Proposed Rule 1110.4
Emissions from Emergency Generators (PR 1110.4)

South Coast AQMD

Working Group Meeting #2 – June 24, 2026

Join Zoom Webinar Meeting:

https://aqmd.zoomgov.com/j/1606894523

Webinar ID: 160 689 4523

Teleconference Dial-In: +1 669 216 1590

Working Group Meeting Agenda

- Summary of Working Group Meeting (WGM) #1
- Background and Need for PR 1110.4
- Updated PR 1110.4 Applicability and Emission Inventory
- Best Available Retrofit Control Technology (BARCT)
- Next Steps

Revised

Summary of February 14, 2024 WGM

- Provided background on emergency generators and regulatory drivers under the 2022 Air Quality Management Plan (AQMP)
- Discussed increasing emergency generator use associated with Public Safety Power Shutoff (PSPS) events, wildfires, and grid reliability challenges
- Presented preliminary emergency generator inventory, emissions, and data limitations
- Initiated BARCT assessment and reviewed existing regulatory requirements
- Stakeholders requested that staff refine emissions estimates using actual operating hour data rather than assumed usage rates

[Proposed Rule 1110.4 Working Group Meeting #1 Presentation]

Engine Rating (kW)	Engine Rating (hp)	Tier	Year(s)	NOx (g/kW-hr)	NOx (g/bhp-hr)
37 to 74	50 to 99	1	1998	9.2	6.9
		2	2004	7.1*	5.3*
		3	**2008**	**4.5***	**3.3***
		4F	2013	0.40	0.29
75 to 129	100 to 174	1	1997	9.2	6.9
		2	2003	6.3*	4.7*
		3	**2007**	**3.8***	**2.8***
		4F	2012-14	0.40	0.29
130 to 559	175 to 749	1	1996	9.2	6.9
		2	2001–03	6.1-6.3	4.5–4.7
		3	**2006**	**3.8**	**2.8**
		4F	2014+	0.40	0.29
≥ 560	≥ 750	1	2000	9.2	6.9
		2	**2006**	**6.1**	**4.5**
		4F	2015+	0.67	0.50

* NOx estimated as 95% of the NMHC+NOx standard consistent with CARB

Background and Need for PR 1110.4

Rule Development Process

Staff is available during the entire rule development process and welcomes active stakeholder participation

2022 AQMP NOx Reduction Goals for Emergency Generators

- The 2022 AQMP identifies actions needed to meet federal ozone standards by 2037
- Control Measure L-CMB-04 targets emissions from emergency standby generators
  - Estimated to achieve ~2.04 tons per day (tpd) of NOx emission reductions
- Control measure L-CMB-04 has the fourth highest estimated NOx emission reductions of all stationary control measures
- Emergency generator emission reductions account for approximately 30% of total NOx reductions identified for Large Combustion Sources

South Coast AQMD

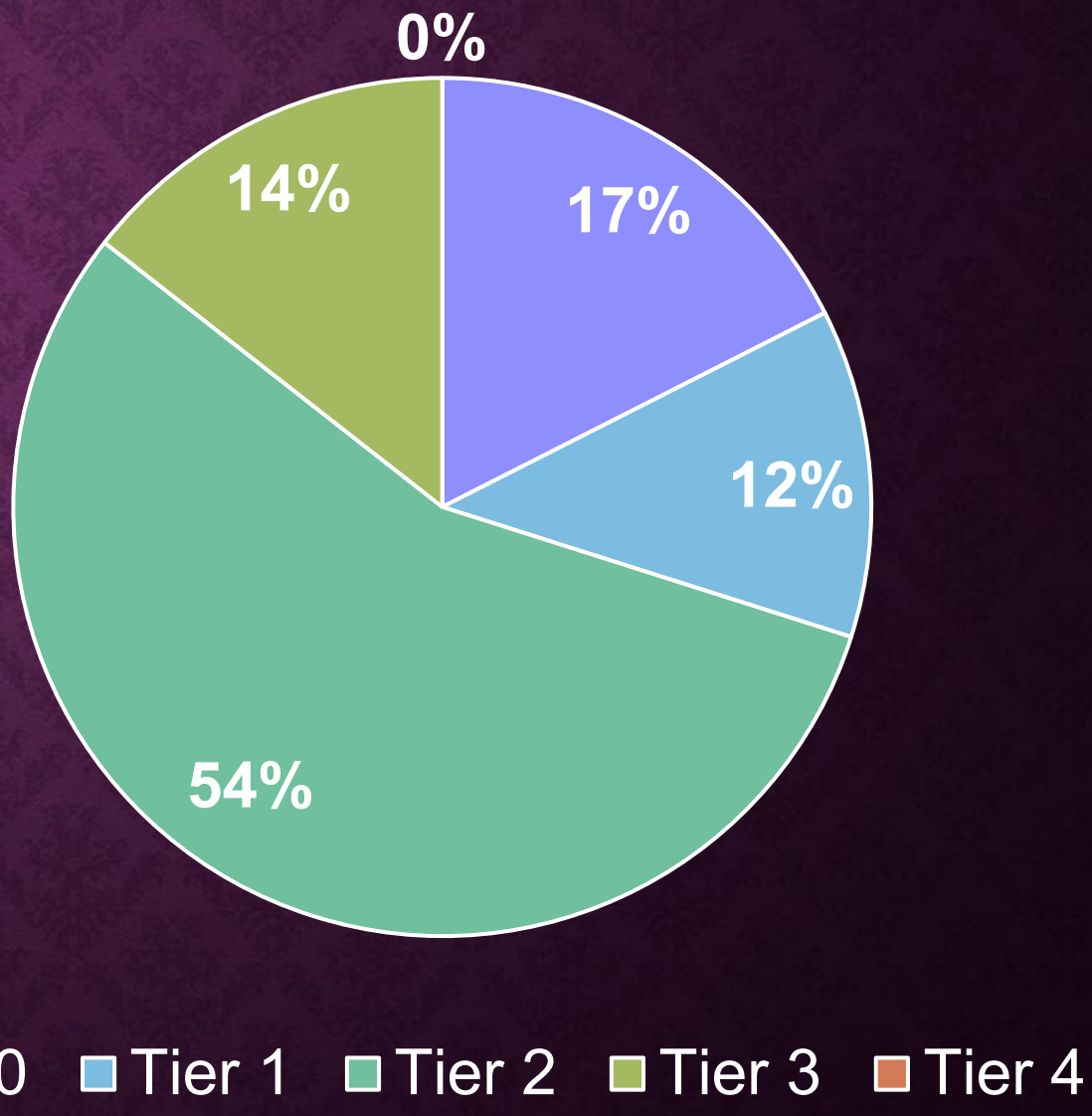
2022 AIR QUALITY MANAGEMENT PLAN

Emergency Generator Longevity

- Emergency generators are designed to be robust and reliable over long periods of time
- Replacement is typically driven by parts availability, not operating hours
- As a result, many generators use engines that pre-date modern federal emission standards (i.e. Tier 4)
  - Tier 4 emission standards for non-road diesel fueled engines were established in 2004
- Tier 0 and early tier engines, which have significantly higher emission rates, are still in operation
  - Tier 4 engines represent ~95% reduction in NOx emissions from a Tier 0 engine

Current Emergency Generator Inventory

- Inventory is dominated by Tier 1–3 engines, with Tier 2 representing the largest share (~54%)
- Older, higher-emitting Tier 0 and Tier 1 engines remain a significant portion of the inventory (~29%)
- Modern Tier 4 engines represent a negligible share (~0–1%), indicating limited unit turnover
- Overall, the inventory consists largely of legacy higher emitting emergency generators



https://thumbs.dreamstime.com/b/old-generators-emergency-diesel-engine-use-industrial-machinery-62974080.jpg

Need for Modernization of Emergency Generators

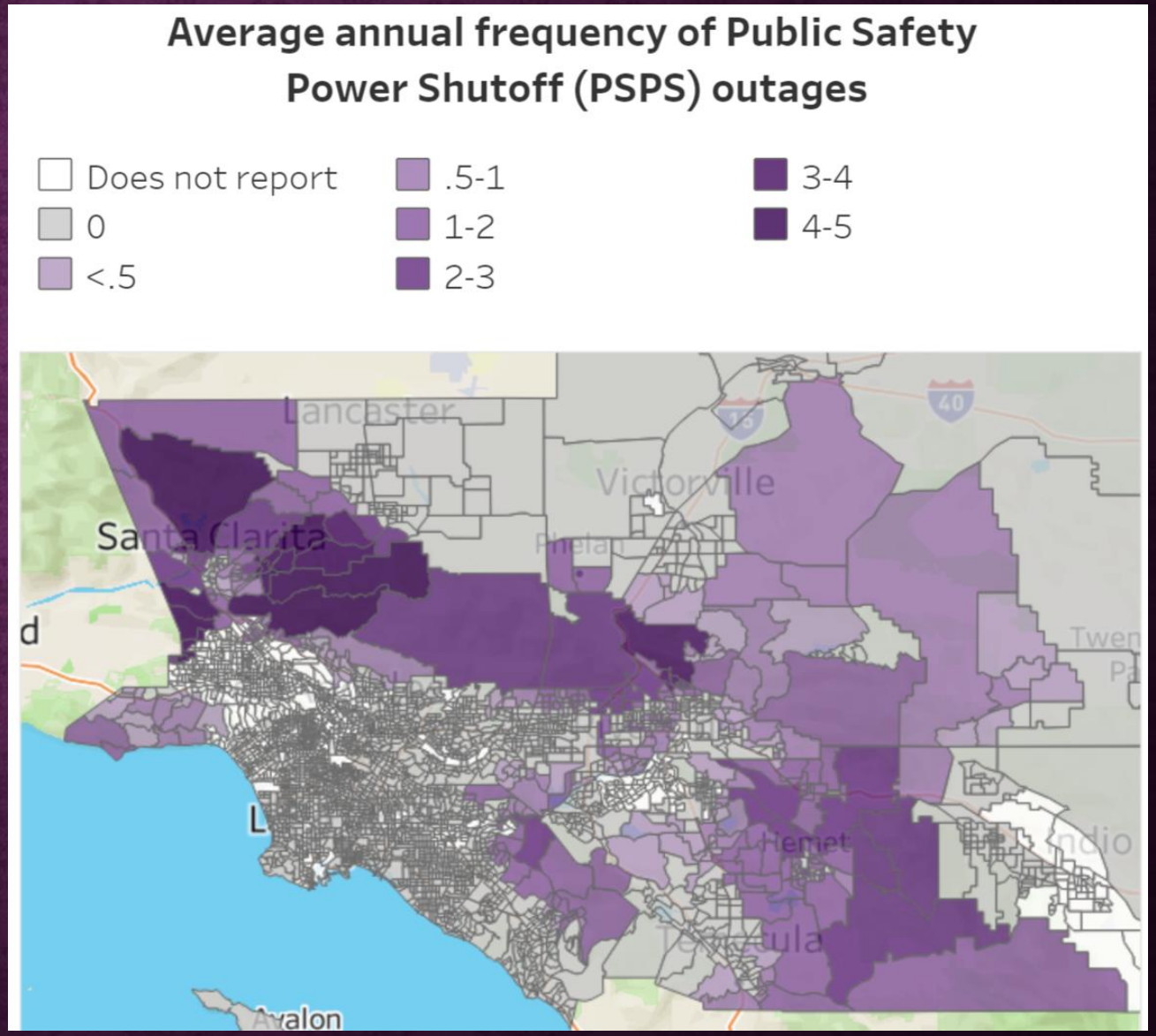
Emergency generators serve a critical power reliability and life-safety function

PR 1110.4 is not intended to limit emergency generator use, but to transition older, higher-emitting engines to lower emitting technologies

Even limited-use equipment is a significant emissions source when deployed at scale and composed of older technologies

Increasing Reliance on Emergency Generators

- Emergency generators were historically used during limited testing and infrequent outage events
- Increasing PSPS events and grid disruptions are changing usage patterns
- A single PSPS event can exceed maintenance and testing hours
  - Many events last 24-48 hours, with some spanning multiple days
- In some cases, total annual operating hours (including maintenance, testing, and emergency operation) exceed runtime assumptions, resulting in higher real-world emissions



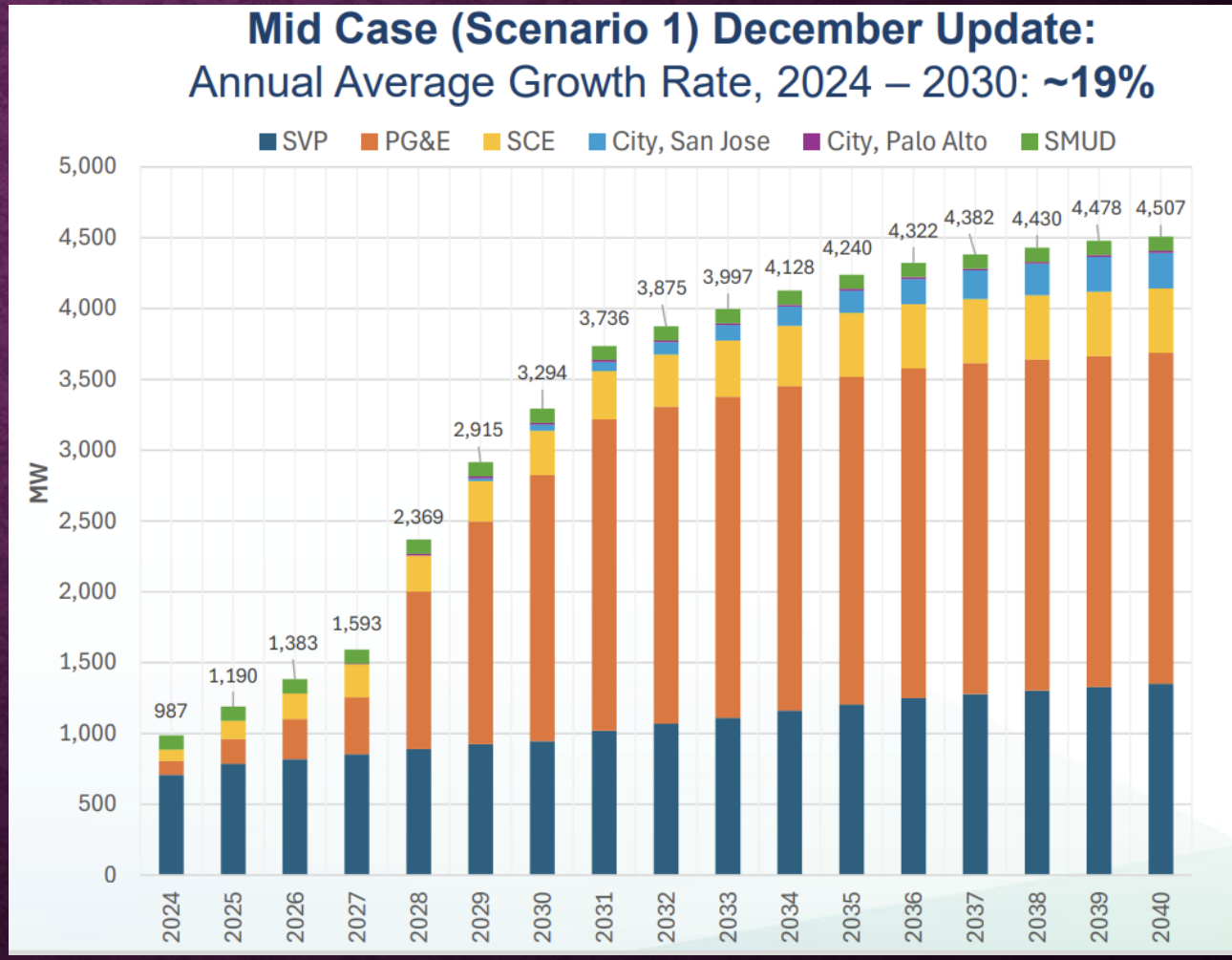
California Public Safety Power Shutoff Interactive Map | PSE | Physicians, Scientists, and generatorers for Healthy Energy (psehealthyenergy.org)

Growth of Data Centers and Emergency Power Demand

- Rapidly growing industry with expansion of data centers driven by:
  - Cloud computing
  - Artificial intelligence and data processing
- Data centers are becoming a significant and growing source of electricity demand
  - U.S. data center electricity demand is projected to grow significantly, potentially reaching ~4–9% of total electricity consumption by 2030*
- Data centers require reliable, uninterrupted power, which typically utilize robust back-up power sources
  - Installations often exceed several megawatts of backup capacity

*Powering Intelligence: Analyzing Artificial Intelligence and Data Center Energy Consumption

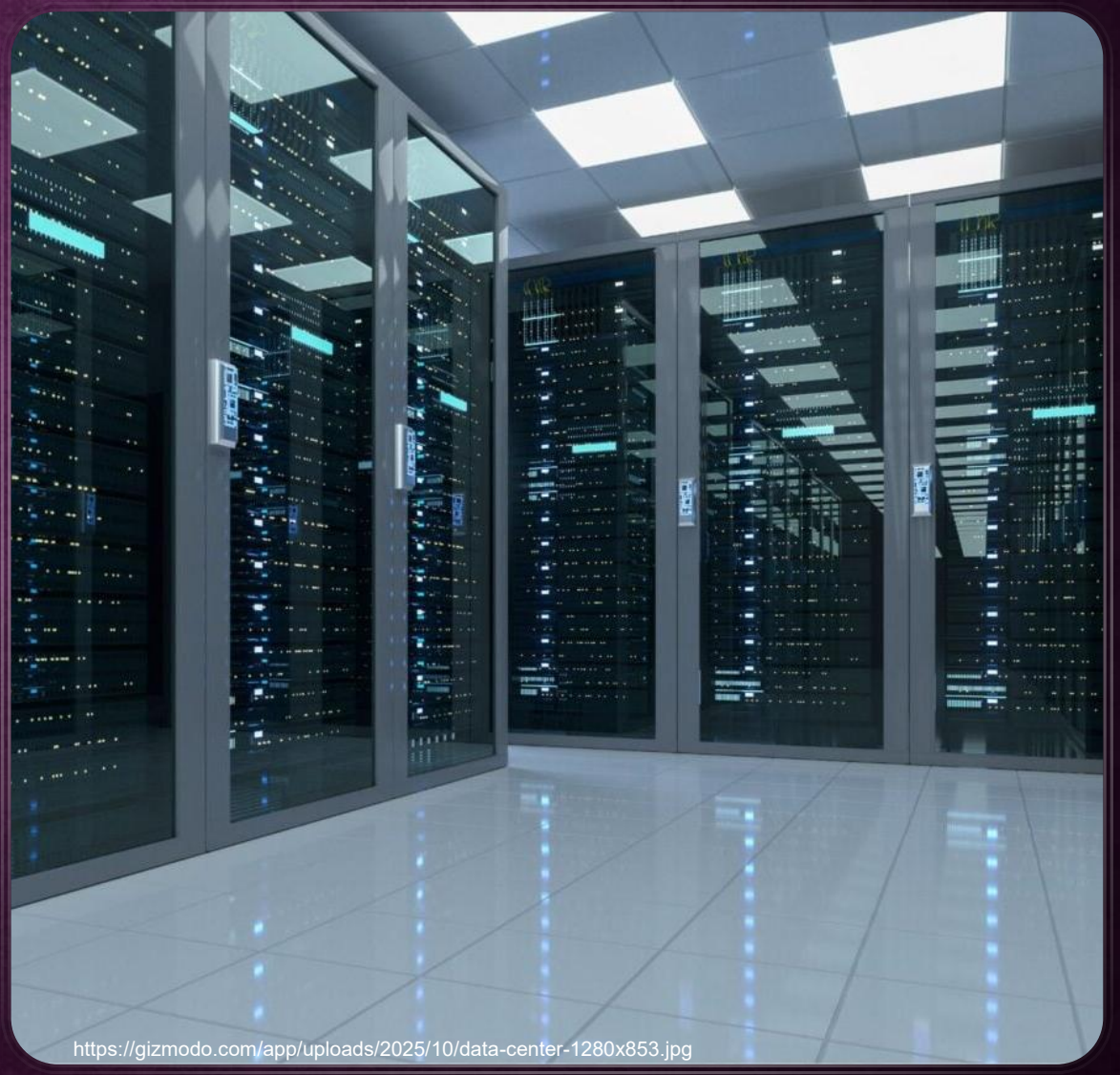
California Energy Commission Mid Case Data Center Energy Peak Demand Forecast Results



Source: CEC Staff (with data inputs from PG&E, Palo Alto, SVP, San Jose, SCE)

Data Center Impact on PR 1110.4

- Data centers typically have 5 to 50+ MW of backup power capacity per facility
  - Even smaller data centers may include ~5 to 10 MW of backup generators, comparable to a small peaking power plant
- Backup systems often consist of dozens of diesel generators operating in parallel
- Continued growth in this sector is increasing overall emissions from emergency power generation


https://gizmodo.com/app/uploads/2025/10/data-center-1280x853.jpg

Key Regulatory Gap and Path Forward

Source-specific NOx standards have not been established for existing emergency generators

2022 AQMP estimated 2.04 tpd of potential NOx emission reductions from emergency generators

Large portion of inventory operates without modern emission controls

Emergency generators at high-capacity facilities (multi-MW sites) can account for a disproportionate share of total NOx emissions

PR 1110.4 will establish BARCT for emergency power generation

Updated PR 1110.4 Applicability and Emission Inventory

Permitted Emergency Generator Universe

Category	Number of Equipment*
All emergency generators	14,115
Diesel-fueled generators	12,466
Non-Diesel generators	1,649

* Data obtained from South Coast AQMD database through January 2026

- Approximately 90% of units are diesel-fueled
- Despite limited operation, emergency generators contributed to an estimated 4.54 tpd of NOx emissions in the 2022 AQMP inventory
- Preliminary assessment indicates emissions are concentrated at facilities with high installed emergency power capacity (e.g. ≥2.5 MW)

Emergency Generator Emission Inventory

Staff developed an emission inventory using a statistically representative sample (95% confidence level, ±5% margin of error)

- The sample included 370 facilities and 555 generators, ranging from 50 to 4300 hp (40 to 3300 kW)

Staff assumed the following when determining the sample group emissions:

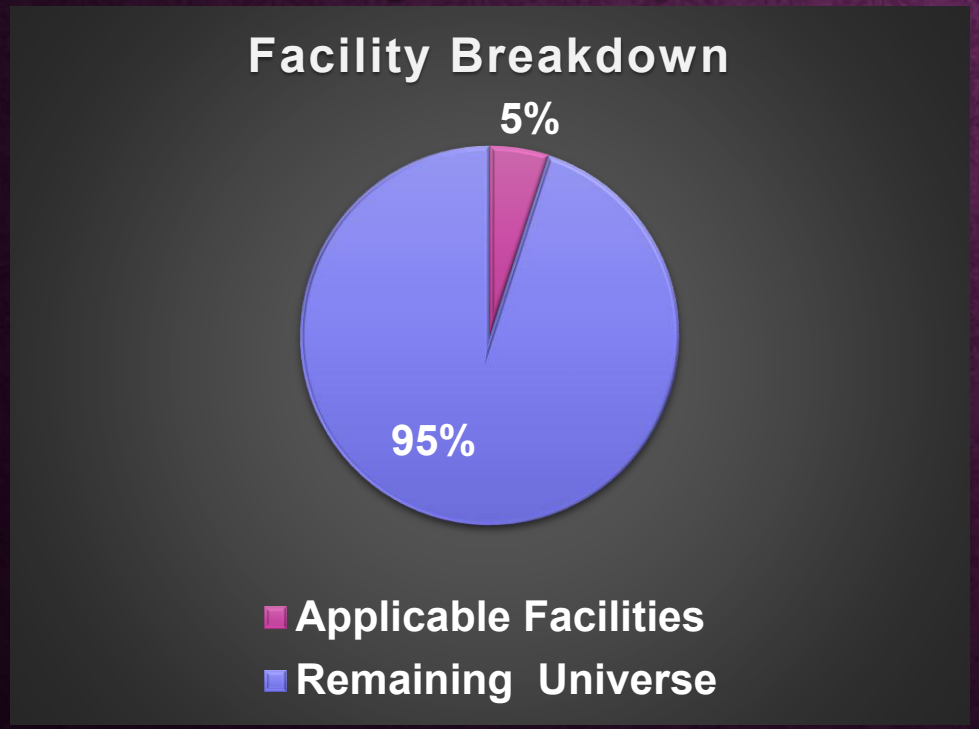
- 17.28 average annual operating hours per generator based on a review of inspection reports from a random sample of 376 generators (95% confidence level, ±5% margin of error)
- Emission rate at the point of permitting (lbs/hr)

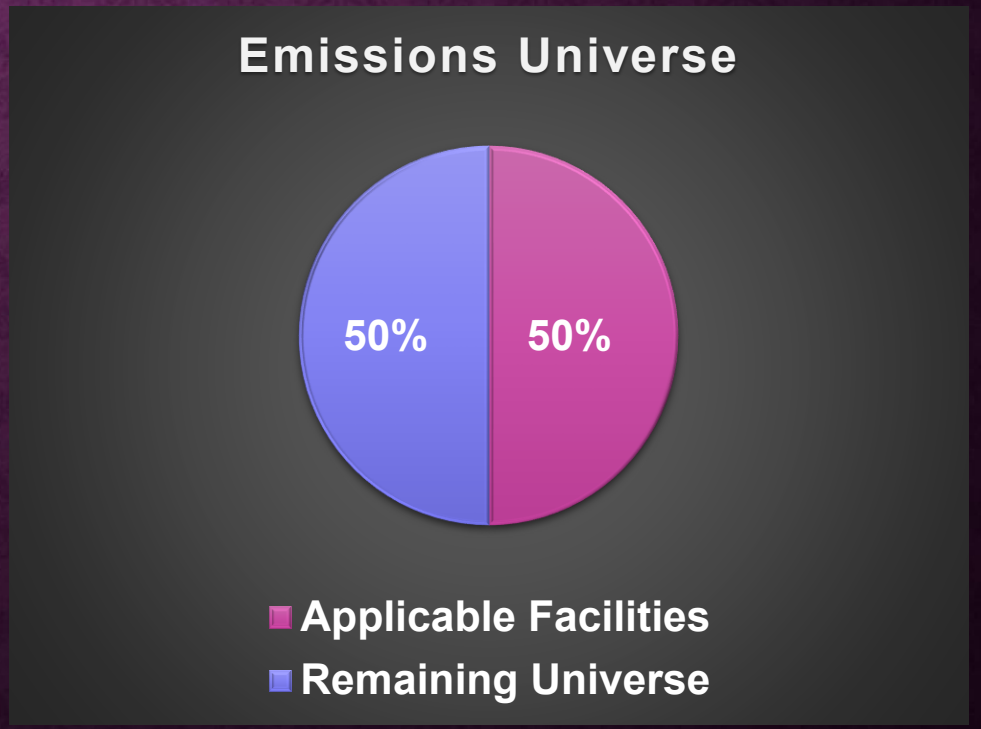
Estimated NOx emissions for the sample group is ~0.09 tpd

Scaling the estimated NOx emissions to all facilities with permitted emergency generators results in ~2.3 tpd of NOx emissions across all 9,440 facilities

Focus on Multi-MW Facilities for Maximum Emission Reductions

- Focusing on high-capacity sites (cumulative emergency generator capacity ≥2.5 MW) results in proportionally high NOx emission reductions relative to the number of affected facilities
  - Represent approximately 5% of total facilities
  - Accounts for approximately ~50% of NOx emissions from emergency generators or about 1.2 tpd of NOx
- The 2.5 MW threshold was identified as an initial focus area based on emissions concentration at high-capacity facilities





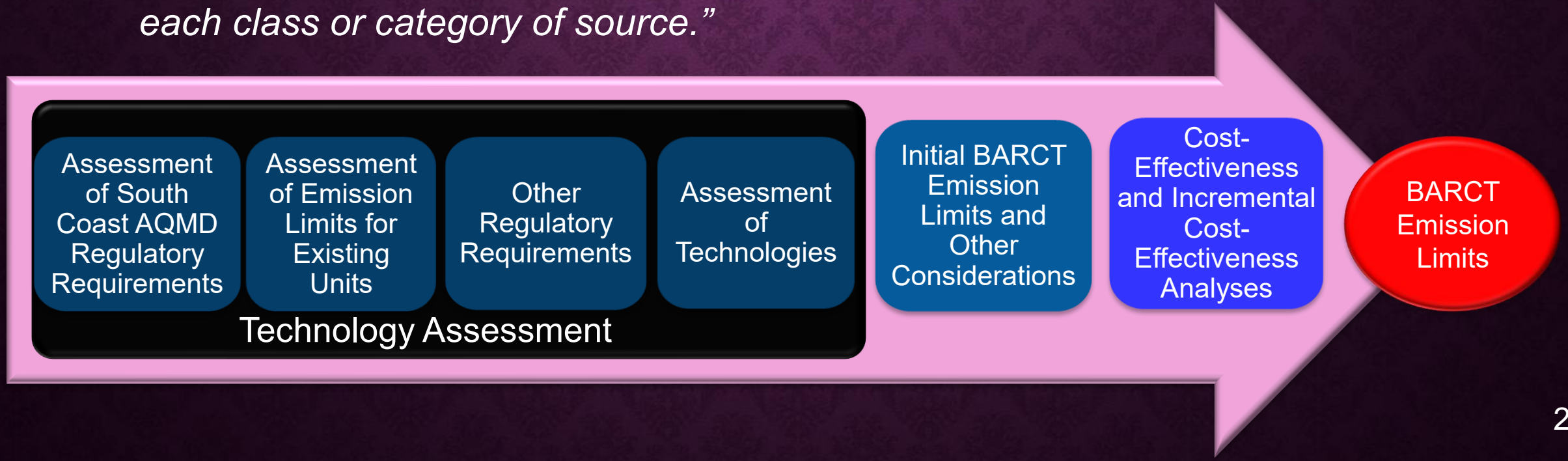
Updated Rule Development Focus

- Staff is proposing to focus on facilities with high cumulative emergency generator installed capacity
- Proposed applicability threshold is ≥ 2.5 MW total emergency power generation capacity per facility
  - Basis of applicability threshold is the average load of a small power plant in the South Coast Air Basin
- This approach targets the largest emergency power generation emission sources while minimizing impacts on facilities with limited emergency power generation capacity

Best Available Retrofit Control Technology (BARCT)

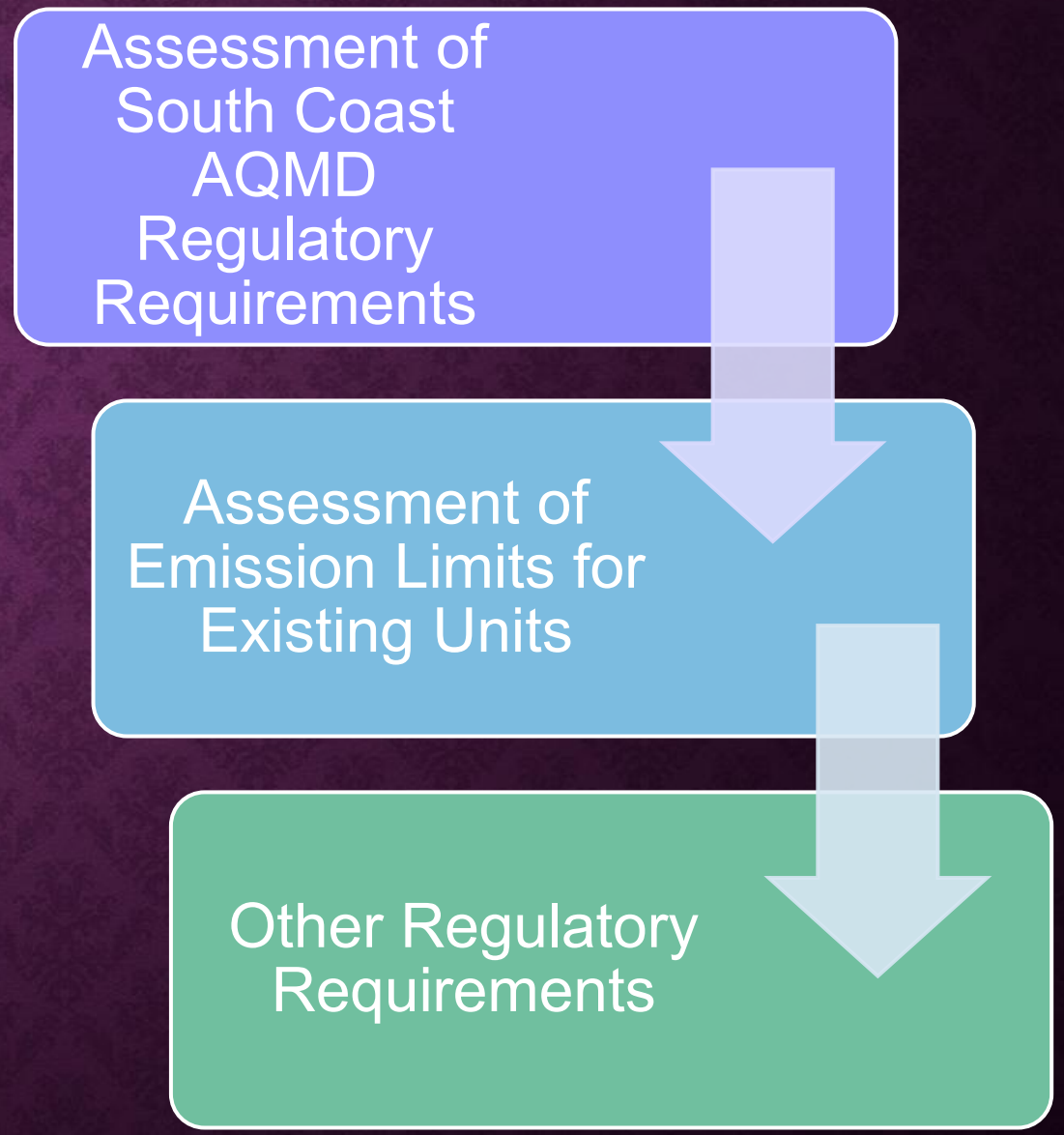
BARCT Assessment

- Staff is conducting a Best Available Retrofit Control Technology (BARCT) assessment to determine if alternative technologies and/or fuels can reduce emissions from emergency generators
- BARCT is defined in the California Health and Safety Code Section 40406
  - *"…an emission limitation that is based on the maximum degree of reduction achievable, taking into account environmental, energy, and economic impacts by each class or category of source."*



BARCT Assessment Status

- Staff previously presented the first three portions of the technology assessment in WGM #1
- The BARCT discussion in this WGM focuses on:
  - Updated regulatory requirements
  - Operational constraints
  - Assessment of pollution control technologies
- WGM #1 is available on the PR 1110.4 proposed rules webpage*



*PR 1110.4 Proposed Rules Page

Bay Area AQMD (BAAQMD) Requirements for New Emergency Generators

Other Regulatory Requirements

- BAAQMD updated their BACT Guideline Stationary Emergency CI generators > 50bhp and < 1000bhp in December 2024
- BAAQMD BACT now generally requires Tier 4 emission standards for new emergency compression ignition (CI) generators across generator sizes
- Recent BACT determinations reflect advancements in available control technologies; however, feasibility may vary by engine size and operational constraints

Summary of BAAQMD BACT Emission Limits for Emergency generators (g/bhp-hr)

Engine Rating	Tier	NOx	CO	PM
CI 50 ≤ hp < 75 CI 75 ≤ hp < 100	4	3.5 0.29	3.7	0.022 0.015
CI 100 ≤ hp < 175 CI 175 ≤ hp < 750	4	0.29	2.6	0.015
CI 750 ≤ hp < 1000	4	0.49	2.6	0.022
CI hp ≥ 1000	4	0.49	2.6	0.02
SI ≥ 50	-	1.0	2.75	-

Operational Constraints: National Fire Protection Association (NFPA) Requirements

Other Regulatory Requirements

- NFPA 110 establishes performance requirements for Emergency Power Supply Systems (EPSS)
- Level 1 EPSS (Life Safety Systems) applies to facilities where power loss could result in loss of life or serious injury (e.g., hospitals)
- Key operational requirements include:
  - Onsite fuel storage (often sized for extended operation, e.g., up to ~96 hours for hospitals)
  - Rapid startup capability (typically within 10 seconds)
  - Continuous and reliable operation during emergencies
- These requirements limit the feasibility of some emergency power generation technologies

Implications for Rule Development

- Emission reduction strategies must consider operational reliability requirements for emergency applications
- Certain alternative technologies may face limitations under NFPA 110 requirements
- Regulatory approaches must account for life-safety requirements, NFPA 110 standards, and critical facility reliability needs

Assessment of Technologies for Emergency Power

Staff is evaluating available technologies that could reduce emissions from emergency generators

Technologies assessed include:

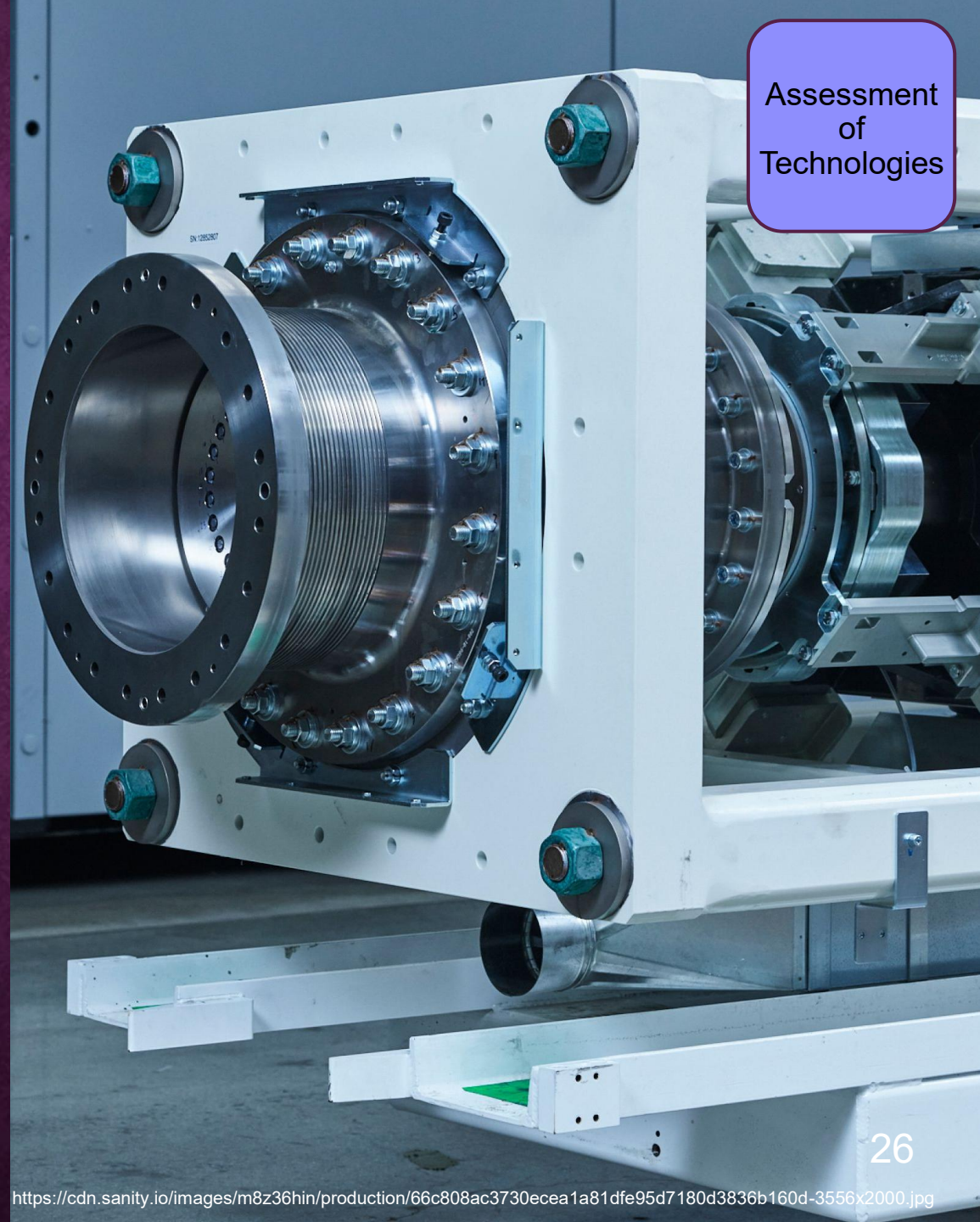
- Linear generators
- Battery energy storage systems
- Solar panel systems
- Fuel cells
- Tier 3 diesel engines
- Tier 4 diesel engines
- Hybrid generators
- Natural gas generators with controls
- Renewable diesel

Evaluation considers:

- Emission rates (primarily NOx and PM)
- Operational feasibility and reliability
- Infrastructure and deployment constraints

Linear Generators

- Emerging technology using linear motion to generate electricity; claimed to be able to operate on nearly any fuel source (natural gas, hydrogen blends, diesel, etc.)
- Modular design and relatively fast startup suitable for non-critical backup applications
  - Around a three-minute cold start time
- Manufacturer estimates equipment life of approximately 25–30 years; long-term field performance evaluation is ongoing
- Lower NOx and PM emissions than conventional diesel generators
  - Around 80% reduction when compared to 560 kW Tier 4 NOx emission limits
- Emission Performance:
  - NOx: ~0.09 g/kW-hr
  - PM: 0 g/kW-hr



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Battery Energy Storage Systems (BESS)

- Stores electricity for use during outages; typically deployed with grid or on-site generation
- Instantaneous response but limited duration (typically hours); requires recharging and may need pairing with power generation technologies for extended outages
- BESS are associated with a shorter equipment useful life (approximately ten years)
- BESS produce no on-site NOx or PM emissions during operation
  - Total emissions depend on any paired generation technologies

Assessment of Technologies

https://electroinvent.com/wp-content/uploads/2025/02/4.-FlexConvert%E2%80%93BESS%E2%80%93Single.jpg

Solar Panel Systems

- Generates electricity from sunlight
- Intermittent and not dispatchable without storage; typically requires pairing with battery storage and sufficient installation space
- Solar panels have a useful life of ~30 years
- Better suited as a compliment to more robust back-up power options
- Zero NOx or PM emissions

https://www.solaralliance.com/wp-content/uploads/2021/06/iStock-1267464847-min-scaled.jpg

Fuel Cells

- Generates electricity through electrochemical reactions using hydrogen, natural gas, or other compatible fuels depending on system design
- Startup characteristics vary by system and can range from three to five minutes
  - Start up times can be offset with a BESS
- Typically used for continuous operation, which may limit suitability for conventional standby applications without system integration
- Fuel cell systems are designed for ~10–20 years
- Very low NOx and PM emissions; high efficiency and capable of continuous operation

Fuel Type	NOx*	PM*
Natural Gas	<0.045 g/kW-hr	Below detectable limits
Hydrogen	0	0

*Emission performance varies based on fuel type and quality

https://nelsonpope.com/wp-content/uploads/2020/02/Bloom-Energy_MEP_15056_005-800x600.jpg

Tier 3 Diesel Engine

- Conventional diesel generators that rely on in-engine controls rather than add-on aftertreatment
- Provide rapid startup (<10 seconds) and have a proven track record in emergency backup applications
- Proven reliability with equipment life often exceeding 30 years with proper maintenance and parts availability
- Lower NOx emissions than legacy Tier 0–2 engines (~40% reduction), but significantly higher emissions than Tier 4 systems
    - Tier 4 engines achieve ~90% reduction in NOx emissions from Tier 3 engines

Capacity (kW)	NOx Emission Rate (g/kW-hr)	PM Emission Rate (g/kW-hr)
37 to 74	4.5	0.40
75 to 129	3.8	0.30
130 to 559	3.8	0.20

https://www.depco.com/wp-content/uploads/2020/12/thumbnail_Image-11.jpg

Tier 4 Diesel Engine

- Diesel generators with aftertreatment such as diesel particulate filters (DPF) and selective catalytic reduction (SCR)
  - Some generators are designed to control PM emissions at the point of combustion removing the need for a DPF
- Capable of rapid start up (< ten seconds) with an equipment life of 30+ years dependent on part availability
- Significant NOx (~90%) and PM (~90-95%) reductions compared to Tier 3 diesel engines

Capacity (kW)	Tier 4 Diesel Engine NOx Emission Rate (g/kW-hr)	PM Emission Limit (g/kW-hr)
37 to 559*	0.40	0.02
>560	0.67	0.03

*PM for engines from 37 to 74 kW is 0.03 g/kW-hr

https://multiphase-corp.com/wp-content/uploads/2022/10/DIESEL-GENERATOR-ENGINE-EMISSIONS-Tier-RATINGS-EXPLAINED-1024x683.jpg

Hybrid Generators (Generator + Battery Integration)

- Integrate a BESS with a conventional generator to optimize operation
  - Requires additional system integration, but can be retrofitted onto many existing generators
- Reduces emissions through operational efficiency (reduced runtime) rather than per-unit emission rate reductions
  - Improves efficiency by operating at optimal load
  - Excess power is stored in onboard batteries and deployed as needed
  - Depending on load profile, fuel consumption can be reduced by up to ~75%
- Maintains rapid response capability (< ten seconds)
- Hybrid systems use high cycle life batteries rated for ~40 years
  - Battery chemistry selection (e.g., lithium-ion vs. lithium iron phosphate) influences safety, cost, cycle life, and site feasibility

Natural Gas Generators (with Controls)

- Spark-ignited generators using natural gas with oxidation catalysts and/or SCR
- Natural gas infrastructure historically experiences limited to no interruptions
- Dependance on natural gas infrastructure may present a challenge for critical life facilities
  - On-site fuel storage is limited by space, safety requirements, and applicable codes such as NFPA 110
- Capable of rapid start up (< ten seconds) with an equipment life of 30+ years, similar to diesel generators
- Emission Performance:
  - NOx: 0.03 g/kW-hr (with controls)
  - PM: 0.02 g/kW-hr

https://enchantedrock.com/wp-content/uploads/2025/09/ERT500-Product-Rendering-Enchanted-Rock-2.jpg

Renewable Diesel

- Drop-in replacement fuel produced from renewable feedstocks such as waste oils, animal fats, and vegetable oils but with cleaner combustion characteristics than petroleum diesel
  - Chemically similar to petroleum diesel and meets ASTM D975 specifications
- Maintains operational characteristics of the existing diesel backup generator
  - Fast startup (<10 seconds)
  - Preserves existing generator equipment life
- Demonstrated lower emissions than petroleum diesel, including ~30% lower PM and ~10% lower NOx emissions in CARB testing, with additional reductions in other pollutants

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Technology Considerations for Emergency Power

Technologies vary in emission performance, reliability, and operational capability

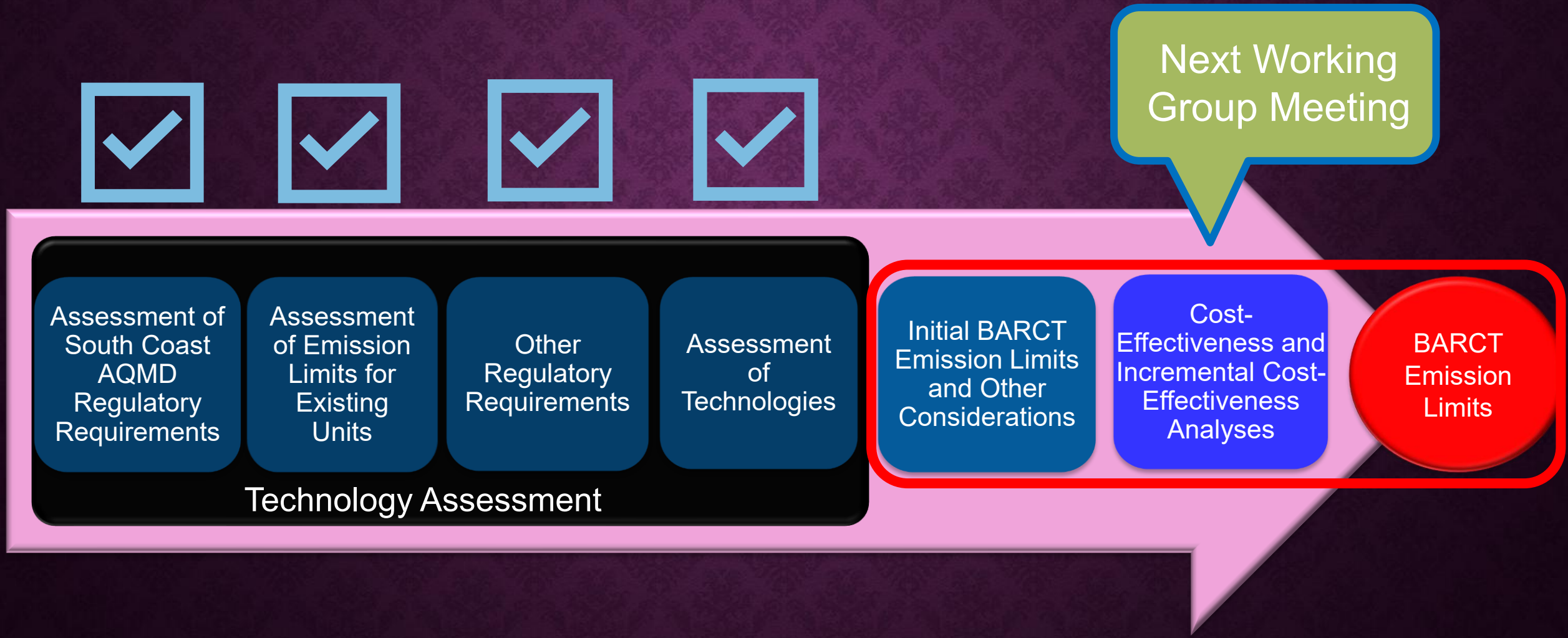
Some zero- and near-zero emission technologies may require additional system integration to meet extended duration and operational requirements

No single technology is universally applicable; suitability depends on:

- Power duration and response time requirements
- Available infrastructure

The initial BARCT emission limits will consider facility operational needs and regulatory constraints across multiple engine classes and categories

BARCT Assessment Summary



Incentive Funding Opportunities for Emergency Power Systems

- Incentive funding will be available for emergency generators through the Climate Heat Impact for Response Program (CHIRP)*
- Staff is working closely with the Technology Advancement Office to develop eligibility criteria and funding priorities
- Program details are under development and early stakeholder engagement is critical to ensure funding is aligned with real-world operational needs and maximizes emission reductions
- Incentive opportunities under the Assembly Bill 617 Community Air Protection Program may also become available**
- Staff will provide updates at future Working Group Meetings

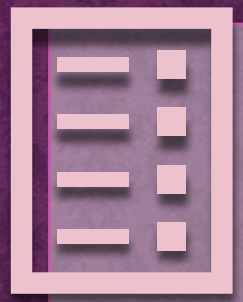
*Climate Heat Impact Response Program

**Community Air Protection Program

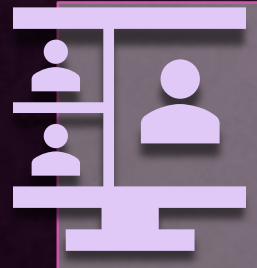
Next Steps

Next Steps

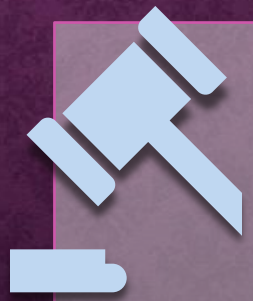
Continue BARCT assessment



Develop initial rule concepts



Tentative Public Workshop August/September 2026



Tentative Public Hearing 4th Quarter 2026

Further Working Group Meetings

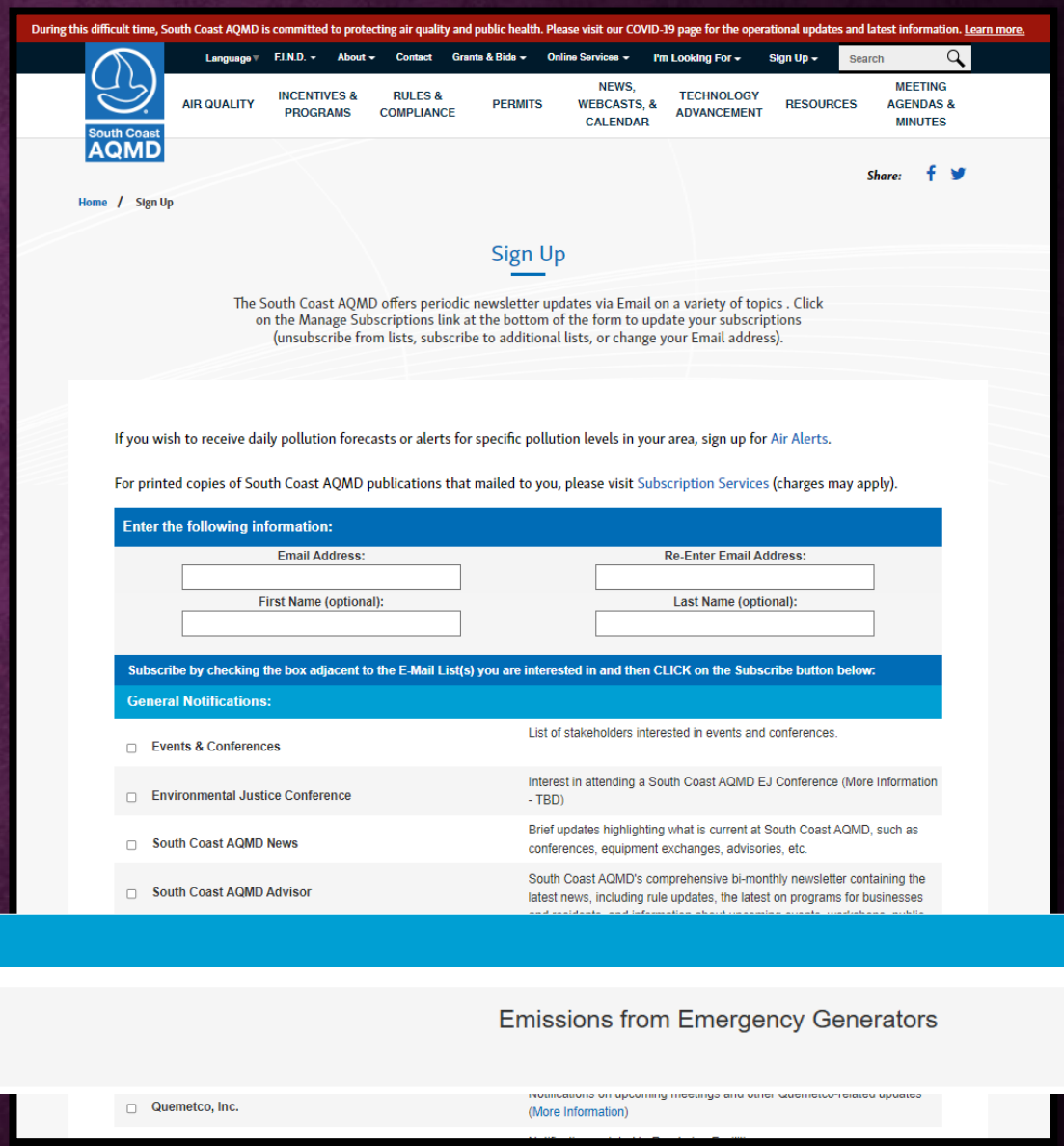
- Progress will be outlined and shared in future Working Group Meetings
- Seek collaboration to better understand industry best management practices as well as community concerns
- Address stakeholder comments
- Encourage active participation from all affected stakeholders

[PR 1110.4 Proposed Rules Page]

https://aventislearning.com/wp-content/uploads/2020/03/Collaboration-1.jpeg

Receiving Rulemaking Updates

- To receive email updates, sign up at South Coast AQMD sign up page *http://www.aqmd.gov/sign-up*
  - Enter email address and name
  - Subscribe by scrolling down to “Rule Updates” and check the box for Rule 1110.4 and click on the subscribe button at bottom of page
  - An email will be sent to confirm



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