

DPM WORKSHOP

Practical Workshop on Strategies and Technologies to Reduce Miners Exposure to Diesel Particulate Matter and Gases.

January 24 / 25, 2007

Reno, Nevada

Practices and principles
associated with DPM
compliance at
Queenstake Resources

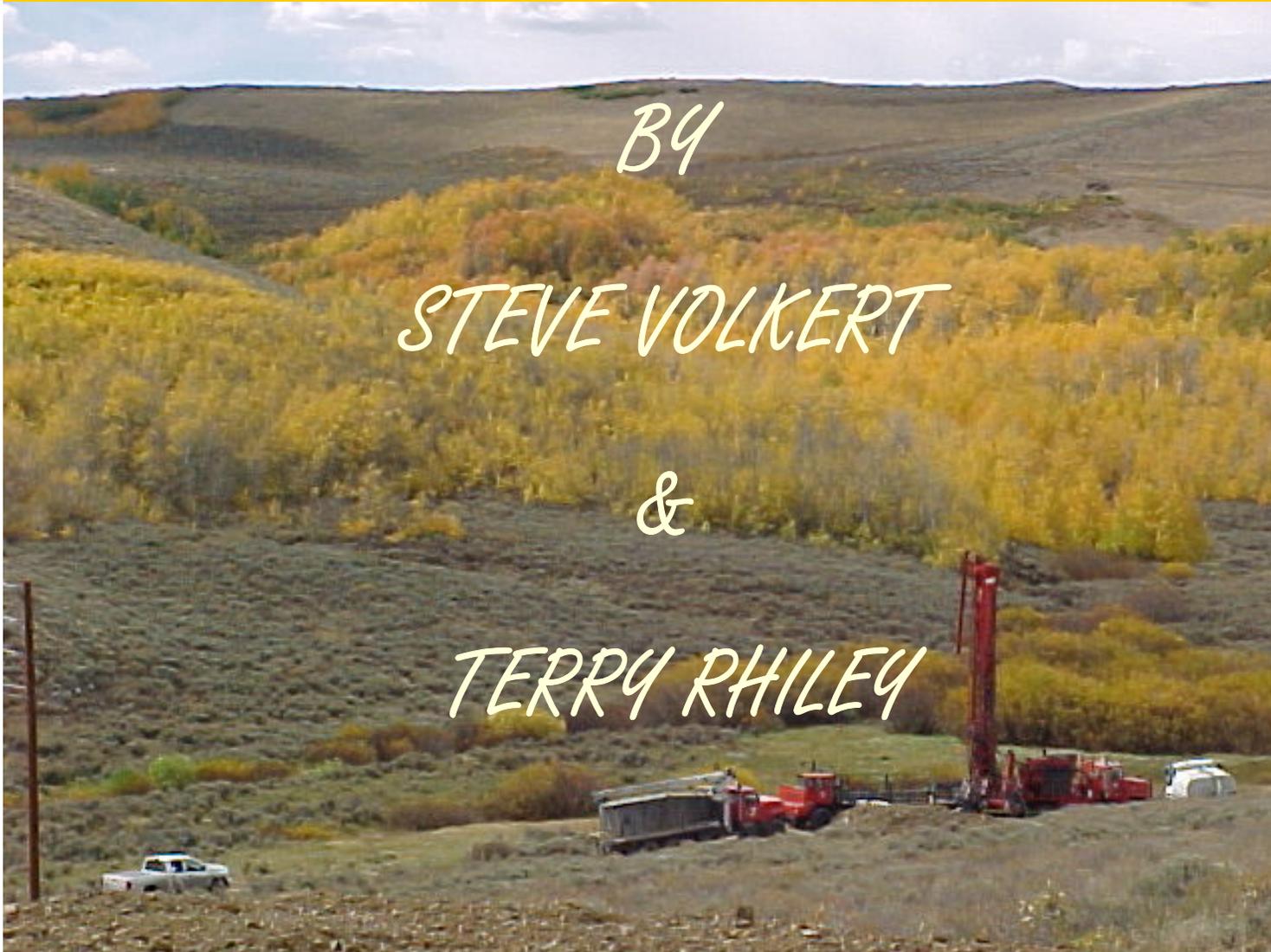


B4

STEVE VOLKERT

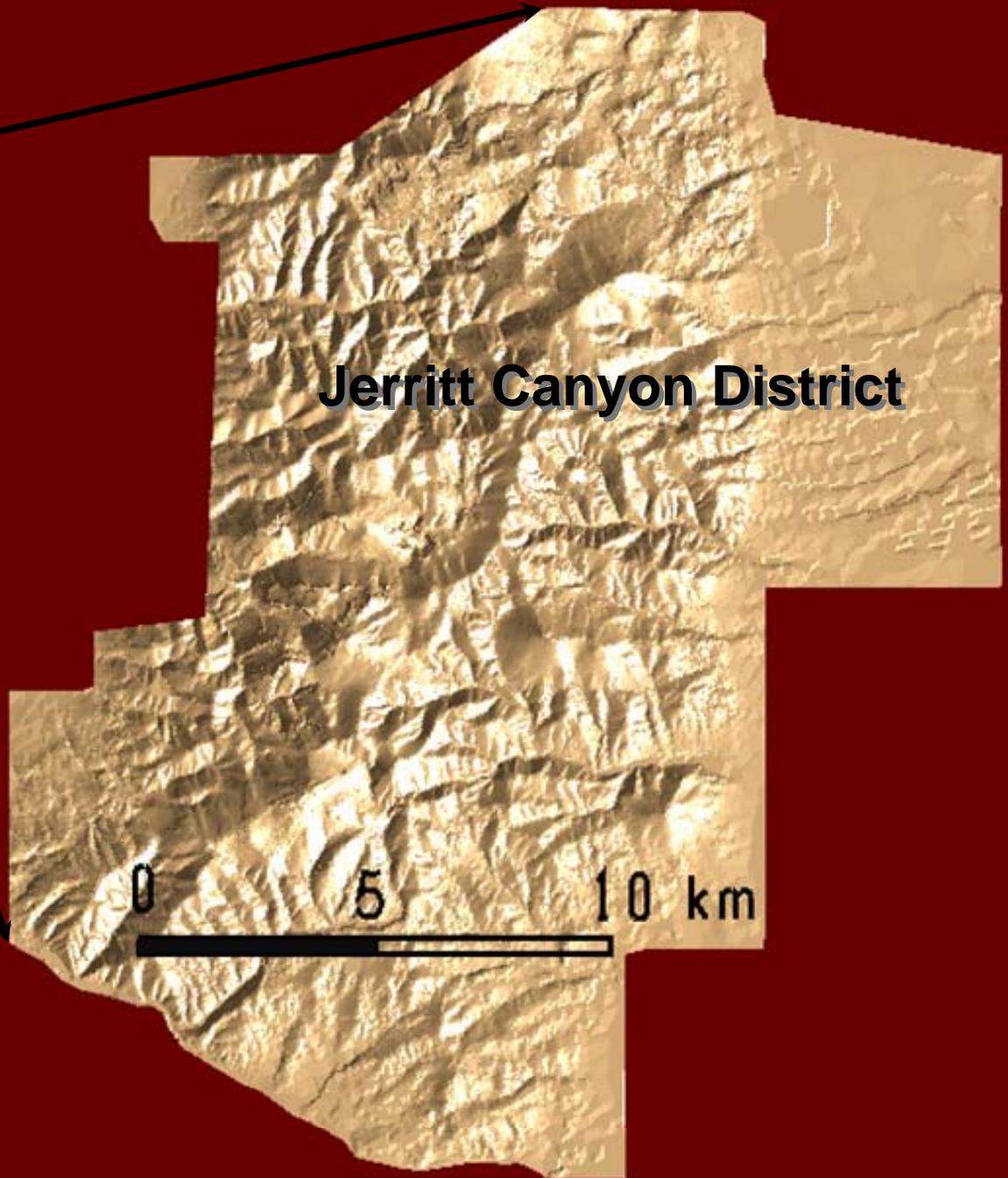
&

TERRY RHILEY





LOCATION



50 Miles North of Elko

LET ME TELL YOU HOW YOU CAN ACHIEVE A...

- **85% reduction in hydrocarbons**
- **95% reduction in Diesel Particulate Matter**
- **75% reduction in NOX**
- **98% reduction in carbon monoxide**

- **Greater fuel efficiency**
- **Improved horsepower**
- **Extended engine life**
- **More efficient engine performance**
- **Cut down on maintenance time**
- **Greatly reduce downtime**

TRIAL & ERROR

- After much experimentation and testing, we discovered that there is no
- Golden egg
- Silver bullet
- Magic wand
- No one single thing that we could implement to clean up our mines.

IN 2003 WE STARTED
LOOKING FOR THE
SOLUTIONS THAT
WOULD MAKE OUR
UNDERGROUND MINES
COMPLIANT WITH THE
RULES AND REGULATIONS
WE WOULD BE FACING

What we started with











Creating a DPM champion position



Collected tail pipe gases information for baseline comparison.



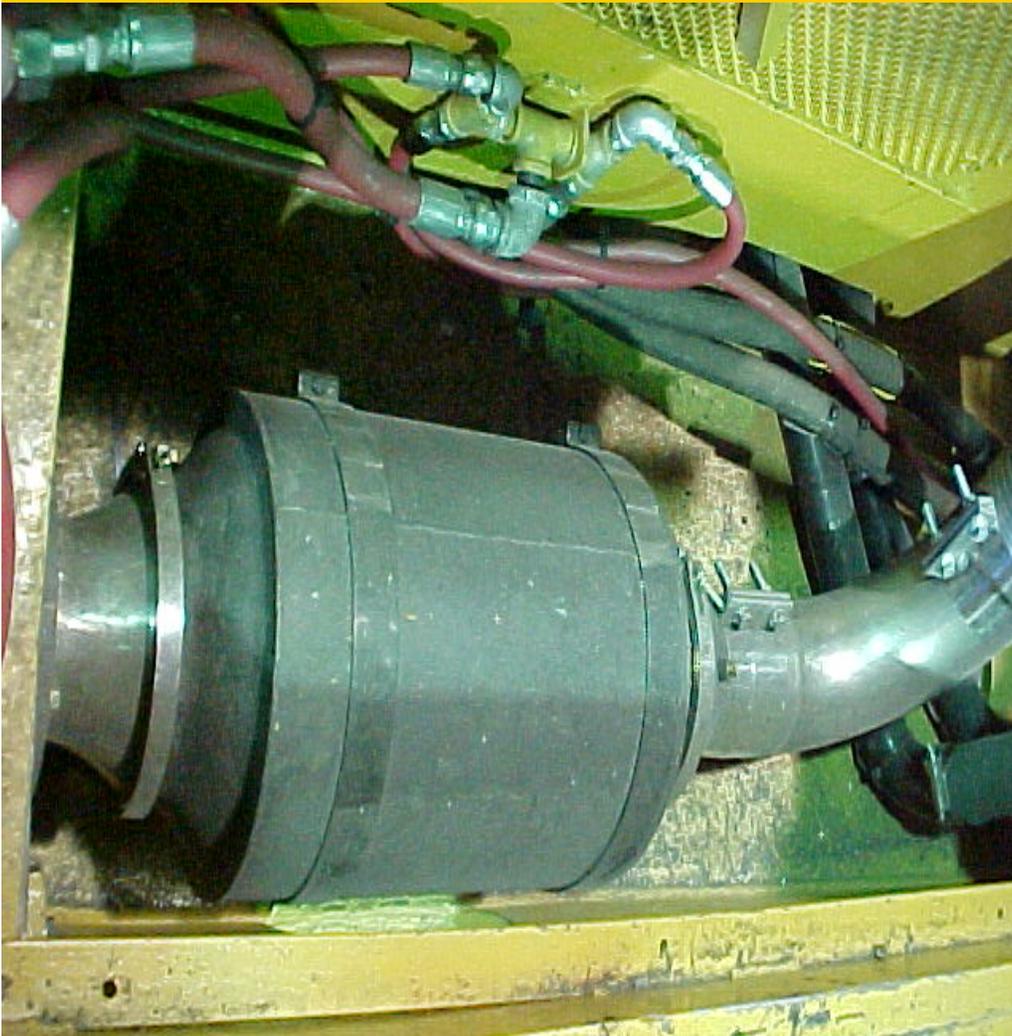
Gathered electronic engine data



Conducted exhaust temperature and back pressure profiles.



Tested several brands and configurations of exhaust after treatments.



Soot traps



Tested different exhaust configurations





Paper Filter Soot Traps

Tested some new technologies



TURNING

THE

CORNER

- Entered into a partnership with NIOSH, which helped us to focus in on key areas to work on.



With the assistance of Drs Schnakenberg and Bugarski, of NIOSH, we realized solving the DPM problem was not going to be a maintenance problem alone.



To reduce our diesel emissions it will require the expertise and participation from all departments which influence exhaust contaminant concentrations at the mine.



DEPARTMENTAL
RESPONSIBILITIES

DPM COMPLIANCE PLAN

ENGINEERING

1. Maximize available ventilation air to reduce DPM loading.
2. Mine planning incorporates evaluation of DPM loading in work areas and haulage areas.
3. Evaluate delivery of ventilation air into work areas for adequacy.



DPM COMPLIANCE PLAN

MINE OPERATIONS

1. Train miners to operate equipment to minimize emissions.
2. Turn off engines when idling for extended time.
3. Identify and tag out equipment that emits excessive smoke.
4. Park away from congested headings.
5. Minimize the use of smaller support equipment that may have higher emissions.



DPM COMPLIANCE PLAN

OPERATIONS

- Maintain a travel way clear of obstacles and large holes.
- Do not convoy vehicles as the exhaust of one engine can adversely affect the exhaust of another following closely behind.



DPM COMPLIANCE PLAN

MAINTENANCE

1. Tune engines for emissions, not power.
2. Determine levels of acceptable emissions from various engines.
3. When engine smoking exceeds pre-determined maximum, unit is taken out of service until repaired.
4. Ensure that purchased engines meet emissions standards.



DPM COMPLIANCE PLAN

HEALTH AND SAFETY DEPARTMENT

1. Perform the quality assurance function by measuring workplace air quality and personal exposures to ensure that the air quality meets expectations.



DPM COMPLIANCE PLAN

MANAGEMENT

1. Must ensure that training and best practices are implemented and enforced.



SUCCESS
STORIES AT
JERRITT
CANYON

Purchase of new equipment with cabs



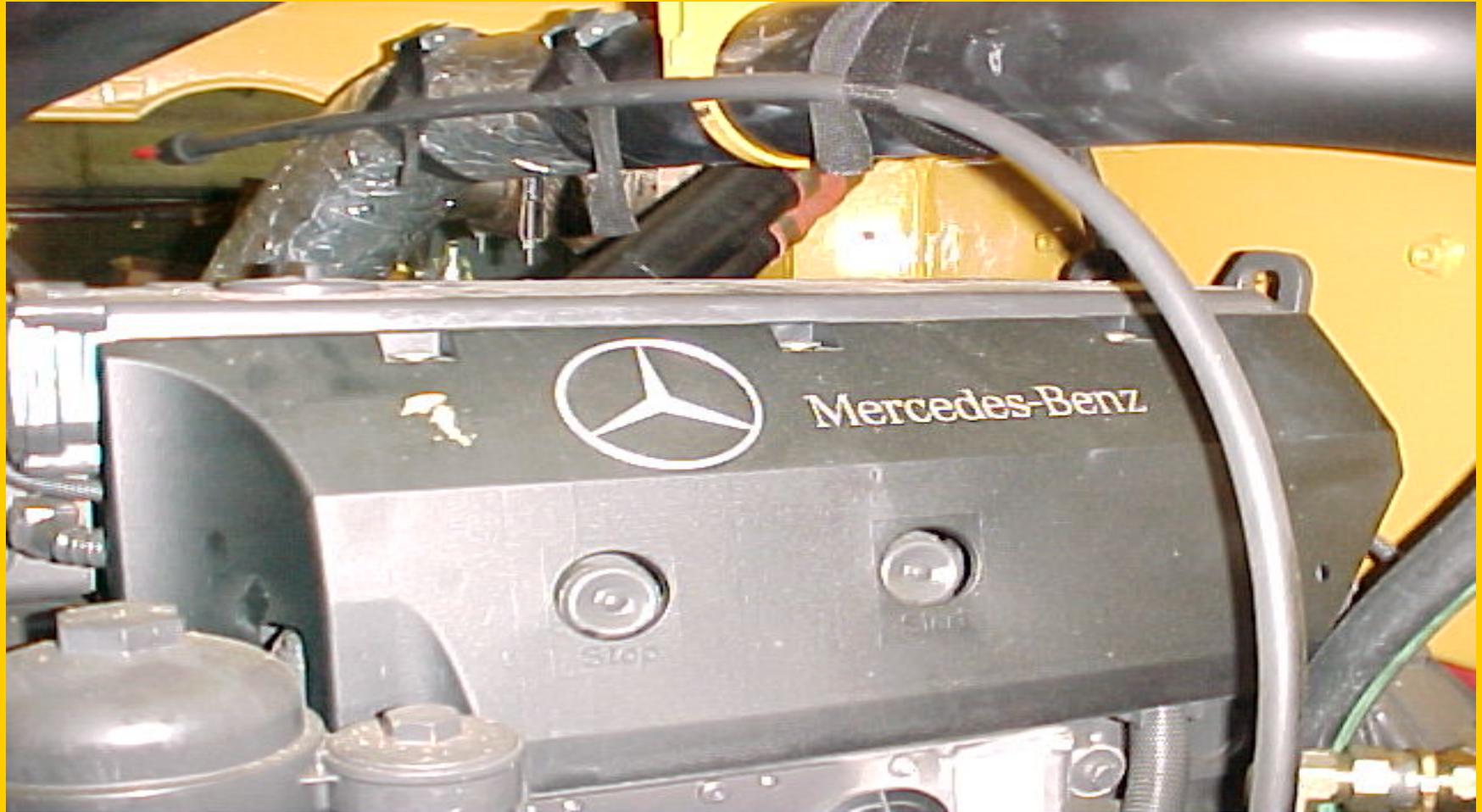
Rebuild trucks and loaders with cabs



Purchase of Dodge pickup



Repowered a huge portion of our fleet to more efficient engines



Started using Ultra Low Sulfur fuel



Maintenance accomplishments In 2006

- Purchased 6 new pieces of equipment with updated engine technology.
- Replaced 14 engines.
- Removed 34 high emission units from production.
- Installed 3 cabs on existing equipment.
- Install updated ECM programs on existing 50 / 60 Detroit engines.
- Started using ultra low sulfur fuel.

Engineering accomplishments in 2006

- Conduct in-depth ventilation surveys
- Using ventilation software to develop best possible air quality in all areas of the mine
- Compare utilization with CFM requirements to increase mine air flows
- Revamp ventilation to more efficiently move and cleanse the mine, greatly impacting air quality

QUEENSTAKE
GOALS FOR
THE FUTURE

**Implement, emission based,
engine performance PM,
concentrating on key tests to be
done on all facets of engine and
exhaust systems.**

Emissions Based Maintenance – PM

Unit Number _____ Hour Meter _____

Date _____ Performed By: _____

Warm up engine to normal operating temperature

Engine RPM @ idle: _____ RPM

Engine RPM @ rated no load: (Hi Idle) _____ RPM

Engine RPM @ rated transmission stall: (TCS) _____ RPM

Engine RPM @ rated transmission & hydraulic stall: (MVL) _____ RPM

Sample emissions @ HI Idle using Bacharach tester and compare Smoke Dot on chart.

Use 10 full Strokes. Record Smoke Dot Number: _____ 0-9

Measure and record intake restriction @ MVL: _____ Inches of Water

Measure and record turbo boost pressure @ MVL: _____ PSI

Measure and record backpressure @ MVL: _____ Inches of H2O
(max 30")

Measure and record fuel transfer pump pressure: _____ PSI

Measure and record temperature differential across radiator:

Top _____ ° F - Bottom _____ ° F = Diff _____ ° F (Min 48° F)

Measure and record charge air temp at cooler outlet: _____ ° F (Max 122° F)

Verify operation of thermostats cycling: _____ Yes / No _____

Notes: _____

Repairs Made: _____

Repairs Needed: _____

Continue to train maintenance staff



Continue to train equipment operators on best practices for use of equipment underground



Continued monitoring and improvement of ever changing air quality conditions underground



Summary

- Solutions for compliance to new MSHA standards has required a paradigm shift for underground mine operators.
- Attention must be focused on all aspects of the mining cycle to minimize particulate contributions to the air quality in the mine.
- Work with regulatory agencies, in order to quantify improvements to air quality.

Summary

- Work with equipment manufacture and engine vendors to continue to improve engine emission efficiency. As new technologies become available.
- Continue testing of alternative fuels and new technologies.

THE END



THANK YOU !

Any Questions?

