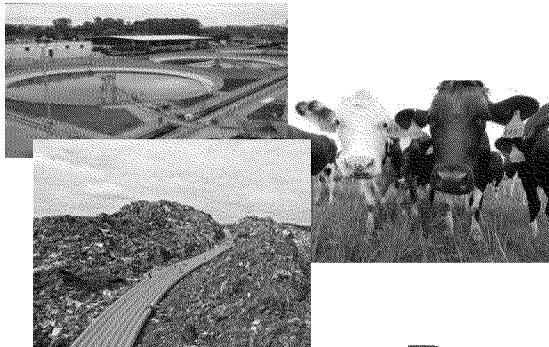


ARB-OEHHA Status Report on AB 1900 Efforts



Presentation to the CPUC
Initial Workshop for
Rulemaking 13-02-008
March 27, 2013

Overview

- * **AB 1900**
- * **ARB-OEHHA Process**
- * **Progress to Date**
 - List of Constituents and Health Values
 - Risk Evaluation
 - * Risk Evaluation “101”
 - * Exposure Scenarios and Preliminary Findings
 - Identification of Constituents of Concern
 - Health Protective Levels for Constituents of Concern
- * **Next Steps**

AB 1900

- * Requires CPUC to adopt standards by Dec 31, 2013 for biomethane injected into the common carrier pipeline that:
 - (1) protect public health
 - (2) ensure pipeline integrity and safety
- * ARB to propose health based standards for constituents of concern in biomethane by May 15, 2013
 - In consultation with OEHHA, DTSC, CalRecycle, and Cal-EPA
 - ARB is also to provide recommendations on monitoring, testing, reporting, and recordkeeping requirements
 - CPUC to give “due deference” to ARB recommendations

AB 1900

ARB-OEHHA Tasks

- * Compile list of constituents of concern in biogas (OEHHA)
- * Determine health protective levels for constituents (OEHHA)
- * Identify realistic exposure scenarios (ARB)
- * Determine appropriate concentrations of constituents (ARB)
- * Identify reasonable monitoring, testing, reporting, and recordkeeping requirements (ARB)
- * Due May 15, 2013, with updates at least every five years

Process

- * ARB-OEHHA develops recommended health based standards
 - Informal public process
 - Relying on existing sources of data
- * CPUC to adopt standards through their regulatory process
 - CPUC give due deference to ARB/OEHHA recommendations
- * Anticipate two public workshops under the CPUC process (includes today's meeting)

ARB-OEHHA Informal Public Process

- * **Established Website**
 - www.arb.ca.gov/energy/biogas/biogas.htm
- * **List Serve**
 - Sign up at http://www.arb.ca.gov/listserv/listserv_ind.php?listname=biogas
- * **Posted update on activities December 2012**
 - Invite stakeholders to provide pertinent information
- * **Meet with interested parties upon request**
- * **Coordinate with other State agencies**

Focus

- * Biogas generated from larger sources with greatest potential for injection into the pipeline
 - Landfills, dairies, and POTW's (sewage treatment)
- * Analyzing available data from both raw biogas and biomethane (treated biogas)
 - Primary focus on directly emitted emissions, GTI studies primary source of data
- * Can address additional sources of biogas in AB 1900-mandated updates ⁷

Progress to Date



Progress to Date

Tasks Overview

Identify List of Constituents & Measured Concentrations ✓	Develop Health Values for Constituents ✓	Develop Exposure Scenarios ✓
Model Exposure Scenarios ✓	Run Health Risk Assessment (Cancer, Chronic, Acute) ✓	Identify Constituents of Concern Based on Health Risk Assessment ✓
Determine Health Protective Limits	Propose Limits for Constituents of Concern	Propose Reporting and Recordkeeping Requirements

✓ Denotes preliminary results presented at 3/27/13 CPUC Workshop

Sources of Data for List of * Constituents

Landfill

- Gas Technology Institute (2009 and 2012 reports)
- Los Angeles County Sanitation District (2009-2012 data)
- * U.S. EPA (AP-42 2008 Update)
- U.K. Landfill study

* Dairy

- Gas Technology Institute (2009 Dairy report)

POTWs (Sewage Treatment)

- Gas Technology Institute (2009 report)
- * Orange County Sanitation District
- South Coast AQMD

Natural Gas

- * Gas Technology Institute (2009 and 2012 reports)
- Natural Gas analysis provided by Air Liquide

Additional data from selected biogas studies available in the scientific literature

List of Constituents

- * Identified approximately 270 chemicals and chemical groups in biogas
 - All are at trace levels—total Non-Methane Organic Carbon (NMOC) ~ 0.1% of gas
- * Many of these are likely biologic or chemical degradation products of biological materials
- * Scientific Literature: 13 additional constituents

Identification of Health Values

- * Used four main sources of toxicity data and risk values for risk evaluation:
 - * OEHHA Reference Exposure Levels (RELs) for non-carcinogens, and Cancer Slope Factors for carcinogens
 - * U.S. EPA Reference Concentrations and Cancer Slope Factors
 - * ATSDR Minimal Risk Levels (MRLs)
 - * Worker protection values from OSHA, NIOSH, or ACGIH
 - * Most protective value used, adjustments and safety factors applied
- * Developed several screening values based on surrogate chemicals
- * Defined several toxicologically similar chemical groups and provided screening values

Progress to Date

Health Values - Results

- Identified risk-screening values for ~180 constituents
- Defined surrogate screening values for ~25 additional chemicals and groups

Risk Evaluation

- * **Health Risk Assessment (HRA) “101”**
 - Use emissions and mathematical model to estimate exposure concentrations
 - Use OEHHA recommended health values and exposure assumptions to estimate:
 - * **Potential Cancer Risk**
 - * Evaluation of the potential for a chemical to cause cancer, expressed as number of excess cancers in a population of a million over a specified exposure duration
 - * **Acute and Chronic Hazard Quotient**
 - * The ratio between the exposure concentration and Reference Exposure Level for an individual compound

Exposure Scenarios Evaluated

* Three Exposure Scenarios

- Two Residential
 - * Leak in a home
 - * Stovetop pre-ignition phase
- One Worker
 - * Losses at a biogas production facility

* Four Gas Streams

- Natural Gas, POTWs, Landfills, Dairy

* Conservative Assumptions

- Assumed 100% biogas/biomethane in the pipeline
- Used highest measured concentrations for constituents

Residential Exposure Scenario - Leak

* Residential Leak Scenario

- Leak is 0.7% of the average household consumption
 - * 0.003 m³/hour
 - * Below smell detection level
- Assume 1-year exposure

* Indoor Box Model

- Home Air Exchange Rate – 0.54
- Home Size – 1,700 ft²
- Kitchen Size - 475 ft²

* Draft Dilution Ratios

- Draft 24 Hour Dilution Value – 3.31×10^{-5}
- Draft 1 Hour Max Dilution Value – 1.27×10^{-4}



Residential Exposure Scenario-

* Stovetop

Stovetop Pre-Ignition Phase

- 5 second pre-ignition phase
- Two 2 hour cook periods per day (4 hours total)
- Time decay analysis to determine emission factors



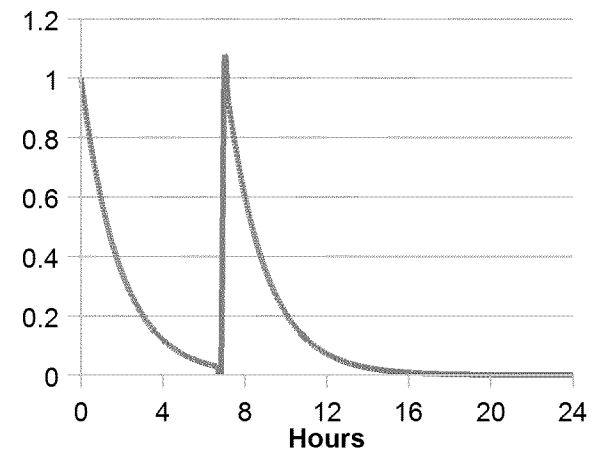
- Assume 30-year exposure

Draft Dilution Ratios

- Draft 24 Hour Dilution Value – 5.21×10^{-6}
- * Draft 1 Hour Max Dilution Value – 4.81×10^{-5}

References

- EPA – Introduction to Indoor Air Modeling
- Risk Assessment of Biogas Exposure in Kitchens (France/UK)



Worker Exposure Scenario – Biogas Facility

- * **Production Facility Leak Scenario**

- Leak is 0.1% of the average biogas production

- * 0.89 m³/hour

- * Below the smell detection level

- Assume 25-year exposure

- * **Indoor Box Model**

- * Production Facility Air Exchange Rate – 1

- * Biogas Production Facility Size – 2,500 ft²

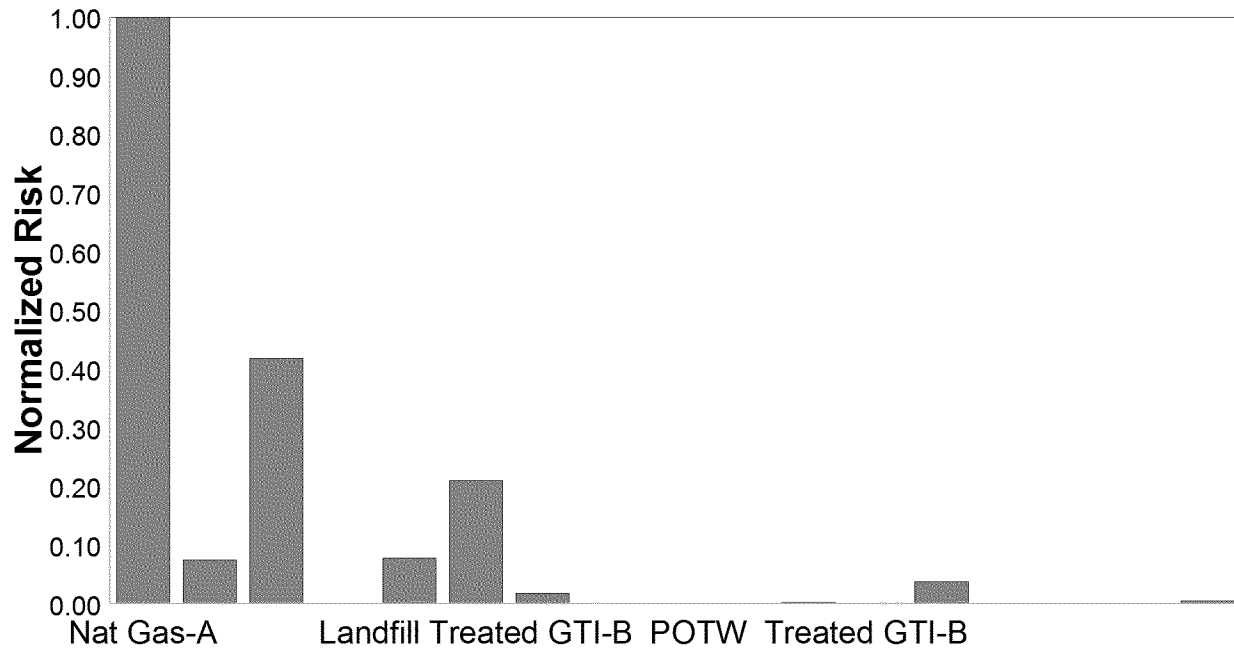
- * Biogas Production 750,000 ft³ per day



- **Draft Dilution Values**

- Draft 24 Hour and 1 Hour Max Dilution Value – 4.46×10^{-4}

Comparison of Combined Potential Cancer Risk* for Natural Gas, Biogas (raw) and Biomethane (treated)



***Data normalized to Natural Gas-A, Leak Scenario**

Preliminary Findings for Potential Cancer Risks

- * Based on preliminary HRA, for the gas streams analyzed:
 - Landfill biogas (raw) and pipeline quality natural gas have similar potential cancer risk
 - Biomethane from Landfill, POTWs and Dairy lowest potential cancer risk
 - All biomethanes (treated) have lower potential cancer risk than pipeline quality natural gas

Acute & Chronic Preliminary Findings*

- * **Chronic Hazard Quotient**
 - 83 Constituents with Chronic RELs
 - 10 constituents with Chronic Hazard Quotient greater than 0.01 in biogas/biomethane
 - 13 constituents with Chronic Hazard Quotient greater than 0.01 in natural gas
- * **Acute Hazard Quotient**
 - 43 Constituents with Acute RELs
 - 3 constituents with Acute Hazard Quotient greater than 0.01 in biogas/biomethane
 - 1 constituent with Acute Hazard Quotient greater than 0.01 in natural gas

* For the gas streams analyzed

Process for Identifying Constituents of Concern (CoCs)

- * CoCs identified on a per-chemical basis
- * Calculated non-cancer Hazard Quotients (HQs) and cancer risks for chemicals and groups
 - Used the highest modeled concentration
 - Used OEHHA methodology for calculations of exposure and risk
 - Focused on health effects of inhalation exposures

Process for Identifying Constituents of Concern (cont)

* Criteria for identification of CoC

- For chemicals with quantified risks, CoCs are those with values greater than specified risk-thresholds
- May add individual chemical, if judged to be of concern based on further evaluation

* CoC risk-thresholds for chemicals with quantified risks:

- Residential: 0.01 for HQs and 1 in a million for cancer risks
- Worker: 0.3 for HQs and 30 in a million for cancer risks

Preliminary Results for Constituents of Concern

- * **Identified ~ 15 CoCs**
 - All have quantified risk values
 - Are continuing to evaluate the data to further refine the list
 - Some may drop out after comparison with NG
- * **13 of the CoCs were present in biogas (raw)**
- * **6 of the CoCs were present in biomethane (treated)**

Preliminary List of Constituents of Concern in Biogas/Biomethane

- * Arsenic*
- * Benzene*
- * Vinyl Chloride*
- * p-Dichlorobenzene*
- * N-Nitroso-di-n-propylamine*
- * Ethylbenzene*
- * Hydrogen sulfide
- * Antimony
- * Methylmercaptan
- * Methacrolein
- * Toluene
- * i-Propyl-mercaptan
- * Copper
- * Lead
- * Manganese

* Denotes the chemical is a carcinogen

Identifying Health Protective Levels for Constituents of Concern

- * Once the CoC list is finalized, health protective concentrations will be identified.
- * OEHHA intends to :
 - o Use exposure and risk formulae to calculate health protective concentrations for CoCs with quantified risk values
 - o Use expert judgment to determine appropriate recommendations for any CoC judged to be a concern based on additional evaluation

Next Steps

- * Finalize CoC list and identify health protective concentrations (OEHHA)
- * Identify reasonable monitoring, testing, reporting, and recordkeeping requirements (ARB)
- * Meet with interested stakeholders upon request
- * Prepare recommendations for 2nd CPUC Workshop
- * Report of findings to CPUC
 - ARB-OEHHA to provide technical resources to CPUC during rulemaking
- * On-going efforts to improve health and technical data for AB-1900 mandated updates

Contact Information

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* Website

- <http://www.arb.ca.gov/energy/biogas/biogas.htm>