**AFTERTREATMENT PROTOCOLS FOR CATALYST CHARACTERIZATION AND PERFORMANCE EVALUATION**

**Why**
- Harmonize aftertreatment direction with emerging combustion strategies
- Assist DOE and USDRIVE in evaluation & management of projects
- A pathway for comparative evaluation and benchmarking
- Accelerate pace of catalyst innovation by maximizing value and impact of reported data

**Aspirations**
- General community consensus
- Consistent with anticipated technologies
- Reproducible, adaptable in various labs
- Be practical and have utility
- Literature citations

**Protocol Considerations**

**Performance & Modeling**
- **RESEARCH ACTIVITY THE PROTOCOL IS SUPPORTING**
  - Discovery stage: screening for overall performance, global in nature
  - Elementary step-based modeling: isolating each reaction/ads./des. step
  - Typically governed by relative maturity of technology
  - Will dictate complexity of the test methodologies employed

**Conversion**
- **TYPE OF FUNCTIONALITY BEING STUDIED**
  - Conversion: Rate (single reaction or class of reactions) versus temperature
  - Adsorption: Rate (ads/des) PLUS capacity PLUS desorption temperature
  - Adsorption characterization (procedures and equipment) more complex

**Functionality**
- **COMPLEXITY OF THE AFTERTREATMENT PROCESS**
  - Singular functionality: conversion- or adsorption-based
  - Device (e.g., system): often involves multiple functionalities (e.g., NSR)
  - Dictates complexity of steps required for adequate characterization

**Combustion Platform**
- **ENGINE TYPE AND COMBUSTION STRATEGY**
  - Diesel versus Gasoline
  - Stoichiometric versus Lean combustion
  - Conventional versus “Advanced” low-temperature combustion (e.g., RCCI)

**Sample Preparation**
- De-greening
- Pretreatment

**Test Conditions**
- Temperatures
- Exhaust Composition
- GHSV

**Aging/Poisoning**
- Thermal deterioration
- Sulfur Poisoning

**Reactor System**
- Sample
- Reactor
- Instrumentation

**STEP 1 – Low-Temperature Oxidation**

**Protocol Structure**

**Performance-based conversion (oxidation) protocol**

**Passive adsorption protocol**

Protocols 3+

- **Multi-Functional**
- **Cold Start**
- **Modeling-Based**

- Additional protocols will be generated as needed based on technology area