

Think Green.® Think Waste Management.



Landfill Methane Outreach Program 13th Annual Conference and Project Expo January 12, 2010 Baltimore, MD

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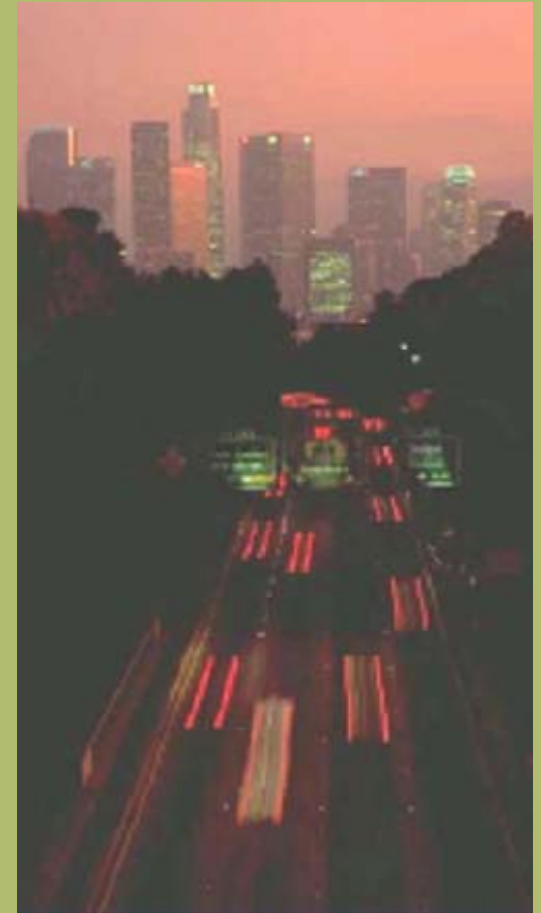
California Air Resources Board

Low Carbon Fuel Standard



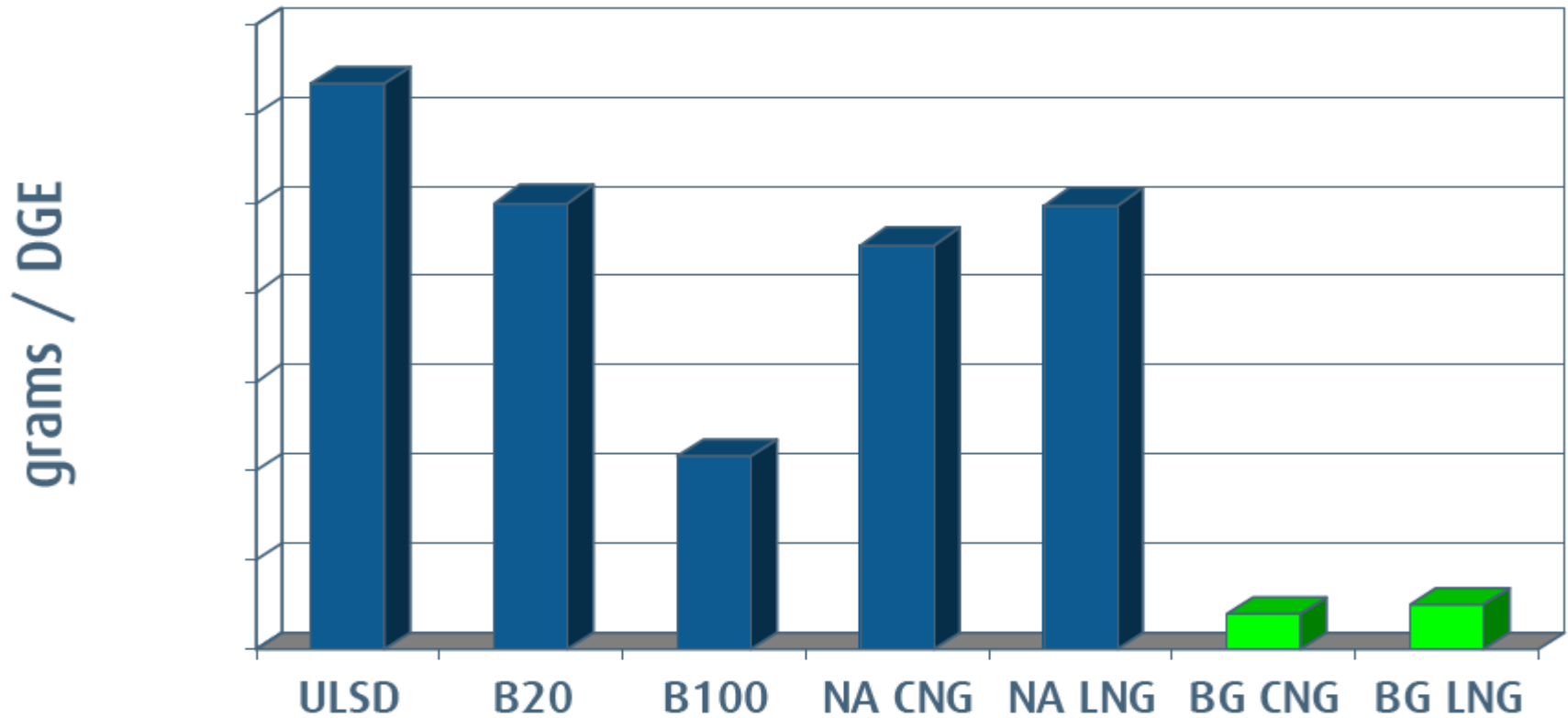
California Low Carbon Fuel Standard

- 10 % Reduction in CA fuel carbon intensity by 2020
 - 2010 is baseline
 - All fuel producers
 - Reduction gradual and weighted to later years
- 16 MMTCO₂e reductions expected by 2020
 - 10 % of AB 32 target
- Increase use of biofuels electricity & biodiesel



Carbon Intensity of Alternative Fuels

WTW GHG Emissions



WM's Natural Gas Fleet (20% and growing!)

WM's California Truck Fleet:

- *Diesel – 2800*
- *LNG/CNG – 700*
- *Total -- 3500*



LFG to LNG

WWM
WASTE MANAGEMENT

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- Recovery and Utilization of Biomethane Landfill Gas for Transportation Fuel
- Altamont Landfill & Recycling Center, Fall 2009
- \$15.5 million capital investment
- 13,000 Bio-LNG Gallons/day
- “Super Ultra Low Carbon Fuel” – lowest in CA
- Largest effort to introduce onsite liquefaction for landfill gas recovery in North America
- Utilize biogas resources and displace fossil fuels

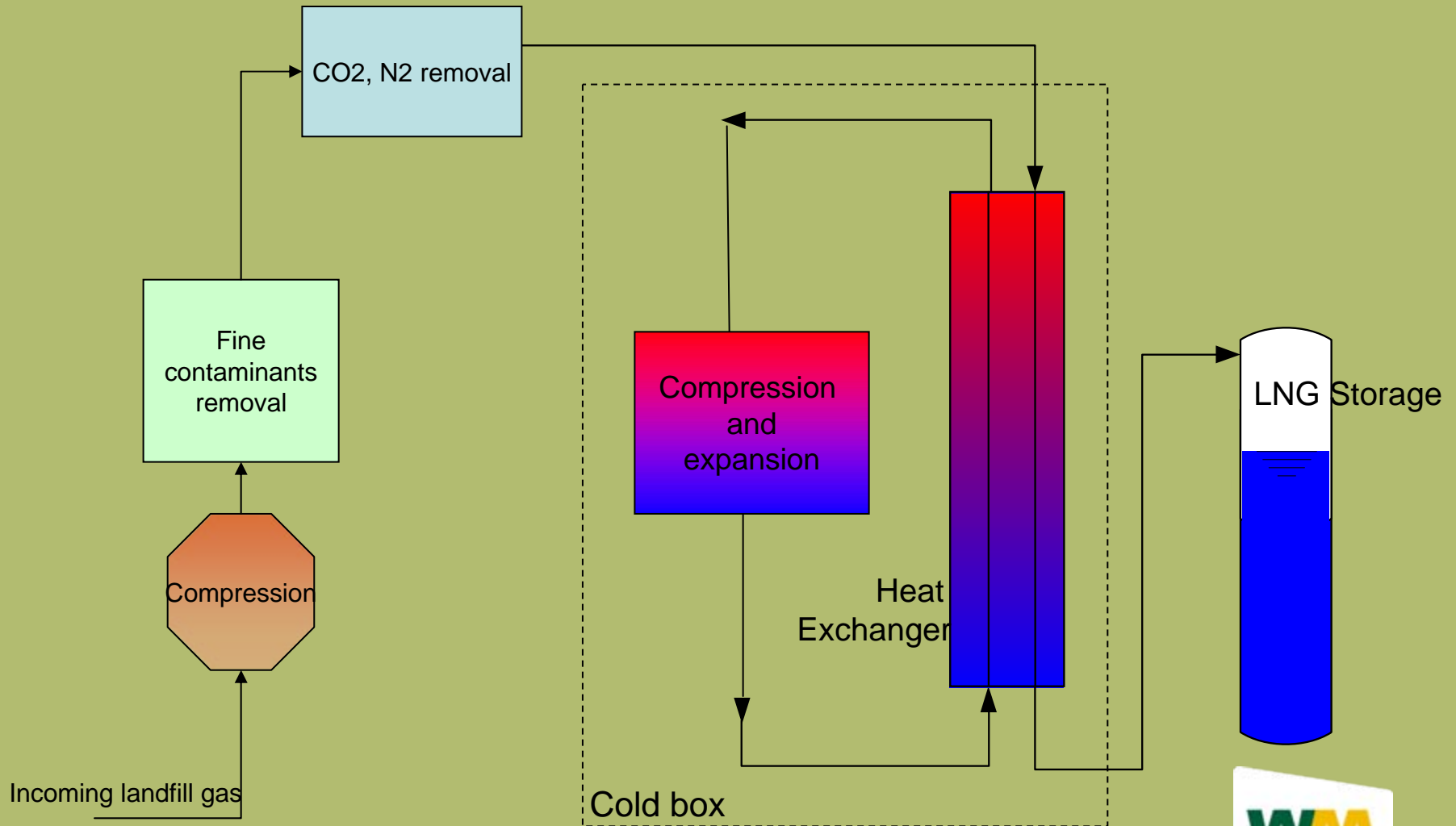
<http://www.youtube.com/wQtch?V=SjCjWVY3MOw>

WWM
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LNG Production Process

- Raw LFG is fed into the gas purification system; A multi-step process that includes compression, chilling, adsorption & membranes to remove impurities from the gas stream. Impurities include sulfur, carbon dioxide, nitrogen, & alcohols.
- The purified stream is then fed into a liquefier where the gas stream is cooled to below the natural gas boiling point of -260 F to produce liquefied natural gas (LNG).
- The impurities are fed into a flare and destroyed along with additional LFG.

Simplified Illustration of Altamont LFG to LNG Process



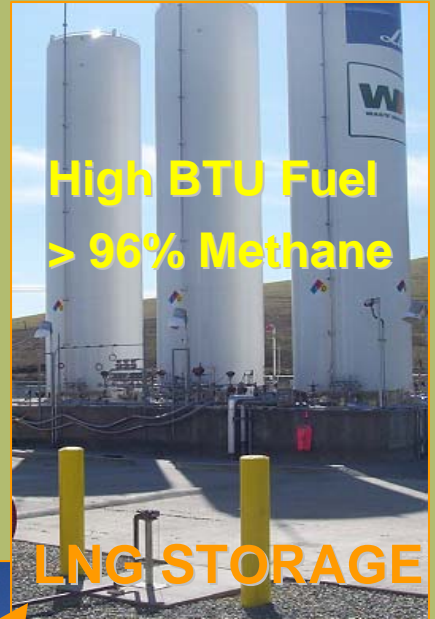
Treatment Train

CH₄ = 46%
N₂ = 12%
CO₂ = 37%
O₂ = 1.3%
H₂S = 100 ppm
H₂O = 3.4%
VOC = 0.3%

SULFUR TREAT



MEMBRANE SKID



High BTU Fuel
> 96% Methane

LNG STORAGE



MOLECULAR SIEVE



LIQUEFACTION



LNG Plant Overview



Altamont Landfill LFG To LNG Project Summary

- World's largest plant to convert landfill gas (LFG) to Liquefied Natural Gas (LNG)
- 13,000 gallons/day (4 million gallons/yr) of transportation grade LNG.
- The \$15.5M project funding includes \$2.0 million in grant assistance from the CIWMB, CARB, the South Coast Air Quality Management Board and the California Energy Commission.



LNG Project Benefits

- The Bio-LNG produced will be used to fuel WM's fleet of natural gas powered collection vehicles.
- The Bio-LNG will be transported to fueling stations throughout California to be used by collection trucks.
- The Bio-LNG is burned in clean burning natural gas engines and will have 88% less carbon emissions than diesel engines – the lowest carbon fuel in California !!
- Reduced vehicle NOx and particulate emissions by up to 75% compared to those of a diesel engine will also be realized.
- Closing the Loop:

