air pollution control district
SANTA BARBARA COUNTY

ASSEMBLY BILL 617: BARCT ANALYSIS - RECIPROCATING INTERNAL COMBUSTION ENGINES

Community Advisory Council
Santa Barbara County
Air Pollution Control District

Our Mission: To protect the people and the environment of Santa Barbara County from the effects of air pollution.

Aeron Arlin Genet, Director / APCO
Timothy Mitro, Air Quality Engineer

February 22, 2023

PRESENTATION TOPICS

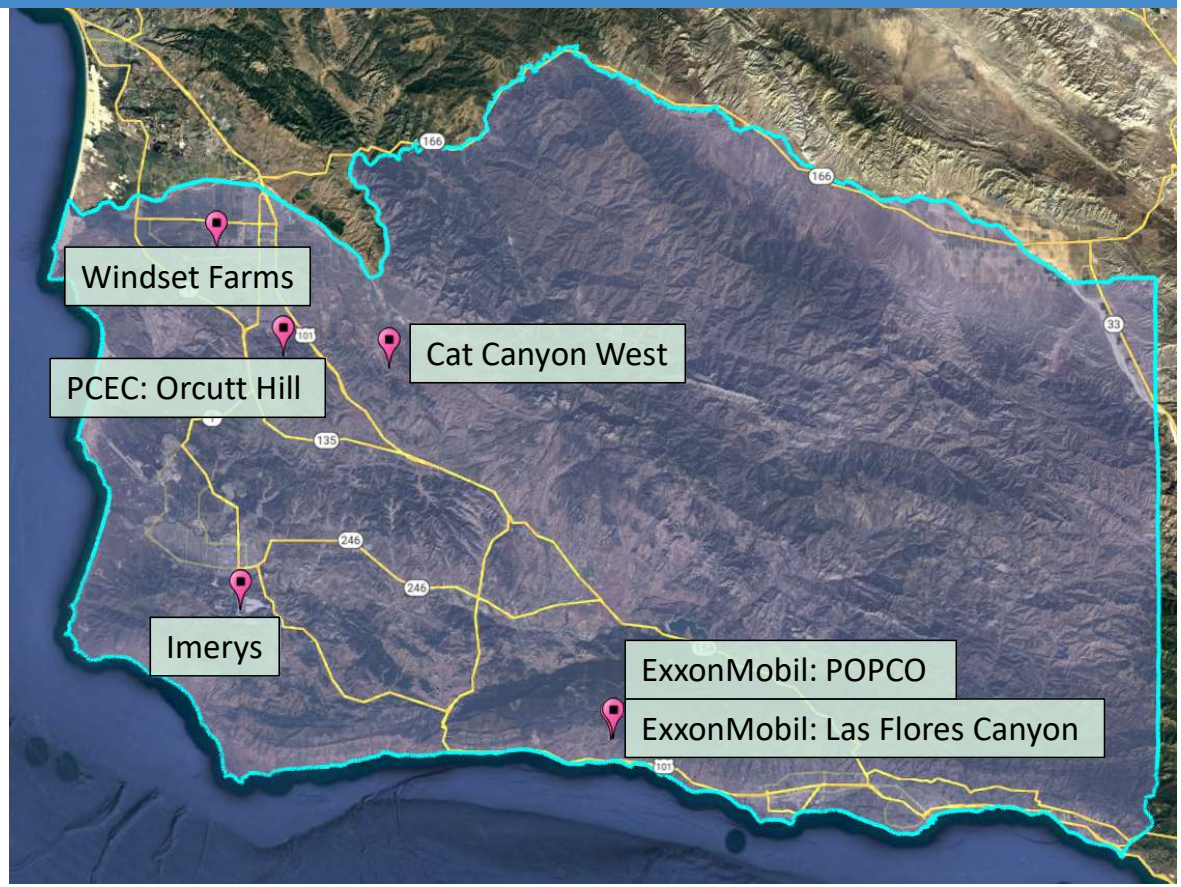
1) Review Background Information
   - Assembly Bill 617 – Best Available Retrofit Control Technology (BARCT)
   - Engine Control Technology Review
   - District Rule 333 – Reciprocating Internal Combustion Engines

2) BARCT Analysis for Reciprocating Engines
   - Updated Emission Standards
   - Industry Impacts
   - Implementation of BARCT

apcd air pollution control district SANTA BARBARA COUNTY

BACKGROUND: ASSEMBLY BILL (AB) 617

- Enacted in 2017 for Community Air Protection.
- BARCT applies to large industrial facilities subject to Cap-and-Trade.
  - >25,000 metric tons/yr of GHGs as of 1/1/2017.
  - Requires maximum emission reduction achievable, taking into account environmental and economic impacts.
- BARCT Rule Development Schedule adopted by Board in 2018.



TECHNOLOGY REVIEW

- Non-Selective Catalytic Reduction (NSCR) - "**3-way catalyst**"
  - Emissions reduced by at least 90% NOx, 80% CO, and 50% ROC.
  - Must operate near stoichiometric conditions. (All O_2 reacted & all fuel burned)
  - **Air/Fuel Ratio Controller:** Makes operational adjustments based on input from O_2 sensor.
  - Catalyst needs high exhaust temperatures & low sulfur fuel.

DISTRICT RULE 333 – ENGINES

- Rule 333 was initially adopted in 1991 (minor amendments in 1997 and 2008).
- Applies to engines with a max rated horsepower of 50 or greater.

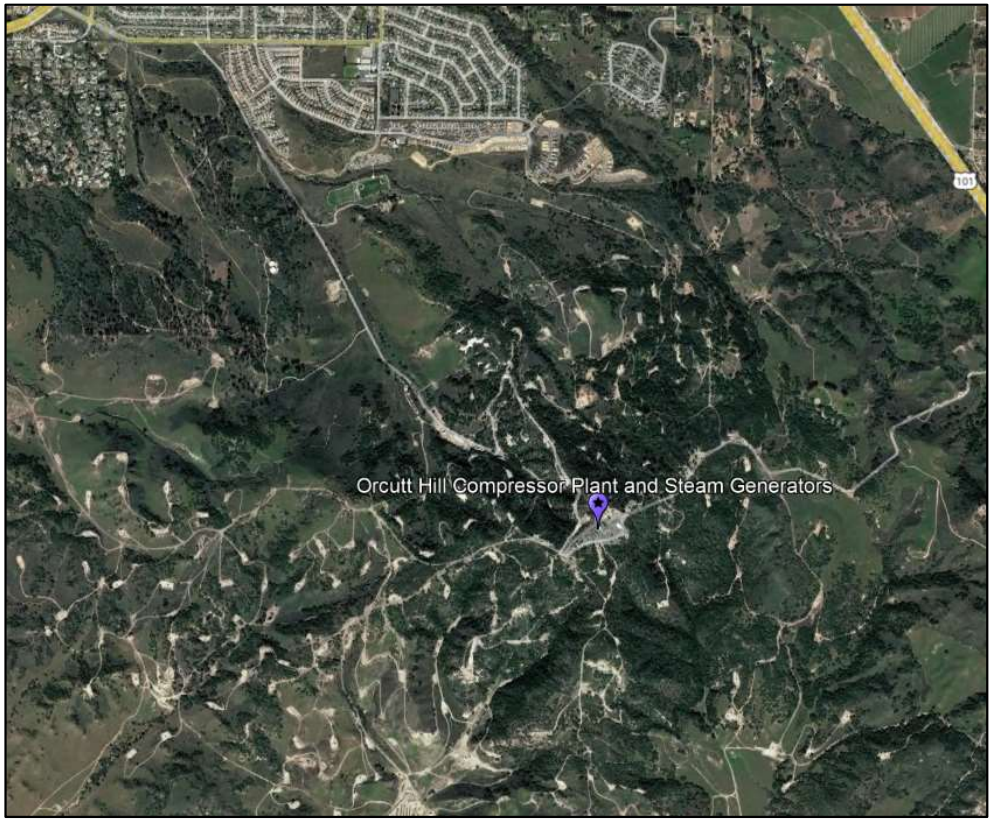
Engine Type		Rule 333 Emission Limits (ppmv, corrected to 15% O_2)		
		NOx	ROC	CO
Rich-burn, SI	Non-cyclical	50	250	4,500
	Cyclical	300		

- To comply with NOx standards:
  - **Non-cyclical engines:** Equip with a 3-way catalyst.
  - **Cyclical engines:** Properly tune or lean the air-fuel ratio.

Cyclical Oil Well Pump

PCEC – ORCUTT HILL

- 27 prime engines remaining
  - **Manufacture Year:** 1970s and 1980s
  - **Original Max Horsepower:** 130 – 200 hp
  - **Derated Max Horsepower:** 42 – 49.9 hp



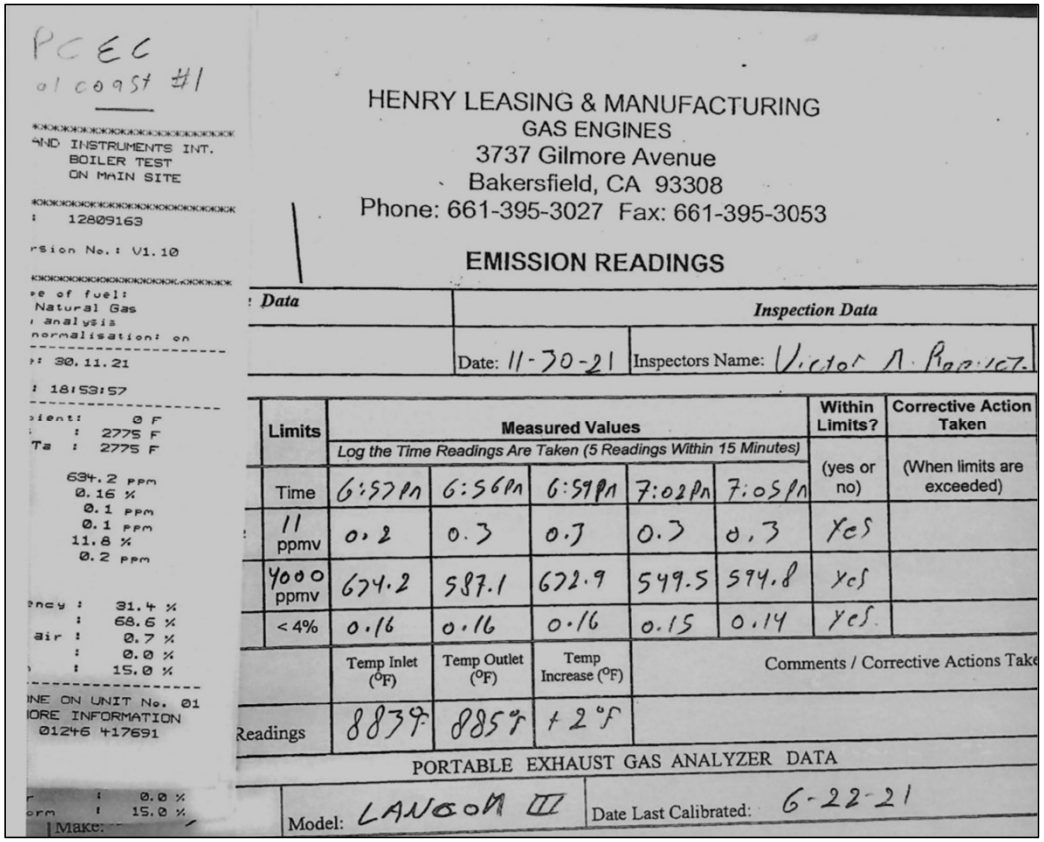
BARCT ANALYSIS

1) Engines need to comply with the BARCT standards regardless of derating.

2) Lower BARCT standards are achievable.
   - Based on South Coast AQMD Rule 1110.2 and San Joaquin Valley APCD Rule 4702;
   - 95-98% NOx control for engines;
     - Difficulties maintaining high exhaust temperature on derated, cyclical engines.

Engine Type		Uncontrolled NOx EF (ppmv)	Rule 333 NOx Limits (ppmv)	NOx BARCT (ppmv)
Rich-burn, SI	Non-cyclical	500	50	11
	Cyclical		300	11
	Derated, Cyclical		N/A	25

TECHNOLOGY TRIALS



PCEC
al coast #1

AND INSTRUMENTS INT.
BOILER TEST
ON MAIN SITE

12809163

rsion No.: V1.10

e of fuel:
Natural Gas
analysis
normalisation: on

30.11.21

18:53:57

ient: 0 F
: 2775 F
Ta : 2775 F

694.2 ppm
0.16 %
0.1 ppm
0.1 ppm
11.8 %
0.2 ppm

ency : 31.4 %
: 68.6 %
air : 0.7 %
: 0.0 %
: 15.0 %

INE ON UNIT No. 01
ORE INFORMATION
01246 417691

: 0.0 %
orm : 15.0 %
Make:

HENRY LEASING & MANUFACTURING
GAS ENGINES
3737 Gilmore Avenue
Bakersfield, CA 93308
Phone: 661-395-3027 Fax: 661-395-3053

EMISSION READINGS

Data	Inspection Data
	Date: 11-30-21 Inspectors Name: Victor A. Rodriguez

	Limits	Measured Values (Log the Time Readings Are Taken (5 Readings Within 15 Minutes))					Within Limits? (yes or no)	Corrective Action Taken (When limits are exceeded)
Time		6:57pm	6:56pm	6:59pm	7:02pm	7:05pm		
11 ppmv		0.2	0.3	0.3	0.3	0.3	Yes	
4000 ppmv		624.2	587.1	672.9	549.5	594.8	yes	
	< 4%	0.16	0.16	0.16	0.15	0.14	yes	

	Temp Inlet (°F)	Temp Outlet (°F)	Temp Increase (°F)	Comments / Corrective Actions Take
Readings	883°F	885°F	+2°F	

PORTABLE EXHAUST GAS ANALYZER DATA

Model: LANCOM III Date Last Calibrated: 6-22-21

- PCEC initiated control technology trials on a few engines.
  - Installed catalysts and Air-Fuel Ratio Controllers.
  - NOx analyzer tests show that the lower limits are feasible.
- Decision to pursue controls on all engines.

COST-EFFECTIVENESS

	Per Engine Retrofit	Total (27 engines)
Capital Costs:	**$60,000**	**$1.62 million**
Catalyst and AFRC installation	$30,000	
Powerpole extensions for AFRC	$30,000	
On-Going Costs:	**$12,000/yr**	**$324,000/yr**
Catalyst and O_2 Sensor Replacement	$4,000/yr	
Biennial Source Testing	$4,000/yr	
Quarterly NOx Analyzer Testing	$2,000/yr	
Added Maintenance & Recordkeeping	$2,000/yr	
Emission Reductions:	**2.6 - 2.7 tpy NOx**	**73 tpy NOx**
Cost-Effectiveness:	**$6,600 - $6,800 per ton of NOx** (15 year project life, 6% interest)	

BARCT IMPLEMENTATION

- PCEC submitted an Authority to Construct (ATC) application to incorporate BARCT directly into their operating permit.
  - Equipment installed no later than December 31, 2023.

- Amendments to District Rule 333 no longer necessary.
  - The BARCT Analysis will be presented to the District Board & forwarded to CARB.
  - The BARCT Analysis will continue to apply to existing and new equipment units at the AB 617 Industrial Facilities.

BARCT TIMELINE FOR IC ENGINES

- **December 2018:** BARCT Schedule adopted by District Board
- **2019 – 2022:** Technology Trials at PCEC
- **October 2022:** ATC application submitted by PCEC
- **February 2023:** CAC Meeting to receive update on BARCT Analysis
- **Spring 2023:**
  1) ATC Permit issued
  2) District Board Hearing to receive BARCT Analysis
  3) Forward Analysis to CARB
- **Dec 31, 2023:** Implementation of BARCT Analysis

CONTACT INFORMATION

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