



### **Locomotives and Rail**

- Equipment Replacement
- Operational Improvements
- Clean Fuels
- Emission Control Technologies
- Idle-Reduction Technologies

#### Strategies

Here are some effective strategies that can be applied to address emissions from Locomotives and Rail:

#### **Equipment Replacement**

Strategy – Replace older locomotives with locomotives that meet cleaner engine standards. New and cleaner locomotives could include electric or hybrid locomotives. For example; the San Pedro Bay Ports Clean Air Action Plan requires switch and Class I locomotives to meet EPA Tier II engine standards and when Tier III locomotives when they become more available. The European Union currently has standards for cleaner locomotives, Euro III and IV.

Technical Considerations – Retire older locomotives.

Options for Implementation – Implementation may include setting an operational agreement with the locomotive companies or creating a memorandum of understanding with the port, regulatory agencies and other stakeholders.

Pros and Cons – Replacing old locomotives with newer locomotives has a significant emissions benefit. Locomotive replacement is costly and international availability may be a concern for some ports.

#### **Operational Improvements**

Ports should evaluate the feasibility of increased use of on-dock and near dock rail, address rail bottlenecks in and around ports, and use of RFID and OCR at rail yards. Increasing the efficiency how trains are stacked and queued, building trains to reduce drag and/or building longer trains for overall fuel efficiency will also reduce air emissions.

Strategy – Repower older locomotives with cleaner engines.

Technical Considerations – Assess technical feasibility.



## ***IAPH Tool Box for Port Clean Air Programs***

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Options for Implementation – Implementation may include setting an operational agreement with locomotive companies or creating a memorandum of understanding with the port, regulatory agencies, and other stakeholders.

Pros and Cons – Engine repowers demonstrate great emission reduction benefits. However, locomotive engine replacement is a costly procedure notwithstanding the cost for the cleaner engine itself. Purchasing a new cleaner locomotive may prove to be a better option. International availability may be a concern for some ports.

### **Clean Fuels**

Strategy – Implement the use of cleaner fuels with low sulfur content. Cleaner fuels include; low to ultra low sulfur diesel fuel, emulsified diesel fuels, oxygenated fuel (O2 diesel fuel), LNG and CNG.

Technical Considerations – Work with ports and fuel suppliers on the availability and supply of clean fuels. Depending on the type of clean fuel used, cleaning of the fuel tank may be required in order to avoid fuel contamination. For LNG or CNG locomotives, a fueling infrastructure is required for some ports that may not be near LNG or CNG fueling stations. Railroads interested in using LNG or CNG need to be converted to handle that fuel type.

Options for Implementation – Implementation strategies may include the use of incentives, lease requirements, tariff changes, or a memorandum of understanding.

Pros and Cons – Positive emission reduction benefits for NO<sub>x</sub>, PM and GHGs. Challenges may arise with fuel availability.

### **Emission Control Technologies**

Strategy – Consider retrofitting locomotives with proven emission control technologies. Some of these technologies include diesel oxidation catalysts (DOCs), diesel particulate filters (DPFs) with PM emission reduction benefits, and selective catalytic reduction (SCR) that reduce NO<sub>x</sub>. The use of ultra low sulfur diesel fuel (ULSD) is mandatory for locomotives retrofitted with DPFs.

Technical Considerations – Technical and operational feasibility testing is required. Emission control technologies which have been certified or verified by regulatory agencies are most likely to deliver the claimed benefits,

Options for Implementation – Implementation strategies may include the use of incentives, lease requirements, tariff changes, or a memorandum of understanding.

Pros and Cons – There can be positive emission benefits from using emission control technologies. However, retrofitting locomotives with the appropriate ECT can be difficult. Due to various operational constraints, some ECTs may not be appropriate depending on the locomotive. A thorough technical assessment and feasibility study is required to carry out a successful retrofit. It is recommended to retrofit locomotives that have cleaner operating engines.



### **Idle-Reduction Technologies**

Strategy – Reduce idling emissions by putting in place idle-reduction technologies. Technologies include: automatic engine stop-start controls (AESS); auxiliary power unit (APU); diesel-driven heating systems (DDHS); shore power plug-in unit and a hybrid switching locomotive.

Technical Considerations – Test operational feasibility.

Options for Implementation – Implementation strategies may include the use of incentives, lease requirements, tariff changes, or a memorandum of understanding.

Pros and Cons - Eliminating idling time by using an idle-reduction technology greatly reduces emissions that would be generated from regular idling. International availability of idle-reduction technology may present a challenge for some ports. Applying idle-reduction technologies to locomotives can yield significant fuel savings, which results in a significant cost savings.