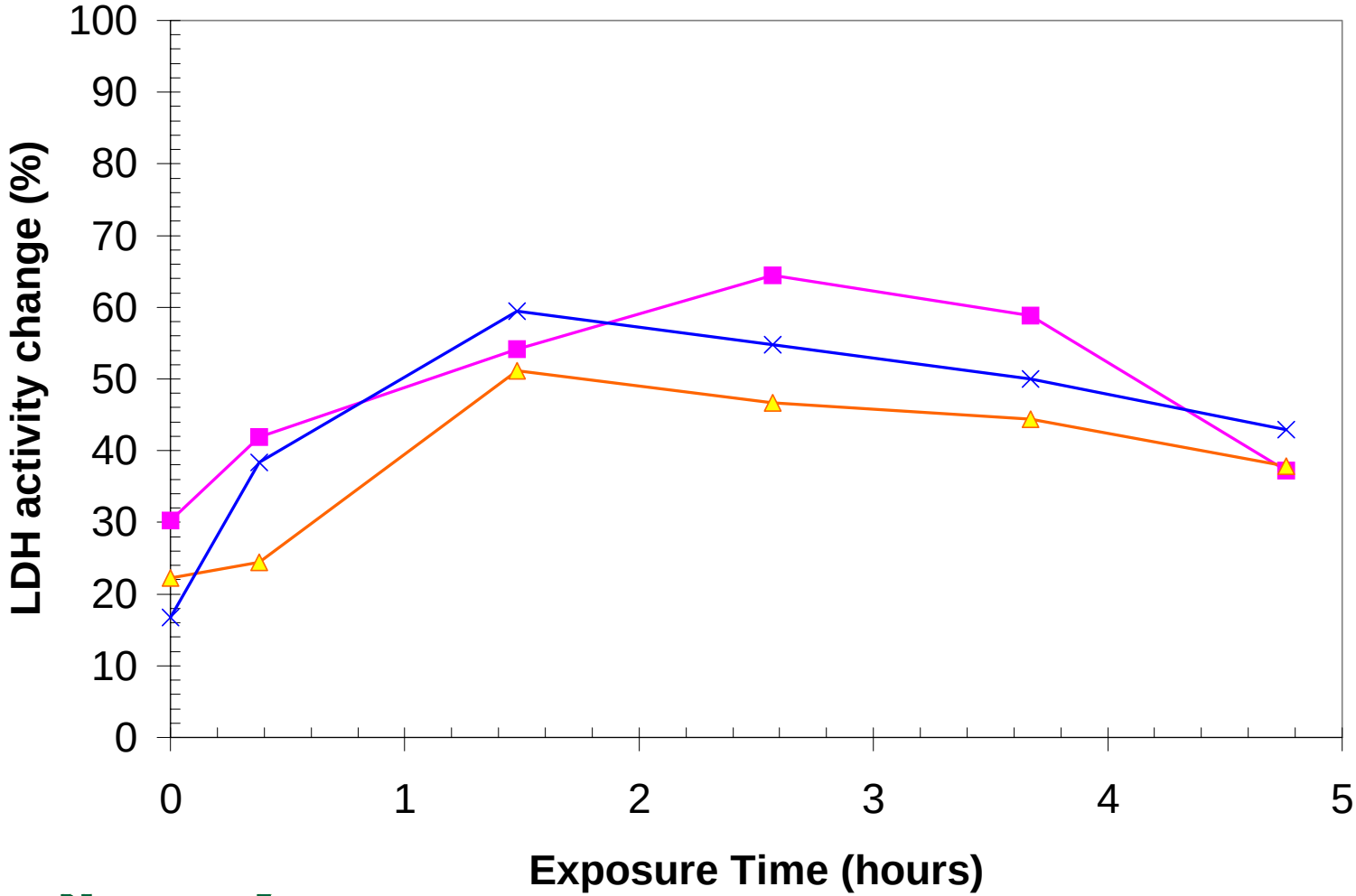
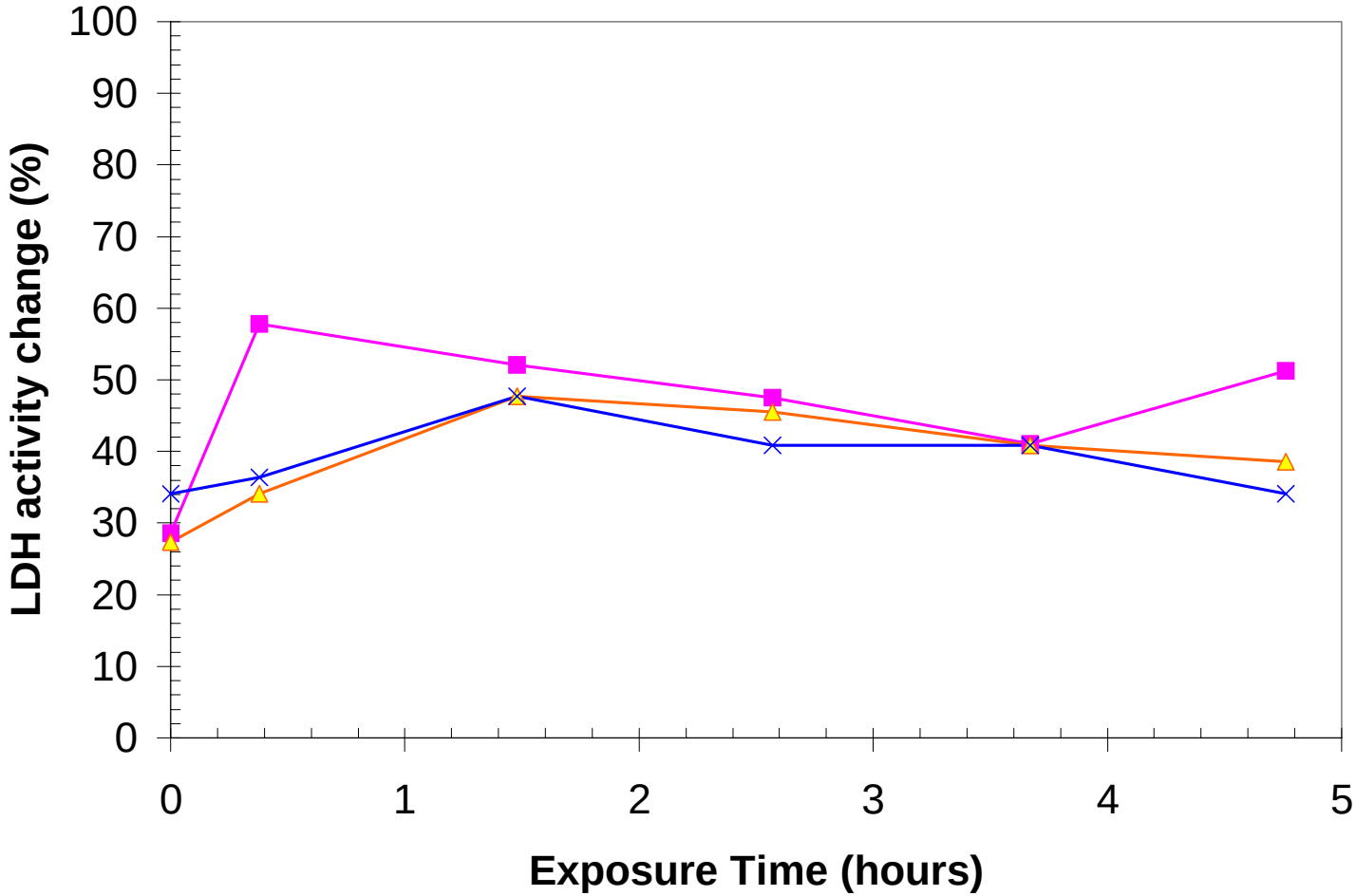


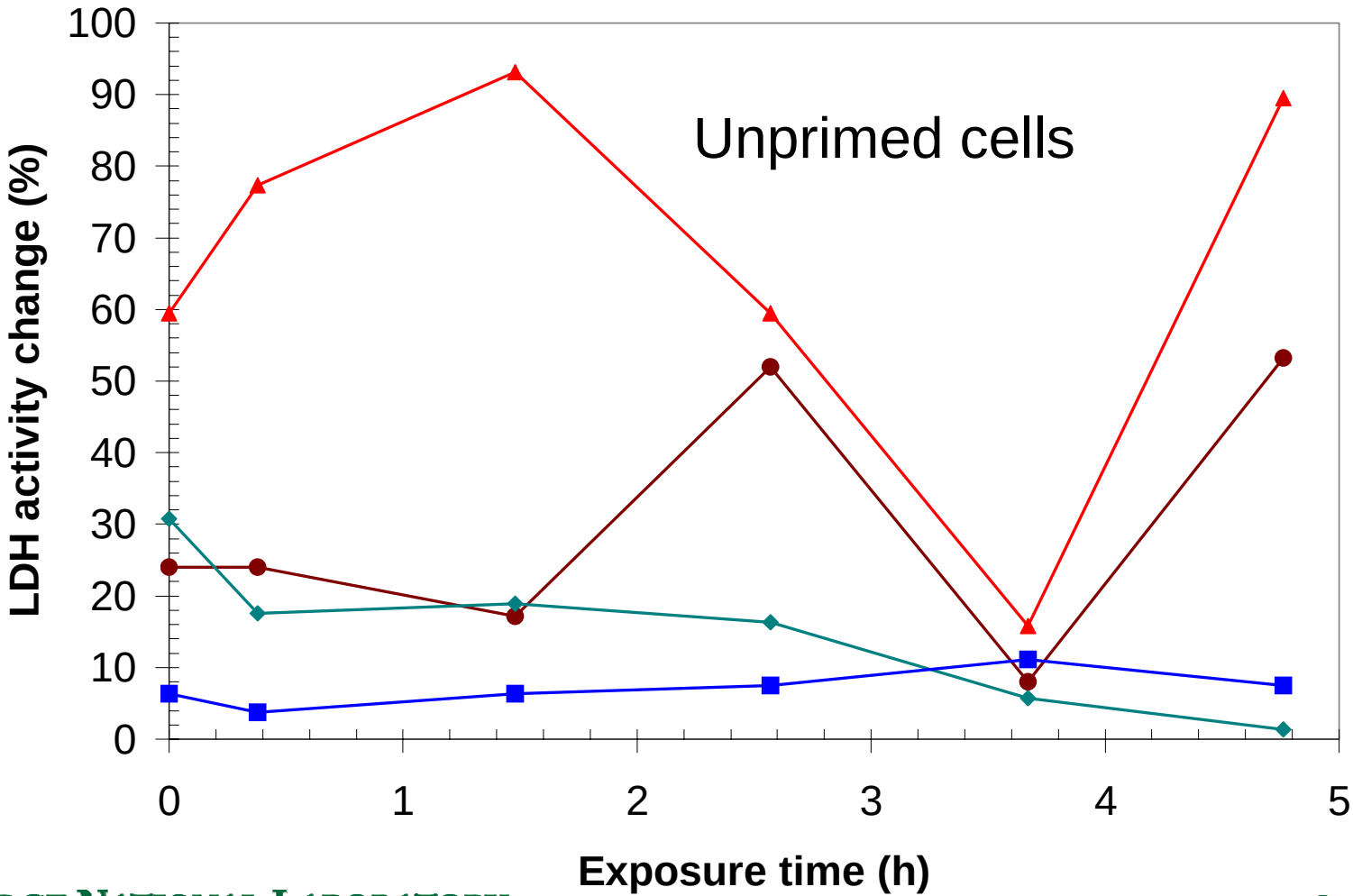
# Lactate dehydrogenase production increases slightly during test – gasoline unprimed



# Lactate dehydrogenase production shows little increase for primed cells– gasoline SI



# Lactate dehydrogenase production not conclusive during diesel exposure



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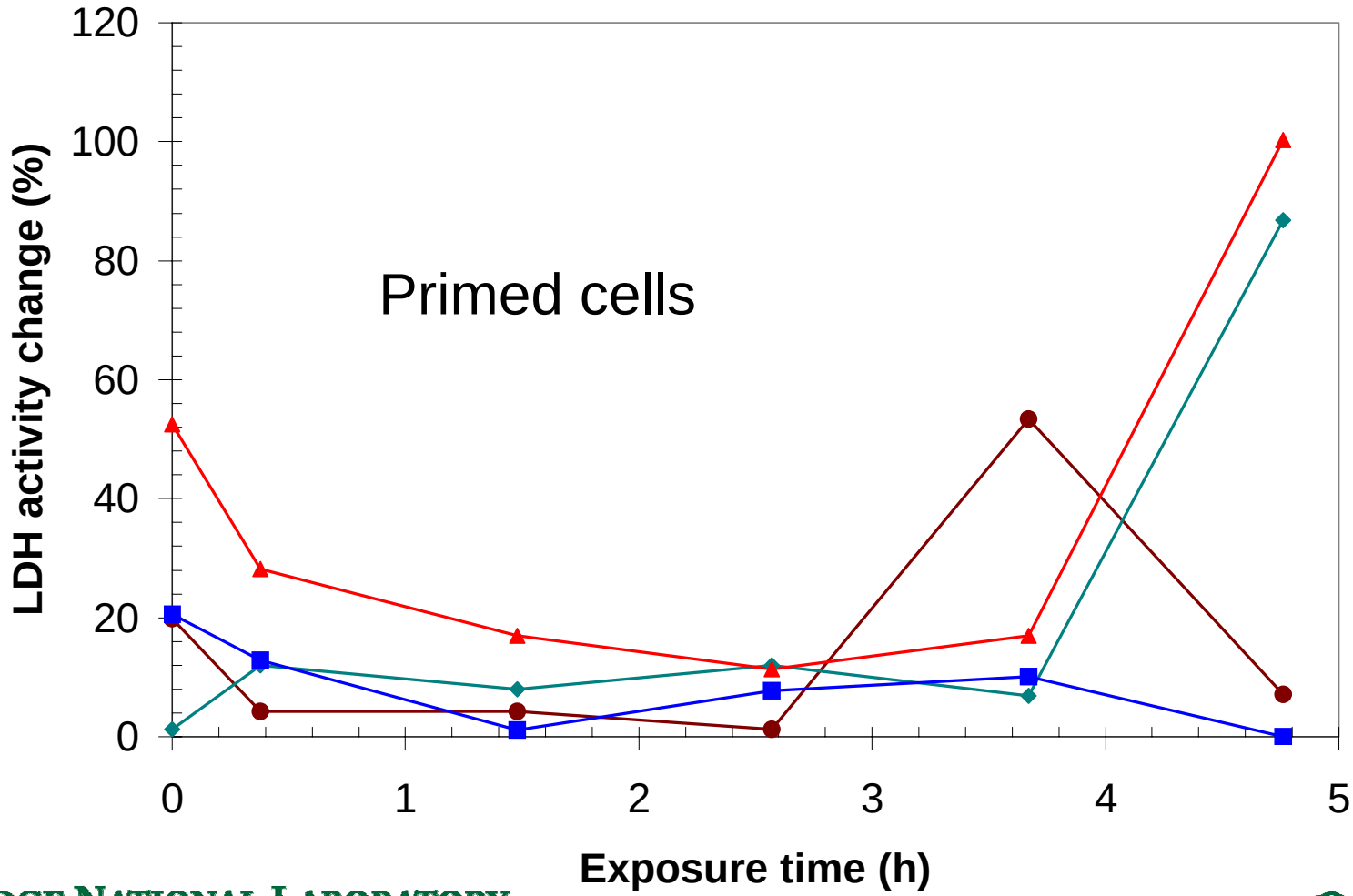
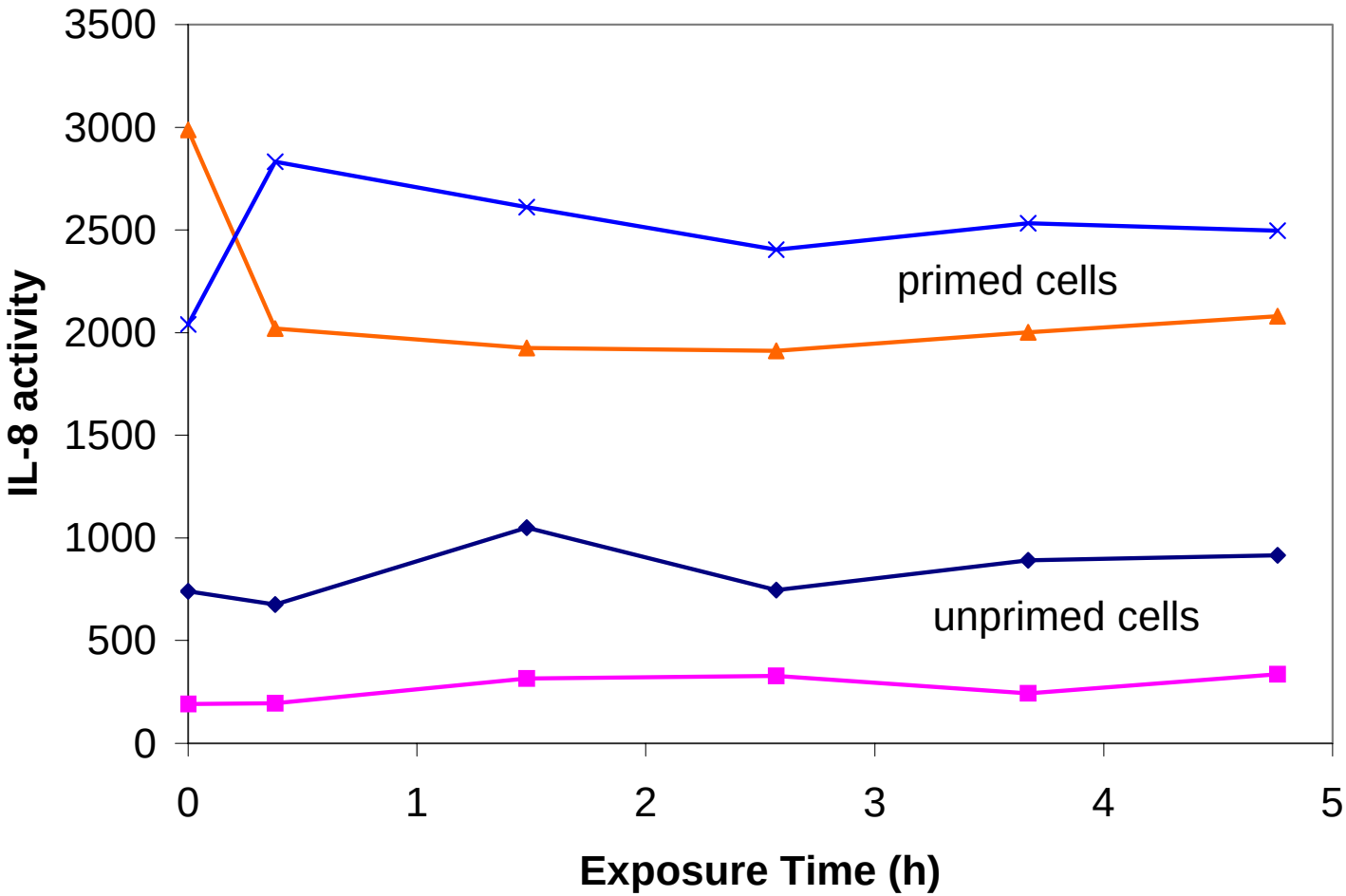


# IL-8 production remains flat during test – gasoline



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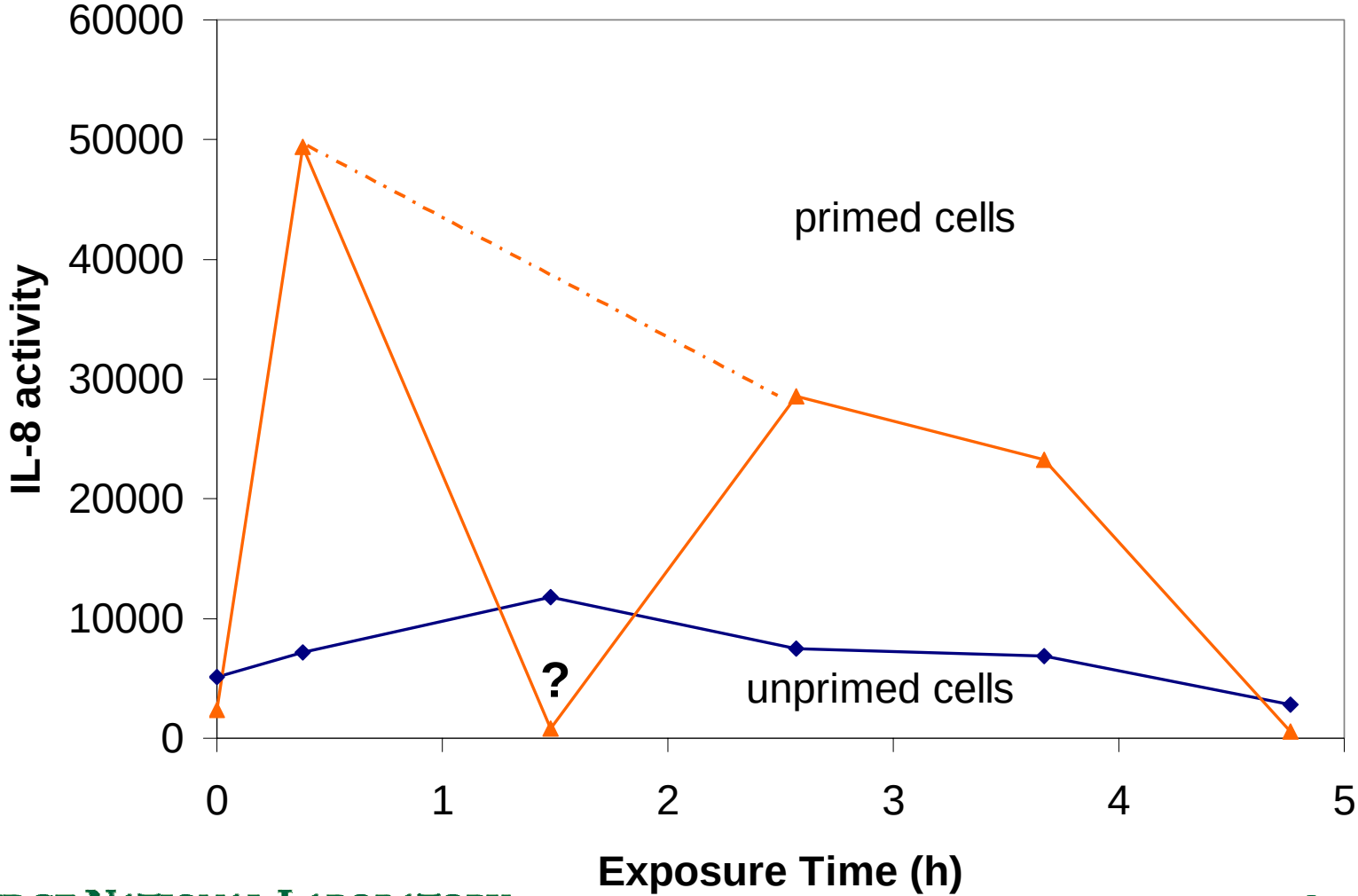

# Summary

- **PM levels, particle counts very low for these studies**
- **Cellular toxicity measures gave noisy results**
- **Although not conclusive, little effect seen on cells from either exhaust**
- **Increase in resistance consistent with cell growth seen by LRRI (Seagrave et al., 2000) with diesel exhaust exposure**