

## Greenhouse Gas Emissions - Options and Concerns for Oregon's Wastewater Utilities

2009 ACWA Annual Conference  
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City of Eugene - Wastewater Division

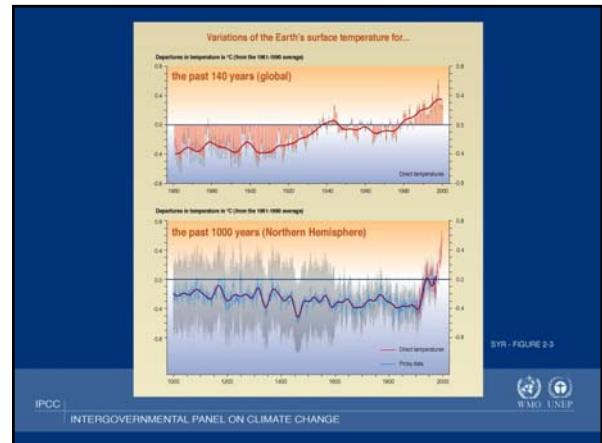


## Presentation Outline

- Overview
- Brief Review of Climate Change
- Impact Projections for Oregon
- Greenhouse Gases (GHG)
- Oregon GHG Management Activities
- Recommendations
- Case Study

## Overview

- Interest in greenhouse gases (GHG) is driven by the climate change concerns
- WWTP do generate GHG, but quantifying the emissions is still under study
- GHG regulations and controls specific to WWTP are still in development



## Climate Change- Predictions for Upper Willamette Basin

### Temperature

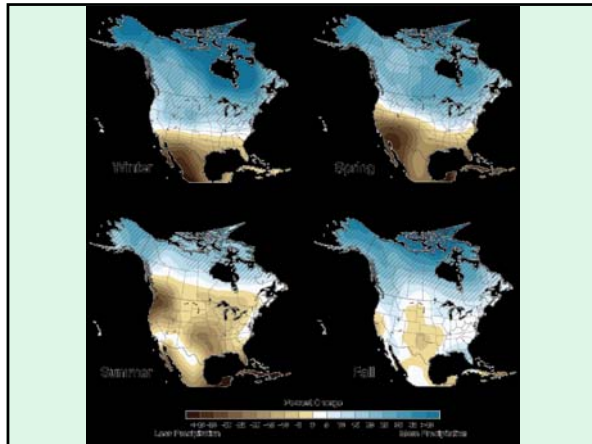
#### By the year 2040--

- Annual average temperatures +2° to 4° F
- Average summer temperatures +4° to 6° F
- Average winter temperatures +1° to 2° F

## Climate Change- Predictions for Upper Willamette Basin

### Precipitation and Snowpack

- Larger shifts that include monsoon patterns in the spring coupled with increased seasonal drought in the summer.
- Snowpack likely to decline by 60% by 2040 and 80-90% by 2095 from current levels.
- Earlier peak streamflows but at lower levels than typical flows in recent years.

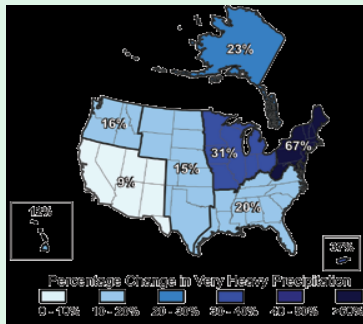


## Climate Change- Predictions for Upper Willamette Basin

### Storms and Flooding

Storm events could increase in intensity, resulting in more flooding in all rivers in the Basin

## Increases in Amounts of Very Heavy Precipitation (1958 to 2007)



## Climate Change- Predictions for Upper Willamette Basin

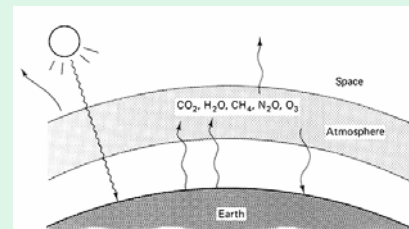
### Aquatic Systems and Species

- Decreased reproduction and survival of many native fish and amphibians
- Benefit to warm water native species and non-native fishes and amphibians
- Increased summer drought in the McKenzie watershed could lead to seasonal water shortage for Eugene

## Greenhouse Gases

- What are they?
- Where do they come from?
- What is wastewater's contribution?

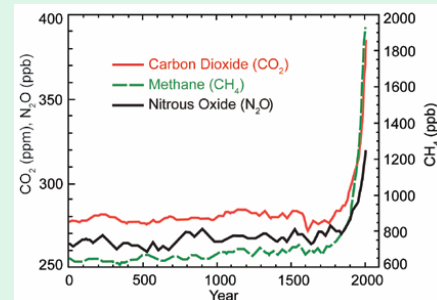
## The Greenhouse Effect



## Greenhouse Gases (GHGs)

1. Carbon Dioxide - CO<sub>2</sub>
2. Methane - CH<sub>4</sub>
3. Nitrous Oxide - N<sub>2</sub>O
4. Sulfur Hexafluoride - SF<sub>6</sub>
5. Hydrofluorocarbons - HFCs
6. Perfluorocarbons - PFCs

## 2,000 Years of Greenhouse Gas Concentrations



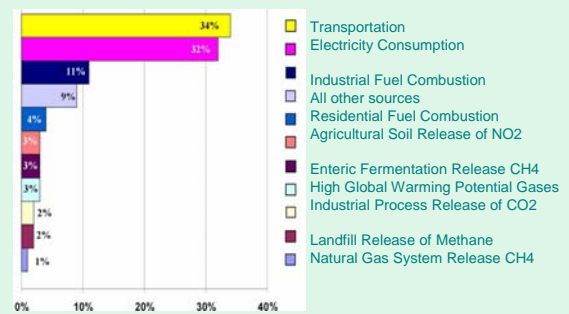
## Global Warming Potential

- Indication of the potential of various GHGs to trap heat in the atmosphere
- Serves as a common basis for comparison relative to CO<sub>2</sub>

GHG	100-yr GWP
CO <sub>2</sub>	1
CH <sub>4</sub>	23
N <sub>2</sub> O	296

Source: Intergovernmental Panel on Climate Change, *Climate Change 2001: The Scientific Basis* (Cambridge, UK: Cambridge University Press, 2001).

## Major Sources of Greenhouse Gas Emissions in Oregon (2004)



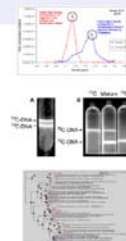
## Wastewater Generated GHGs

- Methane (CH<sub>4</sub>)
  - Anthropogenic – anaerobic degradation, digestion
  - Global Warming Potential = **21 to 23**
- Nitrous Oxide (N<sub>2</sub>O)
  - Anthropogenic – natural by-product of WWT, nitrification
  - Global Warming Potential = **296 to 310**
- Carbon Dioxide (CO<sub>2</sub>)
  - Biogenic (carbon from biogenic sources (food/wood, etc) which would have otherwise decayed into CO<sub>2</sub>)

## CHARACTERIZATION OF N-GHG EMISSIONS FROM WASTEWATER TREATMENT OPERATIONS

Kartik Chandran  
Columbia University

WERF Research Forum  
December 3<sup>rd</sup>, 2008



## U.S. Actions on GHG

### GHG Reporting and Registries



Source: [www.pewclimate.org](http://www.pewclimate.org)

### GHG Emission Targets



### Climate Action Plans

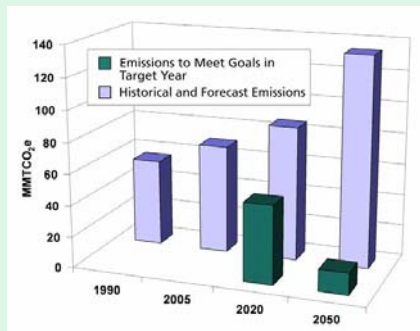


## HB 3543 (2007)

GHG emissions reduction goals:

- **By 2010**, stop the growth of Oregon's greenhouse gas emissions
- **By 2020**, achieve greenhouse gas levels that are **10 percent below 1990** levels
- **By 2050**, achieve greenhouse gas levels that are **at least 75 percent below 1990** levels

## Emission Goals Relative to Forecasted Emissions



## Other Oregon GHG Legislation

- **HB 2186 (2009)**: authorizes targeted reduction strategies and studies of alternative land use and transportation scenarios, sets clean fuel objectives
- **SB 38 (2009)**: authorizes registration and reporting by any person selling, allocating or distributing for use in Oregon electricity, the generation of which emits greenhouse gases

## Oregon GHG Reporting Rules

On October 23, 2008, the EQC approved new Greenhouse Gas (GHG) mandatory reporting rules:

- Report 2009 GHG emissions for annual total GHG emissions greater than 2500 metric tons of carbon dioxide equivalent (CO<sub>2</sub>e) in 2010—
- CO<sub>2</sub>; CH<sub>4</sub>; NO<sub>2</sub>; hydrofluorocarbons; perfluorocarbons; and sulfur hexafluoride.

## Oregon GHG Reporting Rules

- GHG information will be submitted concurrently with Title V and Air Contaminant Discharge Permit (ACDP) annual reports.
- It is anticipated that little, if any, new testing or monitoring will be required for Title V or ACDP permittees for 2009 emissions reporting.
- Emission calculation training workshops will be held in the fall of 2009.

## GHG MANDATORY REPORTING RULES OAR 340-215-0030

Table 1 (who monitors & reports) includes:  
*Sewage Treatment Facilities employing internal combustion for digester gasses*

*Medford, Portland, Gresham, Clean Water Services, Clackamas County WES, MWMC, Tri-City*

## Oregon GHG Reporting Rules

- WWTP that hold a Title V or ACDP permit have a one-year exemption from reporting
- Granted under OAR 340-215-0030(6) because emission quantification methodologies are not currently available
- These facilities will be required to report 2010 GHG emissions in 2011

## Oregon GHG Reporting Rules

For more information and updates check:

[www.deq.state.or.us/aq/climate/rulemaking.html](http://www.deq.state.or.us/aq/climate/rulemaking.html)

## Challenges for POTWs

- Lack of good methodology for measuring and quantifying GHG emissions
- Lack of understanding of operational controls to manage GHG emissions
- Little control over source material for GHGs
- Potentially competing mandates (water quality vs air quality)
- Small fish in a big pond

## Opportunities for POTWs

May be able to get credits for:

- Reduction in electricity use
- Production of carbon neutral fuel
  - Digester gas
  - Dried biosolids
- Renewable energy use of carbon neutral fuels
  - Digester gas
  - Biodiesel

## Opportunities for POTWs

Other than GHG emissions associated with wastewater treatment processes, the two largest liabilities are electricity usage and fleet functions.

Oregon Association of Clean Water Agencies:  
Energy Independence Study for WWTPs:

<http://www.oracwa.org/news.php?NewsID=417&HPSESSID=9373ec76702a39ef45f971b3f892d302>

## Recommendations

- Learn about WWTP-generated GHGs
- Inventory your operations for GHG emissions and liabilities
- Track DEQ rules for measurement and reporting (check in Fall of 2009)
- Look for offsets or positive actions
- Develop draft GHG reduction plan

## Eugene/Springfield Water Pollution Control Facility



## Overview of Facility

- Secondary treatment process
- Serves the cities of Eugene and Springfield, approx. 229,000 citizens
- Discharges treated wastewater to the Willamette River
- Includes treatment plant, Biosolids Management Facility, Biocycle Farm
- 49 mgd average dry weather flow, 175 mgd peak wet weather flow

## Scope of GHG Assessment

Evaluate GHG sources for most cost effective controls for reduction.

- Determine 2005 GHG emissions (baseline) from:
- Electricity Use – WWTP and 49 Pump stations
  - Transportation functions for O&M
  - Stationary Combustion Sources
  - Plant Processes
    - Liquid Process Emissions
    - Solids Processing Emissions

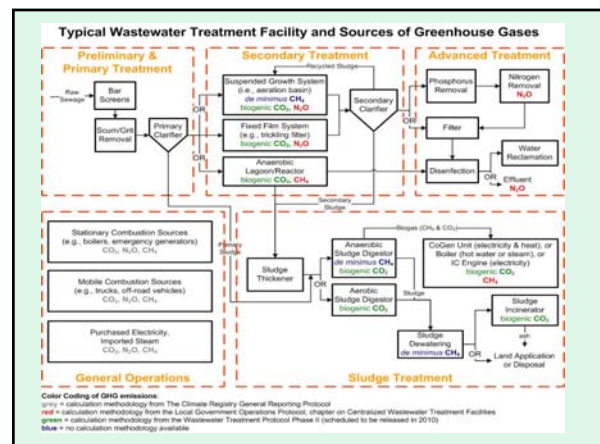
## Focus of Study and Methodology

Focus was on 3 major GHGs:

- Carbon Dioxide
- Methane
- Nitrous Oxide

Methodology/Protocol:

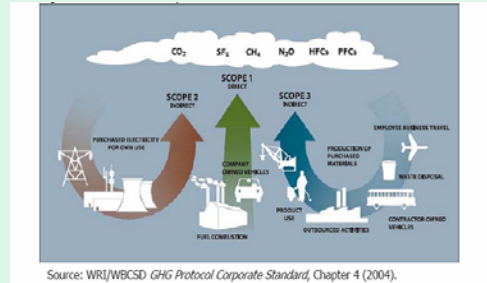
- The Climate Registry Protocol for General Emissions
- California Air Resources Board – Local Government Operations Protocol



## Not Included in Assessment

- Biosolids lagoons
- Scope 3 Emissions
  - Employee's Commute
  - Upstream emissions from transportation of purchased fuels, etc.
  - Solid Waste
- Embodied Carbon in the construction of future capital improvements
- Embodied Carbon in materials, chemicals and new or upgraded equipment.
- Biocycle Farm – carbon sequestration

## Western Regional Climate Initiative GHG Emissions Protocol



## Results of the Inventory

	CO <sub>2</sub> Emissions		CH <sub>4</sub> Emissions	N <sub>2</sub> O Emissions	Total
	Metric tons CO <sub>2</sub> eq/yr	Metric tons CO <sub>2</sub> eq/yr			
Stationary Combustion (direct emissions)	130	11	0.11	0.27	142
Mobile Combustion (direct emissions)	160	28	0.18	1.7	190
Purchased Electricity (indirect emissions)	396	N/A	0.3	0	396
Sources Unique to WPCF					
CO <sub>2</sub> emissions from aeration basins, digesters, combustion of biogas	N/A	<b>12,044</b>	N/A	N/A	12,044
CH <sub>4</sub> emissions from incomplete combustion of biogas	N/A	N/A	308	N/A	308
Plant N <sub>2</sub> O emissions	N/A	N/A	N/A	362	<b>362</b>
Effluent N <sub>2</sub> O emissions	N/A	N/A	N/A	1,698	<b>1,698</b>
<b>Total</b>	<b>686</b>	<b>12,083</b>	<b>N/A</b>	<b>2,062</b>	<b>15,140</b>

## GHG Reduction Strategies

- Optimize anoxic feed process for N removal
- Beneficially reuse effluent
- Upgrade and/or install additional cogen units
- Increase use of biodiesel in fleet
- Substitute alternative fuel vehicles for regular gasoline powered vehicles
- Perform energy audit
- Install wind turbines or solar panels

## Next Steps

- Work with DEQ to refine modeling of emissions from the WWTP and reporting requirements for Wastewater Treatment Facilities
- Evaluate GHG sources not included in initial scope – biosolids lagoons, scope 3 emissions, etc.
- Coordinate with other City Departments to develop GHG Action Plan

## References & Links

- Climate Literacy Brochure: [http://climate.noaa.gov/index.jsp?pg=/education/edu\\_index.jsp&edu=literacy](http://climate.noaa.gov/index.jsp?pg=/education/edu_index.jsp&edu=literacy)
- California Air Resources Board, Climate Change: <http://www.arb.ca.gov/cc/cc.htm>
- EPA Climate Change and Water News - [water\_and\_climate\_change\_listserve]
- Global Climate change impacts: [www.globalchange.gov/usimpacts](http://www.globalchange.gov/usimpacts)
- University of Oregon's Climate Leadership Initiative: <http://climlead.uoregon.edu/>
- Intergovernmental Panel on Climate Change, *Climate Change 2001: The Scientific Basis* (Cambridge, UK: Cambridge University Press, 2001).

## References & Links

- Oregon GHG rules:  
<http://www.deq.state.or.us/eq/climate/rulemaking.htm>
- Oregon Strategy for GHG reductions:  
<http://www.oregon.gov/ENERGY/GBLWRM/docs/GWReport-Final.pdf>
- Oregon GHG Reporting rules:  
<http://www.deq.state.or.us/eq/climate/docs/FinalGHGRule.pdf>
- [PEW Center on Global Climate Change: www.pewclimate.org](http://www.pewclimate.org)