10 November 2017

Permit and Emissions Review
Denton Energy Center

Diane Fischer, Michael Fisher,
Mike Rinkol and Paul Lee

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BLACK & VEATCH

About Black & Veatch

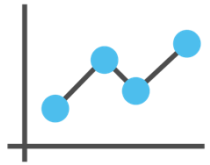
11,000+
Professionals

110+ offices

Six continents

7,000 active projects worldwide.

$3.2 Billion
in revenue in 2016.



1915
Year Established

Agenda

- Overview of Assignment and Conclusions
- Permitting Process
- DEC and Red Gate
  Facility and Emission Rates Comparison
- DEC Emissions Validation

Overview of Assignment and Conclusions

Michael Fisher
Project Manager

Black & Veatch Contracted as Independent Review

Project Description	**Denton Energy Center (DEC) – twelve (12) reciprocating internal combustion engines (RICE) used for peaking purposes.**
	Wärtsilä is RICE manufacturer, and Burns & McDonnell is the engineer and constructor.
Community Involvement	**Surrounding community has concerns with permit application and permit process.**
Assignment	**Denton Municipal Electric (DME) retained Black & Veatch to perform independent analysis of permit process and application.**
	DME requested that we compare the DEC to Red Gate.

Independent Engineering Consultant Review Conclusions

- The DEC permit application was filed correctly
  - DEC permit is valid and filed in accordance with EPA and TCEQ requirements

DEC Permit

- Permitted as a peaking unit in an ozone non-attainment area
- Minor Source
- Standard Permit designation
- 3,200 hours per year - limit on number of hours each unit may operate

Independent Engineering Consultant Review Conc. (cont'd)

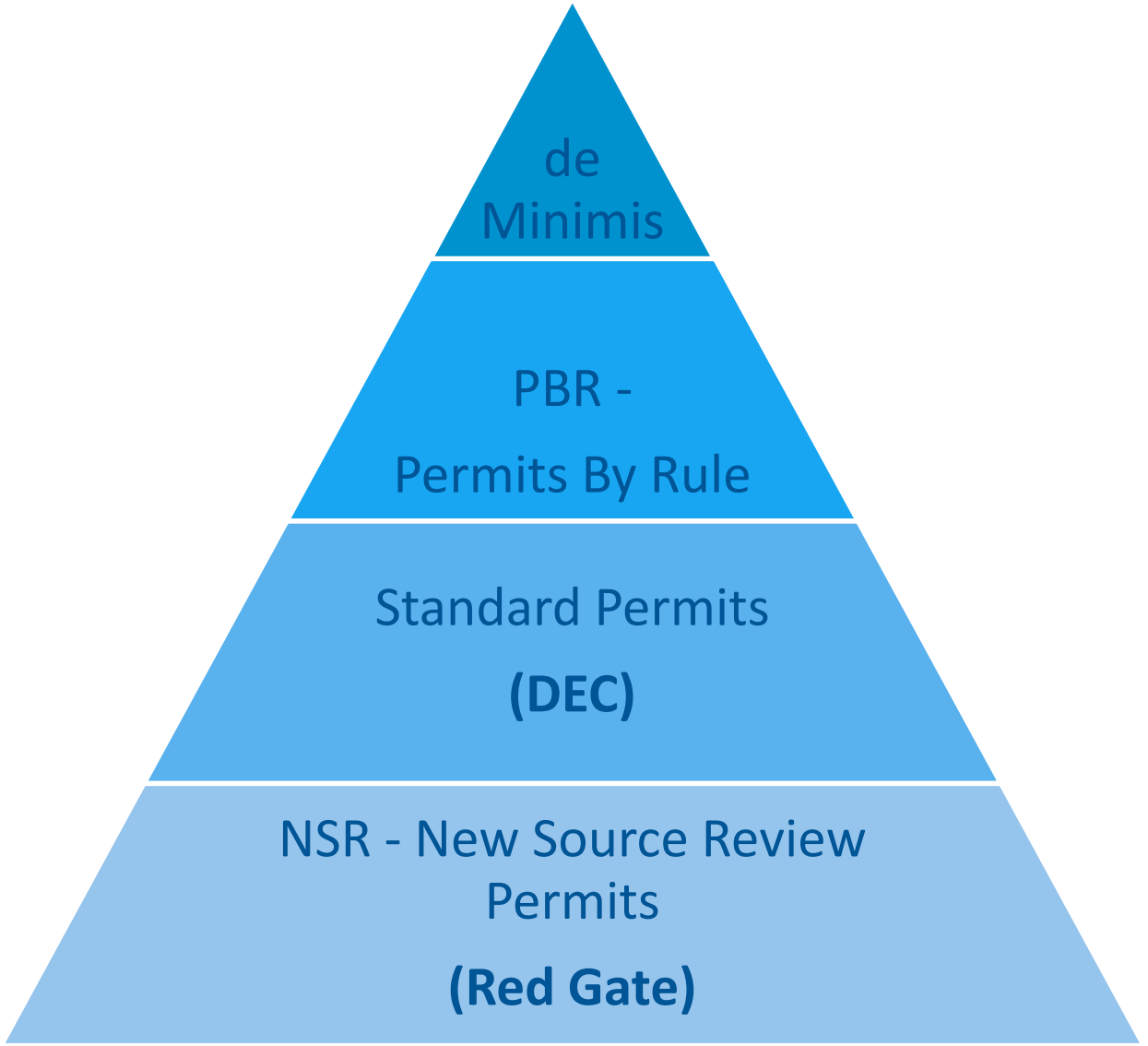
- Black & Veatch has no concerns with the DEC project meeting the emissions limits in its permit
- DEC has enhanced emissions control package
- Emissions testing performed by a third party agency using procedures approved by the EPA and TCEQ, with witness by TCEQ and Black & Veatch
- Industry Standard is for Emission Performance to be backed by contractual guarantee from engine manufacturer

Permitting Process

Mike Rinkol

Environmental Engineer; Permitting Specialist

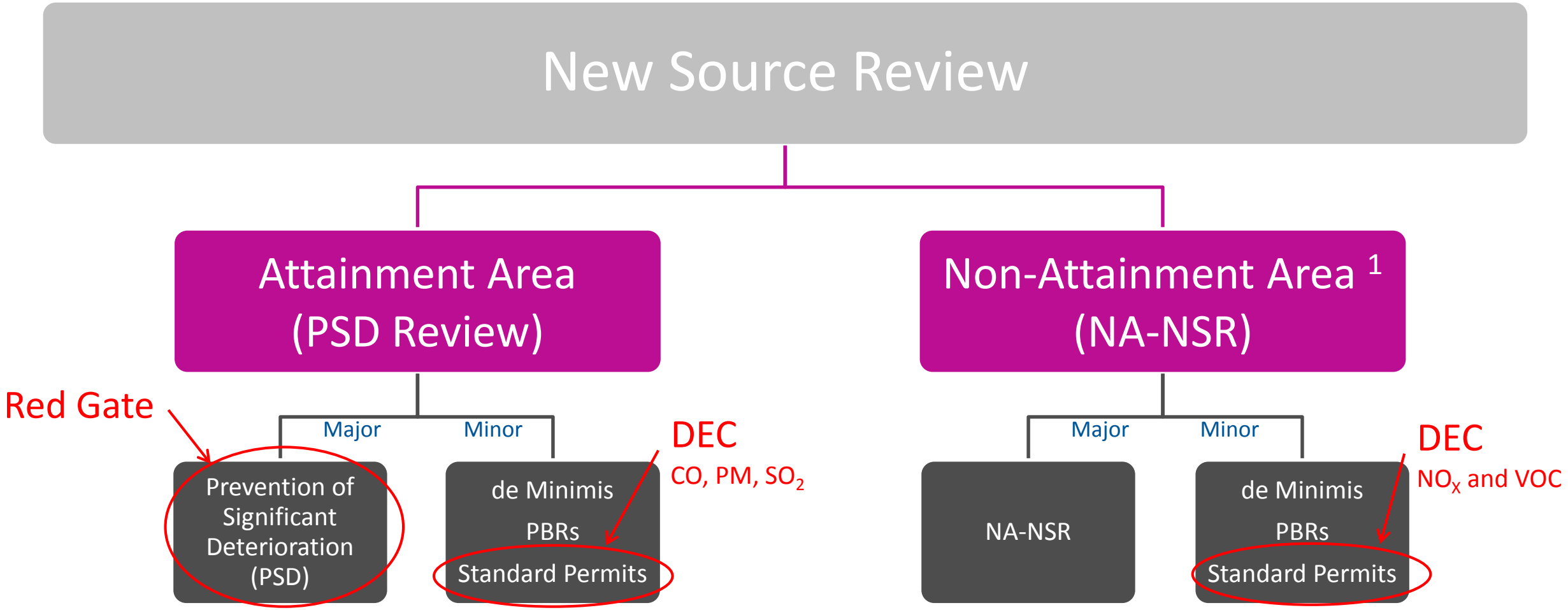
Permitting Hierarchy



Minor Source/Modification

Major Source/Modification

Air Permitting



[1] Non-Attainment is an area that has not achieved compliance with the National Ambient Air Quality Standards

DEC and Red Gate Facility and Emission Rates Comparison

Paul Lee

Air Quality Control Engineer

Facility Comparison

Description	DEC	Red Gate
Facility Type	Peaking (3,200 hours)	Baseload (8,760 hours)
Permit Type	Standard Permit	PSD
Control Equipment	Selective Catalytic Reduction - SCR (NO_X) Oxidation Catalyst (CO, VOC)	Selective Catalytic Reduction - SCR (NO_X) Oxidation Catalyst (CO, VOC)

Emission Rates for DEC and Red Gate

- DEC's NO_X, SO_2, VOC, and H_2SO_4 emission rates are noticeably lower
- DEC's CO emission rate is slightly lower

POLLUTANT	DEC (lb/mmBtu)	RED GATE (lb/mmBtu)	DEC TO RED GATE (% difference)
CO	0.032	**0.039**	18% lower
NO_X	0.0086	**0.030**	71% lower
PM	**0.021**	0.020	5% higher
PM_{10}	**0.021**	0.020	5% higher
$PM_{2.5}$	**0.021**	0.020	5% higher
SO_2	0.00059	**0.0028**	79% lower
VOC	0.013	**0.039**	67% lower
Lead	--	--	
H_2SO_4	0.000090	**0.00043**	79% lower
CO_2e	117.1	117.1	same

*__BOLD__ value represents higher emission rates.

Control Technologies

- Wärtsilä offers enhanced emissions packages for improved emission control
  - Higher performing SCR and oxidation catalysts
  - DEC utilizes the enhanced emission package
- Emission guarantees are “make-good”

DEC Emissions Validation

Paul Lee

Air Quality Control Engineer

How are DEC Emissions Validated?

- Validated with Physical Testing
  - Run Engines
  - Third Party Testing
  - Witnessed by TCEQ
- Test Results Submitted to TCEQ
  - Test results must be approved to receive Operating Permit
- Operations
  - Has a Continuous Emissions Monitoring System (CEMS) to validate during operation

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