City of Spokane

1990 & 2005
Greenhouse Gas Inventory

March 9, 2009

Letter from Mayor Verner

This inventory documents the City's emissions of greenhouse gases and also marks the beginning of coordinated City government and Community response. Your government recognizes that the two most important things we can do in this arena are to set a good corporate example of reducing greenhouse gas emissions and finding, with community help, ways to support your efforts to the same end.

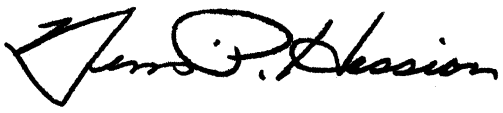
My administration in cooperation with the City's other elected officials is committed to facing the climate change challenge head-on. We look forward to the Sustainability Task Force's recommendations and to continued interaction with a wide range of community representatives to conclude and implement plans that address this challenge. We recognize that while this is a significant problem that requires commitment and resources, it is also an opportunity that can result in stronger community and a more resilient economy.

Mary B. Verner
Mayor, City of Spokane

Letter from former Mayor Hession

The true mark of a progressive society is how it prepares for its future and in the way it is able to secure that future for its children. We are demonstrating the right to claim that status by signing the Mayor's Climate Protection Agreement and effectuating our responsibilities under that agreement to complete this Greenhouse Gas Inventory. But this is only the beginning as we take our place in this country and the world to ameliorate the effects of climate change and to lead this community to modify its lifestyles, to change its habits and discard its conventions and aggressively address global warming.

This is not just about self denial; it is also about creative solutions and limitless opportunities, which will translate into a new economy for Spokane. We have the conviction and the spirit of progress. Now let's go show the world how it's done!



Dennis P. Hession
Former Mayor, City of Spokane

Acknowledgements

I want to thank City Elected Officials, City Staff, the Mayor's Sustainability Task Force, and our Regional Partners – particularly Greater Spokane Inc. and The Lands Council – for their direction and assistance in preparation of this document. I would especially like to recognize the efforts of student interns Leon Letson and Ben Braudrick in compiling and writing this report. In addition, I must acknowledge the significant contribution of Deborah Bisenius, Environmental Analyst in checking calculations and bringing the document into close alignment with new protocols.

The information in this report is provided as a good faith effort to document the City's greenhouse gas emissions particularly for 2005. Data reliability and availability affect the quality of this inventory. In addition some errors likely have escaped our attention. Where this is the case I am responsible. Should you be aware of inventory problems/errors, please bring them to my attention.

This is a significant challenge that faces our community and the world. I trust this inventory will assist staff, citizens, and elected officials in rising to the challenge. It is not possible to do service to our community without recognizing here an individual who has **long** advocated getting this inventory done and getting on with actions to address the problem: Spokane citizen activist Julian Powers.

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City of Spokane Greenhouse Gas Inventory
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Executive Summary

The time to act is now. Scientific consensus has concluded that human-induced climate change is a reality and represents one of the most pressing environmental problems we face. In the 20th Century, the planet has experienced warming temperatures that are unparalleled since human record keeping began. The past decade has been the warmest in recorded history, and the world's preeminent climate scientists have overwhelming evidence that human activity is the cause. Scientific studies by the University of Washington's Climate Impacts Group show that allowing this warming trend to continue at present rates could result in decreased agricultural output, increased catastrophic weather events such as forest fires, drought and floods, and the displacement of entire populations due to rising sea levels.

The City of Spokane has chosen to do its part. With a population that is expected to grow more than 38 percent by 2020, the City of Spokane recognizes making an impact on this global phenomenon requires taking responsibility for local actions.[1] In 2001, the City of Spokane joined more than 350 U.S. local governments and 800 local governments worldwide in ICLEI's Cities for Climate Protection® (CCP) Campaign. Furthering this effort, former Mayor Dennis Hession signed the U.S. Conference of Mayors Climate Protection Agreement in 2007. Under this agreement, participating cities aim to meet or exceed Kyoto Protocol targets in their own communities – a 7 percent reduction in greenhouse gas emissions below 1990 levels by 2012. In early 2008, Mayor Mary Verner appointed a sustainability task force to help create a strategic action plan to identify and address the impacts of climate change and energy security on the City. Consistent with Governor Christine Gregoire's Washington Climate Change Challenge, the City of Spokane has also agreed to assist in a statewide reduction of greenhouse gas emissions. The state goal is to reduce 2020 emission levels to what they were in 1990, a reduction of 10 million metric tons of carbon dioxide equivalent (MTCO2e) below 2004 levels.

The City of Spokane has developed this inventory and its reduction targets based in part on the 1990 calendar year. As limited 1990 data was available, the available data has been supplemented with data derived from trend analysis and historical information. Calendar year 2005 was chosen as a base inventory year for analysis as well because this was the year for which the most information was available when the inventory process began. Calendar year 2000 was chosen as an interim year to help determine trends and to evaluate the effects that certain policies and actions have had on greenhouse gas emissions. Calculating emissions with precision is difficult and is dependent upon numerous assumptions. It is also limited by the quantity and quality of available data. With this in mind, it is useful to think of any specific number generated by this process as an approximation, rather than an exact value.

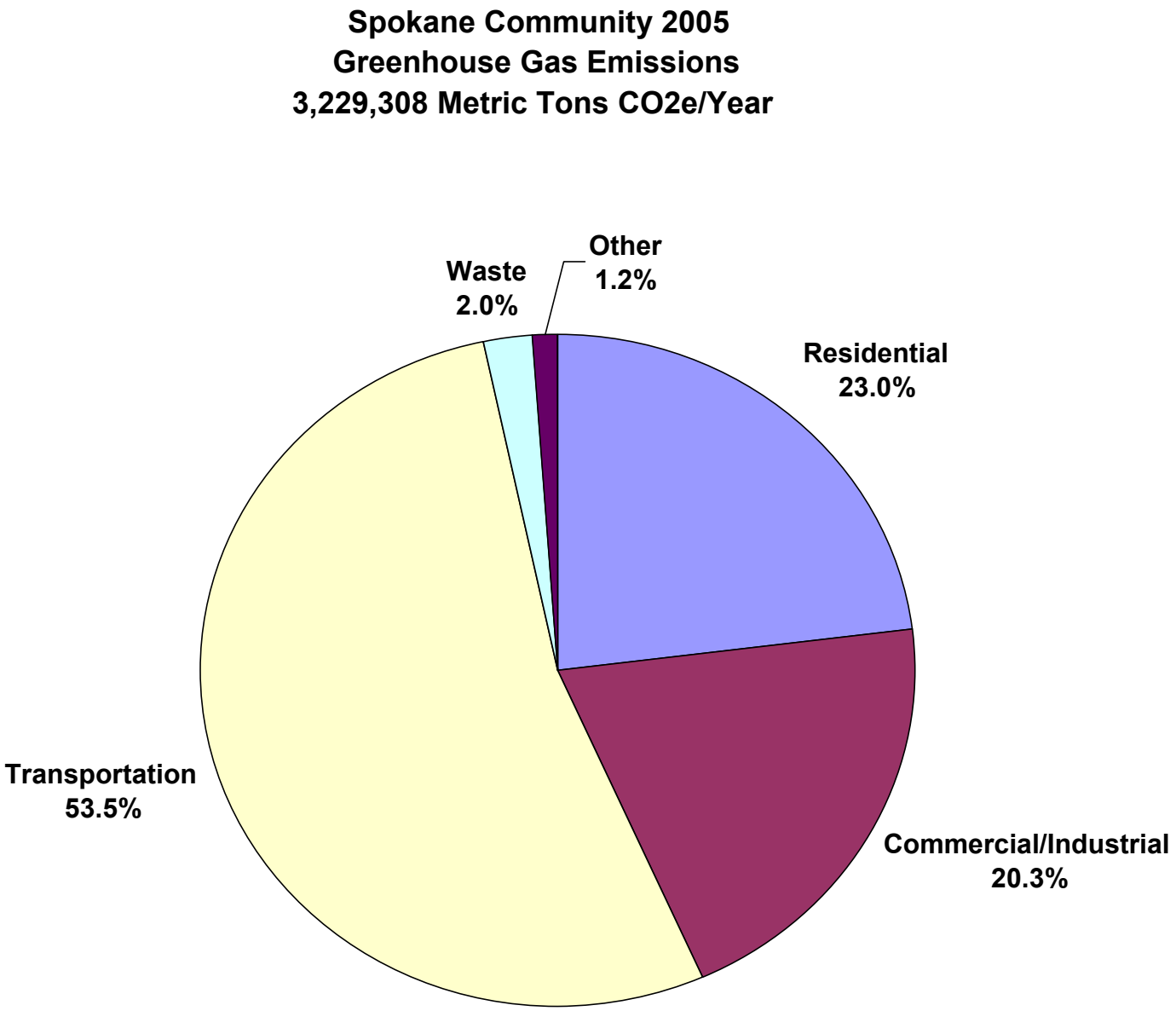
The inventory is composed of two **categories**, which are analyzed independently: **government emissions** and **community emissions**. The inventory of the community emissions explores all sources within the City of Spokane city limits. The government inventory includes those sources that are under the operational control or financial purview of the City of Spokane government. It is important to be clear that these two categories are not cumulative. The community-wide inventory is the total, and the government category is a specific subset of that total.

Each of these categories is further broken down by sources and sectors. **Sources** are the fuel, energy, or other gas that is the basis of the emissions. In this inventory, the main sources considered are electricity, natural gas, diesel, gasoline, waste, and other sources. **Sectors** are the portion of the community or government operations to which the emissions are attributable. Sectors

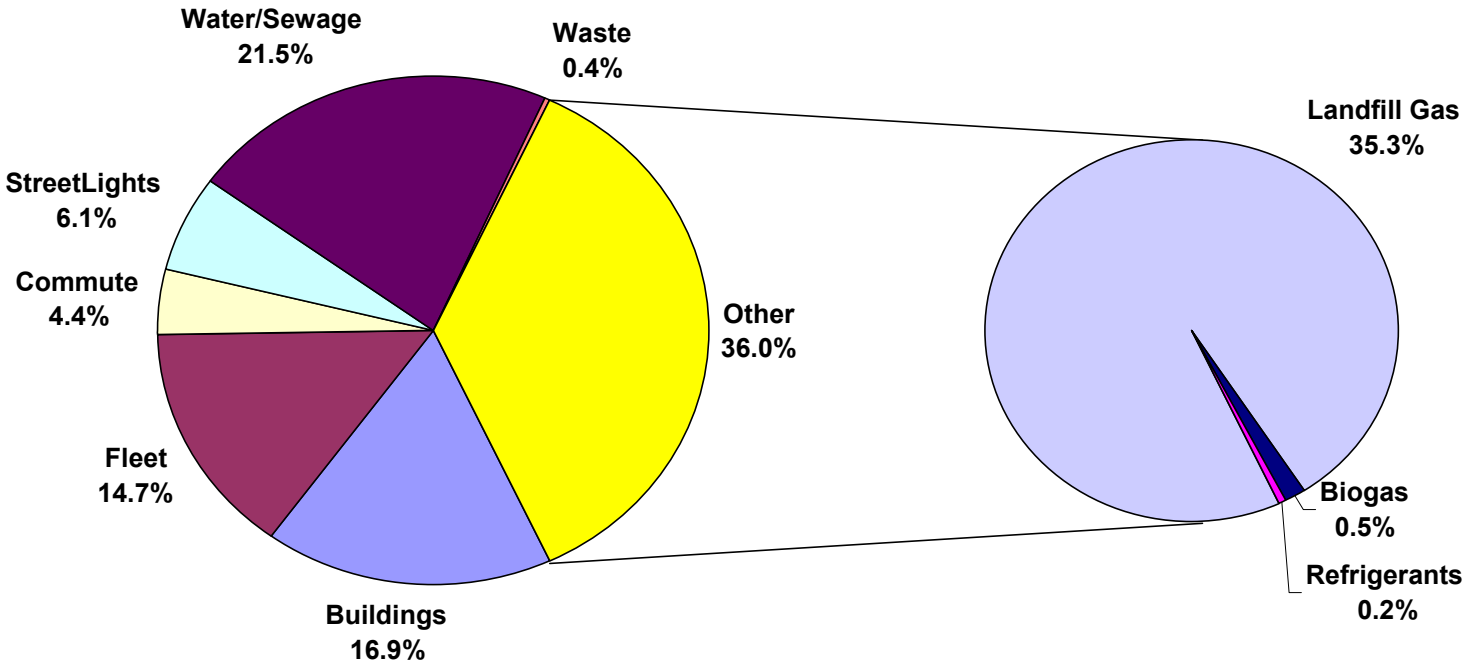
[1] Office of Financial Management State of Washington

were also established with an understanding that sources within would likely be controlled through common measures. For example, improved engine efficiency would be a common reduction measure in the transportation and fleet sectors. In the **community inventory** the **sectors** considered are residential, commercial/industrial, transportation, waste, and other. In **government operations** the **sectors** considered are buildings, vehicle fleet, streetlights, water/sewage, employee commute, waste, and other. Information regarding emissions from the long-haul export of waste is also included for reference but is not reflected in the government emissions total.

In 2005, the City of Spokane's total greenhouse gas emissions (GHG) were 3,229,308 metric tons of carbon dioxide equivalents (CO_2e). Emissions associated with transportation made up the majority of the total at 53.5 percent. Energy used in buildings (residential, commercial, and industrial) essentially accounted for the remainder of emissions at 43.3 percent, with emissions from waste disposal and decomposition accounting for only 3.2 percent of the total.



City Government 2005
Greenhouse Gas Emissions
70,835 Metric Tons CO2e/Year



City government operations resulted in the emission of 70,835 metric tons of CO_2e in 2005 or **2.2 percent of the community emissions mentioned above.** Government buildings accounted for 16.9 percent of total government emissions. Emissions generated by water and sewer operations accounted for 21.5 percent. Gasoline and diesel fuel used by City vehicles contributed 14.7 percent and energy used in streetlights made up 6.1 percent of total emissions from City government operations. Emissions generated by City employee commutes to work represented 4.4 percent of total emissions and emissions associated with waste totaled 0.4 percent. Emissions associated with the Northside and Southside landfills, biogas emissions from the treatment of wastewater, and emissions associated with the use of refrigerant in the City's vehicle fleet accounted for 36.0 percent of total government emissions.

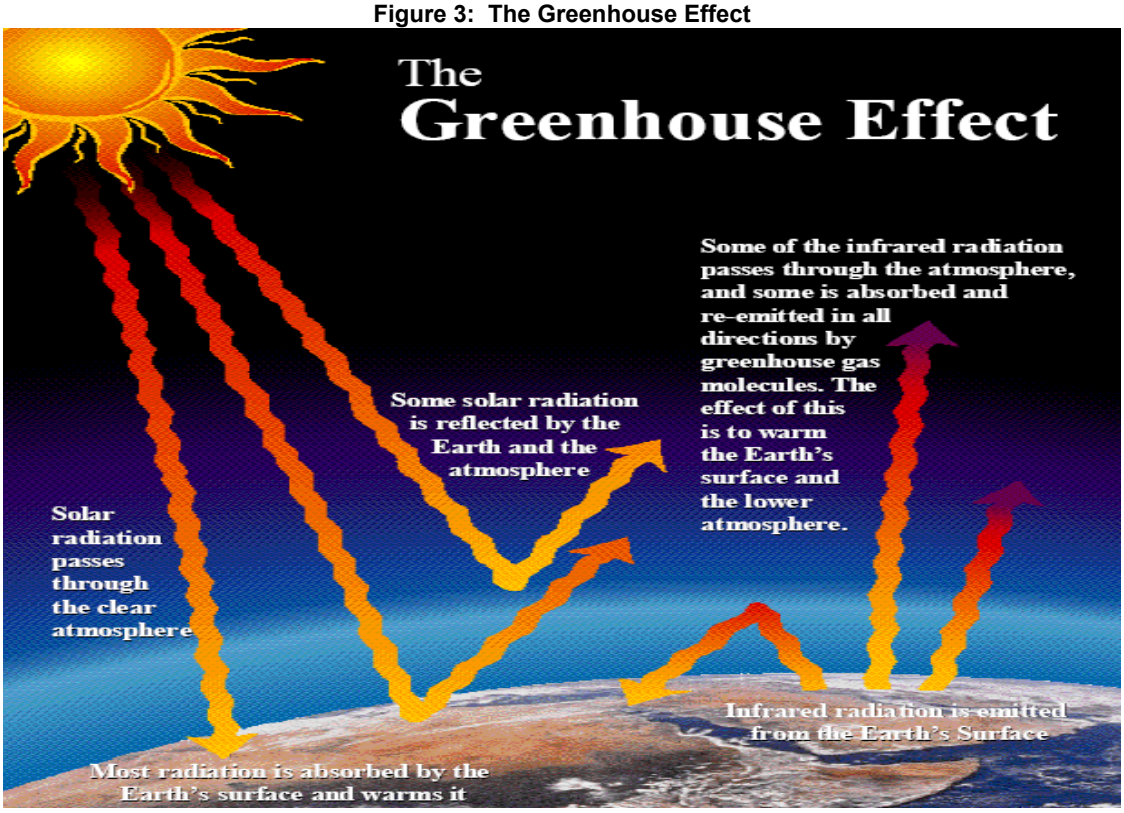
Assuming a compound annual growth rate (CAGR) of 0.71 percent, community wide emissions are projected to increase 11.2 percent by 2012 to approximately 3,592,095 metric tons. Government emissions are projected to rise 5.5 percent to 74,762 metric tons of CO2e by 2012.

I. Introduction

A. Introduction to Climate Change Science

The Earth's atmosphere is naturally composed of a number of gases that act like the glass panes of a greenhouse, retaining heat to keep the temperature of the Earth stable and hospitable for life at an average temperature of 16 degrees Celsius (60 degrees Fahrenheit). Water and carbon dioxide (CO_2) are the most prolific of these gases.[2] Other contributing gases include methane (CH_4), nitrous oxide (N_2O), ozone (O_3), and halocarbons. Without the natural warming effect of these gases, the Earth's surface temperature would be too cold to support life. A visual depiction of this process is provided below.

Figure 3: The Greenhouse Effect



Source: U.S. EPA

While the existence of GHG in the atmosphere is necessary for life on Earth, human beings are changing the proportions of these gases in the atmosphere, most significantly by adding carbon dioxide from the burning of fossil fuels. Atmospheric carbon dioxide concentrations have increased from between 270-280 parts per million (ppm) in pre-industrial times to more than 380 ppm today.[3] If current emissions levels continue, the atmospheric carbon dioxide concentration is projected to reach 730-1020 ppm by 2100. The current atmospheric concentration of carbon dioxide exceeds by

[2] Water, which exists in significant quantities on earth in the forms of solid, liquid, and gas, is not typically included in the list of greenhouse gases of concern because its interaction with light is so variable. For example, the reflective qualities of snow, clouds, ice, lakes, oceans, etc. all vary dramatically.

[3] United Nations Intergovernmental Panel on Climate Change - IPCC (2007) "Climate Change 2007: The Physical Science Basis. Summary for Policy Makers" http://www.ipcc.ch/SPM2feb07.pdf

far the natural range over the last 650,000 years (180 to 300 ppm) as determined from ice core measurements.[4]

Over this same geologic time period, methane concentrations have increased from 715 parts per billion (ppb) to more than 1,774 ppb, and nitrous oxide, concentrations have increased by 270 ppb to 319 ppb.[5] In addition to these naturally occurring gases, humans have introduced synthetic gases with heat-trapping capacity into the atmosphere, such as hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). Though relatively low in concentration, these gases are of particular concern because they have a heat trapping capacity between 1,500 and 22,000 times stronger than carbon dioxide.[6]

Elevated concentrations of GHG in the atmosphere have had a destabilizing effect on the global climate, fueling the phenomenon commonly referred to as global warming. Increases in global temperature have accelerated recently, with 11 of the 12 warmest years on record occurring between 1995 and 2006.[7]

The climate and the atmosphere will not necessarily react in a linear fashion to increased GHG. That is to say that you cannot simply predict that for each ton of carbon dioxide emitted the Earth will warm a certain amount. The Earth's climate has a number of feedback loops and tipping points that scientists fear will accelerate global warming beyond the rate at which it is currently occurring. For example, as CO_2 emissions have increased in recent human history, the oceans and terrestrial ecosystems have been absorbing a significant portion of these gases. With continued warming, scientists anticipate a decrease in the ability of oceans and terrestrial ecosystems to absorb GHG, causing anthropogenic CO_2 emissions to have a larger impact on global climate.[8]

In regards to inventories, there is another type, "carbon inventory" based on carbon rather than carbon dioxide equivalent (CO2e). The differences between these two are significant and worth explaining in further detail. In terms of number reporting, the atomic weight of carbon is 12 atomic mass units, while the weight of carbon dioxide (CO2) is 44. To switch from one inventory type to the other, use the formula: **one ton of carbon equals 3.67 tons of carbon dioxide**. It is also important to keep in mind that both inventory types are generally concerned with accounting for emissions not part of the historic carbon cycle. These inventories typically only account for CO2 emitted as the result of burning fossil fuels, rather that CO2 emitted from the burning of non-fossil-fuel based carbon sources. This is due to the concern in measuring anthropogenic (man-made) emissions of carbon, carbon dioxide, and other greenhouse gases. For example, fossil-fuel-derived emissions are counted, Freon and methane emissions are counted, but emissions generated from the burning of paper and wood are not.

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[4] United Nations Intergovernmental Panel on Climate Change - IPCC (2007) "Global Climate Projections. In: Climate Change 2007: The Physical Science Basis"
http://ipcc-wg1.ucar.edu/wg1/Report/AR4WG1_Pub_Ch10.pdf

[5] United Nations Intergovernmental Panel on Climate Change - IPCC (2007). "Climate Change 2007: The Physical Science Basis. Summary for Policy Makers," http://www.ipcc.ch/SPM2feb07.pdf

[6] United Nations Intergovernmental Panel on Climate Change - IPCC (2001). "Third Assessment Report. Climate Change 2001: The Scientific Basis," http://www.ipcc.ch/pub/wg1TARtechsum.pdf

[7] Ibid

[8] United Nations Intergovernmental Panel on Climate Change - IPCC (2007). "Climate Change 2007: The Physical Science Basis. Summary for Policy Makers," http://www.ipcc.ch/SPM2feb07.pdf

B. Effects and Impacts of Climate Change

Global Impacts

Changes in temperature and climate will have a dramatic impact on plants and animals that are adapted to present climactic conditions. Surface temperatures are on course to increase between 1.8 to 4 degrees Celsius (3.2 to 7.2^{o} Fahrenheit) by the year 2100, with temperatures in the Arctic expected to increase by twice the global average.[9] In addition to causing average temperature increases, rising levels of GHG have a secondary destabilizing effect on a number of different microclimates, conditions, and systems. Increases in the temperature of the oceans are projected to accelerate the water cycle, thereby increasing the severity and rate of both storms and drought. These conditions, along with decreased snow pack, could disrupt ecosystems, agricultural systems and water supplies.[10]

Local Impacts

Climate change is a global problem influenced by an array of interrelated factors that have significant consequences for the Pacific Northwest. A 2005 report by the University of Washington's Climate Impacts Group found that climate change will significantly challenge the region's natural and built systems.[11] (All subsequent mention of climate impacts in the Northwest, aside from the studies directly cited, reference the Climate Impacts Group 2005 study).

***Natural disasters*:** Local climate trends will reflect continued increases in both average air and water temperatures. Additionally, sea level rise is likely to occur faster than global averages, and earlier snowmelt may cause changes in river and stream flows. Sea level rise and increased seasonal flooding could incur considerable costs as these phenomena pose risks to property, infrastructure and even human life. In addition, the number of large (>500 acre) wildfires in Washington State has increased from an average of 6 per year in the 1970s to 21 per year in the early years of the 21st century.[12]

Impact on water: Water quality and quantity will also be impacted as a result of changing temperatures. With warmer average temperatures, more winter precipitation will fall in the form of rain rather than snow, shortening the winter snowfall season and accelerating the rate at which the snow pack melts in the spring. Furthermore, increased rainfall and more extreme storm events will result in more stormwater runoff, putting a strain on the natural and man-made treatment systems that clean automotive oils, antifreeze, and other pollutants from our water sources – most notably the Spokane Valley-Rathdrum Prairie Aquifer and the Spokane River.[13]

These snow melt patterns increase the threat for spring flooding and decrease the storage of the natural "water tower" in mountains, meaning less water will be available for agricultural irrigation, hydro-electric generation and the general needs of a growing population. As we have seen in recent years, water resources for agricultural and residential use may become more constricted, especially during the summer months.

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[9] Ibid
[10] Ibid
[11] Casola, Kay, Snover et. al. (2005). "Climate Impacts on Washington's Hydropower, Water Supply, Forests, Fish, and Agriculture." Climate Impacts Group, University of Washington. http://www.cses.washington.edu/db/pdf/kc05whitepaper459.pdf
[12] Bauman, Youram et. al (2006). "Impacts of Climate Change on Washington's Economy: A Preliminary Assessment of Risks and Opportunities." Climate Leadership Initiative, University of Oregon.
[13] Petersen, Mike (2007). "Our Climate is Changing: How the Lands Council is Reacting." http://www.landscouncil.org/climate_change/our_climate_is_changing.asp

***Impact on plants and animals*:** The local native plants and animals are also at risk as temperatures rise. Scientists are reporting more species moving to higher elevations and more northerly latitudes. Increased temperatures also provide a foothold for invasive weed and insect species, such as the pine bark beetle, as well as other non-native threats.

Additionally, these trends alter the natural cycle of flowering and pollination, as well as the temperature conditions necessary for a thriving locally adapted agriculture. Perennial crops in particular will be challenged.

***Public health impact*:** Warming temperatures and increased precipitation can accelerate the breeding of mosquitoes, thus engendering diseases for which mosquitoes are vectors, such as the West Nile virus. Increased temperatures also pose a risk to human health because it increases ozone levels and air pollution toxicity, which are tied to increased rates of asthma and other pulmonary diseases. Furthermore, the anticipated increase in hotter days poses heat-stroke risks particular for the elderly, young, those already sick, and people who work outdoors.

Regional evidence: The impacts of climate change are already here, and are expected to continue to escalate if the levels of heat trapping pollution continue to increase. **Figure 4a** below shows precipitation trends; **4b** shows trends in April 1 snow pack.
These figures show widespread increases in average annual precipitation for the period 1920 to 2000 and decreases in April 1 snow pack (an important indicator for forecasting summer water supplies) for the period 1950 to 2000. The size of the dot corresponds to the level of change.

Figure 4a: Precipitation trends (1920-2000)

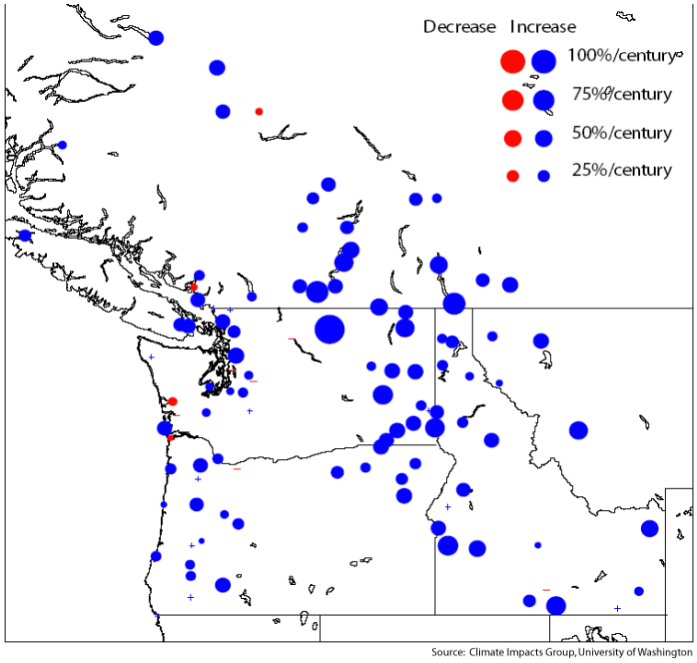
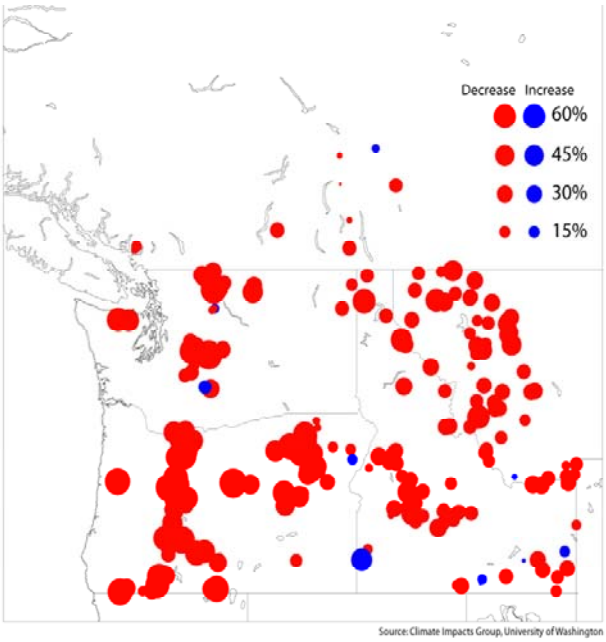


Figure 4b: Snow Apr 1 trend (1950-2000)



Source: Climate Impacts Group, University of Washington, 2006[14]

There is very little variability in short-term predictions of the average global temperature over the next twenty to thirty years. This is due to the significant lag time inherent in the climate system: the

[14] Climate Impacts Group. 2006. "Pacific Northwest 20th Century Climate Change." http://www.cses.washington.edu/cig/pnwc/cc.shtml#figure1

impact of gases already in the atmosphere will determine the impacts felt in the near term. Moreover, despite the proliferation of energy saving technologies, existing power plants and vehicles will continue to be used in the short term. The short- and medium-term implications of climate change are therefore largely unalterable. As one individual put it, "we have already bought the ticket and are on the ride … we just don't know where it is going". Longer-term outcomes, meaning those relating to outcomes that will be felt between 2040 and 2100, will be shaped by the actions taken today.

C. Action Being Taken on Climate Change
National and State Action

State Actions: Many states are considering the effects of climate change. As of July 2008, 38 states have completed or are working on comprehensive Climate Action Plans.[15] The most common state laws call for studies of the impacts of climate change and require inventories of the states' GHG emissions and the creation of commissions to study the possible implications of GHG trading systems. However, 19 states have passed legislation setting GHG targets.[16]

In addition to these individual state actions, regional coalitions are coordinating interstate agreements to mitigate climate change in North America. The Western Regional Climate Action Initiative was announced in February 2007, by the governors of Arizona, California, New Mexico, Oregon and Washington. Since that time, Utah, British Columbia, and Manitoba have joined the Initiative. Under the Initiative, the participating states have agreed to cut GHG emissions levels to 15% below 2005 levels by 2020 by establishing and implementing a market-based system by 2012.[17] [18]

Washington State

Over the past few years the Washington State Legislature has passed a number of bills that should significantly reduce GHG emissions and will most likely increase energy costs for consumers.

HB 3141 (2004) This bill initiates the process of regulating carbon emissions by requiring new fossil fueled thermal power plants with a generating capacity of 25 MW or more to provide mitigation for 20 percent of the CO_2 emissions produced by that plant over a period of 30 years.[19]

SB 1397 (2005) Commonly called the "clean car bill," this legislation adopts the California emissions standards for new cars, which are stricter than national standards. While the California standards, will have significant impact on the ambient air quality in our region, it will have a more limited impact on CO_2 emissions. The waiver request to implement the new California standards is currently being reviewed by Environmental Protection Agency after the Supreme Court ruled that CO_2 is a pollutant that can be regulated by the states. If allowed, this rule would require significant improvements in average fuel efficiency and reduce CO_2 emissions.[20]

[15] Pew Center on Global Climate Change: http://www.pewclimate.org/what_s_being_done/in_the_states/action_plan_map.cfm
[16] Pew Center on Global Climate Change: http://www.pewclimate.org/what_s_being_done/in_the_states/emissionstargets_map.cfm
[17] This is the most current information as of the publishing of this report.
[18] Washington Department of Ecology: http://www.ecy.wa.gov/climatechange/CATdocs/06052007CATsummary.pdf
[19] House Bill Report: HB 3141, (2004). As Reported by House Committee On: Technology, Telecommunications & Energy: http://www.leg.wa.gov/pub/billinfo/2003-04/Pdf/Bill%20Reports/House/3141.HBR.pdf
[20] Sightline Institute: http://sightline.org/research/energy/res_pubs/backgrounder-climate-policy

SB 6508 (2006) This bill creates a renewable fuel standard that requires that biodiesel comprise a small percentage of all diesel sold in Washington and that all gasoline be blended with a small percentage of ethanol. The percentage of the renewable fuels mandated for sale will be increased over time as the Department of Agriculture determines if the state's farmers have the capacity to meet the demand.

I-937 (2006) This voter-passed initiative establishes a state renewable energy portfolio standard. It mandates that 3% of the state's energy come from non-hydro renewable sources by 2012 and 15% renewable sources by 2020.

SB 6001 (2007) This bill sets goals to reduce the state's GHG emissions to 1990 levels by 2020, 25% below 1990 levels by 2035, and 50% below 1990 levels by 2050. This bill also sets power plant performance standards to effectively eliminate coal plants that do not sequester CO_2 emissions from being built in the state, as well as limit new out-of-state electricity purchases produced at coal plants.

HB 2815 (2008) This bill directs the Department of Ecology to develop and implement a program to limit statewide greenhouse gas emissions; authorizes a reporting system to monitor greenhouse gas emissions; and creates a green collar job training account to train and transition workers to clean energy jobs.

In 2007 Governor Gregoire established a Climate Action Team whose report was finalized in 2008. The report outlines 24 strategies that will move Washington toward a low-carbon future. Additionally Ecology has completed a comprehensive plan to meet the State reduction goals. Information on both of these topics can be found at: http://www.ecy.wa.gov/climatechange.htm#CCP1 .

II. Emissions Inventory

A. 2005 City of Spokane Summary Table[21]

Size (2005)	**59.04**	Square Miles	City - Capital Programs
Population (2005)	**197,969**	From U.S. Census	Washington State Office of Financial Management
Annual Budget (2005)	**$637,880,126**	Total City Expenditures	2005 Expenditures, City Accounting
Employees	**1,870**	FTE	
Climate Zone	**"17"**	From website	http://www.energycodes.gov
1971-2000 Average Annual Heating Degree Days(HDD) Base 65 degrees Fahrenheit	**6,820**	Climatography of the United States No. 81	Supplement No. 2 Annual Degree Days to Selected Bases 1971 – 2000
1971-2000 Average Annual Cooling Degree Days(CDD) Base 65 degrees Fahrenheit	**394**	From website	http://www7.ncdc.noaa.gov
Annual HDD (Base 65) 2005	**7,122**	From website	http://www7.ncdc.noaa.gov Northeast Washington region
Annual CDD (Base 65) 2005	**300**	From website	http://www7.ncdc.noaa.gov Northeast Washington region
Scope 1 and 2 Emissions	**Number**	**MTCO2e**	**Total: 66,752 MTCO2e**
Buildings and other facilities	**102**	**11,938**	
Streetlights and Traffic Signals	**85**	**4,290**	
Water Delivery Facilities	**55**	**5,619**	
Wastewater Facilities	**31**	**8,612**	
Port Facilities	N/A	N/A	
Airport Facilities	N/A	N/A	
Vehicle Fleet	**1,201**	**10,399**	Table 5 in report below
Transit Fleet	N/A	N/A	
Power Generation Facilities	**1**	**0**	Upriver Dam
Solid Waste Facilities	**2**	**370**	
Other Process and Fugitive Emissions	**5**	**25,525**	
Scope 3 Emissions	**Number**	**MTCO2e**	**Total: 3,339 MTCO2e**
Employee Commute	**1,870**	**3,139**	
Waste-related emissions	**68,219** tons	**285**	Hauling ash to Rabanco Landfill in Roosevelt, WA
Compost "Clean Green"	**1,231** tons	**-85**	Parks & Streets Yard Waste
TOTAL Govt. Emissions		**70,835**	

[21] This table and the information on 'Scope(s)' is an addition in keeping with the September 2008 ICLEI protocol. For further information on 'Scope(s)' please see section III, A.

B. Community Inventory

The City of Spokane community inventory consists of the following sectors:

- **Residential:** Electricity, natural gas, and other heating fuel consumption from residential buildings.
- **Commercial/Industrial:** Electricity, natural gas, and fuel oil consumption from commercial and industrial facilities.
- **Transportation:** Gasoline and diesel fuel used by on-road vehicles and trains.
- **Waste:** Amount and composition of waste generated by residents, businesses, and by the construction and demolition sector.
- **Other:** Non-captured methane emissions from the Northside and Southside Landfills, from the Riverside Park Water Reclamation Facility, as well as non-captured methane emissions from Avista Utilities natural gas service to residential, commercial, and industrial buildings.

The operation of buildings and vehicles in the City of Spokane, combined with the disposal and decomposition of solid waste, resulted in the net emission of 3,229,308metric tons of CO2e in 2005. **Table 1** below shows the breakdown of community wide emissions by sector.

Table 1: City of Spokane 2005 Community Emissions Summary

Sector	Equiv CO_2 Emitted (metric tons)	% of Total	Energy Consumed (million Btu)[22]
Transportation	1,729,102	53.5	22,271,691
Residential	744,021	23.0	8,859,837
Commercial/Industrial	652,710	20.2	7,237,142
Waste	65,930	2.0	
Other	37,545	1.2	
TOTAL	3,229,308	100.0	38,368,670

[22] Greenhouse gas emissions from the Waste and "Other" sectors are not generated from burning fuel. Therefore, the energy consumed is zero. This is not to imply that energy is not involved. The energy used in waste collection and handling, for example, is captured in the transportation sector.

a. Transportation

Fossil fuels used to power cars, trucks, mass transit, and trains in the City of Spokane resulted in the emission of approximately 1,729,102 metric tons of CO2e in 2005, representing 53.5 percent of community-wide emissions. Within this sector, data was found for emissions associated with travel on the City's surface streets, including freeway on- and off-ramps, and the limited access freeways I-90 and SR-195. The majority of emissions from this sector (90.0 percent) were associated with travel on the City's surface streets, while travel on I-90 and SR-195 accounted for the release of just 135,098 metric tons of CO2e emissions.

BNSF Railway Co., Union Pacific, and National Railroad Passenger Corp. (Amtrak) rail activity in the City of Spokane are estimated to have emitted 21,173 metric tons of CO2e in 2005. Rail activity associated with the hauling of freight accounted for the majority of this total (98.9 percent). This total includes emissions from travel on rail lines as well as within rail yards.

The public's use of Spokane Transit Authority (STA) buses for mass transit is estimated to have contributed 5,674 metric tons of CO2e emissions in 2005. These emissions were the result of 34,288,907 passenger miles traveled on all STA routes, not just those within the City of Spokane. In 1990, STA buses averaged 4.02 MPG. This remained the MPG average for all STA buses until the end of 2005. Buses purchased since 2006 posses improved engine technology that yields a higher average of 4.97 MPG. This represents a 23.6 percent increase in fuel efficiency. The removal of 1990's era buses is scheduled to be complete in 2013.

Data regarding the two airports – Spokane International Airport (outside City limits) and Felts Field (within City limits) – owned in part by the City of Spokane were not counted even though air travel is often a significant source of greenhouse gas emissions. Allocation of air traffic emissions was not attempted in this inventory. This is an area for added effort as regional and state level inventorying moves forward. We do know the following quantities of fuels were dispensed at Spokane International in 2005: 17 million gallons of jet fuel; 107 thousand gallons of aviation gas; 35 thousand gallons of diesel; and 27 thousand gallons of unleaded gasoline.

Transportation Source Notes

Transportation data for emissions associated with automobiles was split into two different sections: the surface streets, including the freeway on- and off-ramps, and the limited access freeways I-90 and SR-395.

The surface street CO2e production was found using local trip survey data embedded in a Spokane Regional Transportation Council model, which then calculated, forecast, and reported the average daily vehicle miles traveled (ADVMT) for the city of Spokane during a wide array of years. This data was sent to the Washington Department of Ecology where State vehicle licensing information was used to generate data broken into vehicle types and percentages of on-road use. This data was aggregated by vehicle types into a format for the CACP software. The miles traveled by vehicle type, derived by multiplying the percentages of each by the total ADVMT, was entered into the CACP software which then provided the CO2e emission values.

To find the limited access freeway annual average vehicle miles traveled (AAVMT), Washington State Department of Transportation Annual Traffic Reports were used. Where this document could not be used, the City of Spokane Traffic Flow Map for average weekday traffic count numbers was used. The numbers were used as counts between both the city limits and the count locations. Each number represented a segment, or specific length, of the road.

Information regarding emissions from rail activity in the City of Spokane was provided by BNSF Railway Co., Union Pacific, and AMTRAK. This data was provided in the form of gallons of diesel used annually. For BNSF, figures were given for Spokane County, which were then scaled down to find emissions relevant to the City of Spokane. The emissions factor for commuter rail from the CACP software was used in determining emissions.

Information regarding STA was provided by Molly Myers. The emissions figure listed above was found by entering the passenger miles traveled (PMT) into the CACP software.

Information regarding the Airports came from Matt Breen. Data for Felts Field was not available as the fueling is done through private firms.

Outside Contacts
Anna Ragaza-Bourasa
Transportation/Air Quality Planner – Spokane Regional Transportation Council
Sally Otterson
Environmental Specialist – Washington State Department of Ecology
Lyle Staley
Manager Environmental Program Development – BNSF Railway Co.
John Germer
Manager Environmental Affairs – Union Pacific Railroad
Jeff White
Senior Environmental Coordinator – National Railroad Passenger Corp. (Amtrak)
Molly Myers
Communications Manager – Spokane Transit Authority
Matt Breen
Manager, Construction & Environmental Services – Spokane International Airport

Sources: 05-146 to 05-168

b. Residential, Commercial, and Industrial Buildings

Emissions derived from energy used in buildings in the City of Spokane equaled 1,396,731 metric tons CO2e, or 43.3 percent of community-wide emissions in 2005. By sector, emissions associated with residential buildings totaled 23.0 percent of community wide emissions, while emissions from commercial/industrial buildings totaled 20.2 percent. It is important to note that emissions related to City of Spokane government buildings and facilities are included in the community commercial/industrial sector as well as being in the government inventory.

Electricity production accounted for 64.5 percent of total building emissions, while natural gas use accounted for 31.3 percent. Based on national averages from the Energy Information Administration, the majority of these emissions were attributable to energy used in home appliances. Energy used in the heating and cooling of buildings also makes up a significant portion of this total.[23] The use of light fuel oil resulted in the release of 38,026 metric tons of CO2e, or 2.7 percent of total building emissions, while propane and fuel wood accounted for less than 1 percent combined.

[23] Energy Information Administration. http://www.eia.doe.gov/emeu/recs/recs2001/enduse2001/figure1.html

Residential, Commercial, and Industrial Source Notes

The electric and natural gas data for these sectors was provided by Avista Utilities for a one-year period beginning in fall 2006 and ending in 2007. The data was broken into separate zip codes that contained residents both completely and partially within city limits.

Zip Codes containing Residents completely within City Limits

99201	99204
99202	99205
99203	99207

Zip Codes Containing Residents both within and outside City Limits

99208	99218
99212	99223
99217	99224

The zip codes 99258, 99260, and 99026 were not included in the Avista Utilities information. These include the campus of Gonzaga University, Spokane County Administrative Center, and the northwestern-most sliver of the city limits, respectively. Spokane Clean Air data on regulated entities was used to partially fill these gaps and to gather other significant energy uses by industrial users.

Avista Utilities data was arranged hierarchically according to:

1. Zip Code
2. Residential or Commercial/Industrial sectors
3. Number of utility accounts, as well as total utility use by those accounts

Because the Avista Utilities data was not from 2005 and because sources for nearly one half of the data occurred both within and outside the city limits, two corrections had to be made. First, the data was projected back to 2005 using State Office of Financial Management population statistics. Second, Spokane County and City GIS data was used to determine the number of parcels within each zip code area and within each portion of the zip code areas lying within the City limits. This resulted in a percentage of parcels within the City for each of the zip codes, which was then used to estimate the number of utility users within the city limits. The calculated energy use within the City limits was then placed into the CACP software under the residential and commercial/industrial sectors. Additional residential and commercial energy use was derived from national and Spokane Regional Clean Air Agency data.

Outside Contacts
Pat Ehrbar
Avista Utilities
Ron Edgar
Chief of Technical Services – Spokane Regional Clean Air Agency

Sources: 05-001 to 05-014

c. Waste

During 2005, the City of Spokane generated 222,514 short tons of municipal solid waste (MSW), resulting in 65,930 metric tons of C02e emissions or 2.0 percent of the community-wide total. Of this total, 10,753 short tons of "Clean Green" yard waste were converted to compost, resulting in -1,669 metric tons of avoided C02e emissions, and 6,097 short tons of waste were disposed of at the City's Northside Landfill. The remaining waste, along with other regional waste, was disposed of via controlled incineration at the Waste-to-Energy facility.

The calculated CO2e emissions in this sector have been modified from the CACP software output to more align with a new government emissions protocol put out by ICLEI and others[24]. The new protocol assumes 35% of emissions are fossil fuel derived. This change has resulted in moderately higher emission levels. Use of the new protocol default fossil fuel quantity is supported by a single waste stream test conducted in Spring 2008 at the Waste-to-Energy Facility[25]. Emissions as output by the CACP software can be seen in Appendix B.

The incineration of 182,457 short tons of waste generated 178,017 MWhr of power. Excess power of 147,323 MWhr was sold to Puget Sound Energy of Bellevue, WA, for $12,520,636. The excess energy produced from the Waste-to-Energy facility would have been enough to furnish the electrical needs of 3,827 City of Spokane residences. Thus the CO2e emissions avoided as a result of this power could be 70,862 metric tons. This inventory does not credit the carbon dioxide emissions avoided due to the availability of this generated power.

The Waste-to-Energy facility significantly reduces the amount of waste. Ash quantity after incineration constitutes a 90 percent reduction in MSW by volume and 68 percent by weight.[26] An additional benefit of this facility involves the recovery of ferrous metals after MSW is incinerated. Metals recovered represent approximately 3.0 percent of the original weight of MSW. These metals are not recovered with traditional landfilling.[27] In 2005, 8,491short tons of ferrous metals (steel) were recovered from the Waste-to-Energy incineration process, resulting in the avoidance of 15,546 metric tons of CO2e. An additional 1,751 tons of "white goods" (appliances, etc.) was also collected at the Waste-to-Energy facility. Under ICLEI guidelines, recycling is considered to reduce emissions from upstream energy use and forest sequestration. Recycling materials is assumed to eliminate the need to use a comparable amount of virgin materials therefore eliminating the climate change impacts of harvesting and processing of the virgin materials.

Aside from the recovered ferrous metal mentioned above, the City of Spokane recycled 11,594 tons of various materials in 2005, resulting in the estimated avoidance of 38,615 metric tons of CO2e emissions. Of this total, 9,099 tons of recycled materials came from residential curb-side collection and 2,495 tons came from commercial collection. The recycling figures listed in this section have not been used to adjust the inventory total, but rather are included for reference.

The figures listed here for CO2e emissions avoided are derived from entering the amount of recycled materials into the CACP software. The CACP software does not account for CO2 emissions generated from burning materials other than those derived from fossil fuels. As a result, the recorded CO2e emissions from the Waste-to-Energy facility are relatively low. In reality,

[24] Appendix G, Table 2; *LocalGovernment Operations Protocol; Version 1, Sept. 2008; Developed in partnership by: California Air Resources Board, Galifornia Climate Action Registry, ICLEI-Local Governments for Sustainability, and The Climate Registry*
[25] Carbon Isotope Ratio Test, Spokane Regional Solid Waste, May 2008
[26] *Spokane Regional Solid Waste System Annual Report – 2005*
[27] Ibid

however, the Waste-to-Energy facility is a significant point source of CO2 emissions in the region. In 2005, the Waste-to-Energy facility total CO2 emissions were 289,052 metric tons, as estimated from stack tests taken from May 17-19, 2005, and corrected by average annual steam pressure and hours of unit operation over the year.

Waste Source Notes

City of Spokane solid waste data was compiled from information provided by the Solid Waste Management department and the Spokane Regional Solid Waste System. Four types of waste were identified through the analysis of the City's various waste collection routes and methods: residential waste, commercial/industrial/construction solid waste, self-hauled waste, and yard waste. The vast majority of this waste went through the Regional Waste-to-Energy Facility.

Information regarding the City's Northside and Southside Landfills was provided by the Solid Waste Management department. CO2e emissions associated with these landfills were estimated using CACP's "Waste-in-Place" assistant. These estimates have been compared to actual field data where available. Actual data are generally higher, and this can occur for a number of reasons, such as: the actual mass of waste in the landfill may be greater than believed; the organic content of the waste may be greater than estimated; and/or the methane generation rate may be accelerated for any number of reasons. Landfill gas emissions from the old, and now capped, landfills have been accounted for in the "Other" sector.

"Clean Green" information was provided by the Spokane Regional Solid Waste System. Emissions avoided information was estimated using the CACP software.

City Contacts
Lois Shields
Solid Waste Management
Russ Menke
Interim Director – Spokane Regional Solid Waste System
Damon Taam
Contract Manager – Spokane Regional Solid Waste System
Suzanne Tresko
Recycling Coordinator – Spokane Regional Solid Waste System

Sources: 05-113 to 05-145; 05-228 & 05-229

d. "Other"

In 2005, there were various direct CO2e emissions not captured in other sectors of this inventory representing 1.2 percent (37,545 metric tons) of community-wide emissions. From the City of Spokane Northside and Southside Landfills, an estimated 145,312 metric tons of CO2e emissions were released in the form of direct methane emissions. These landfills continue to release greenhouse gas emissions as a consequence of the historic dumping of waste that occurred. These emissions are a function of the organic content and quantity of the waste that was dumped and the availability of moisture to help drive the biological reactions that convert the waste to greenhouse gas emissions, most notably methane. The rate of emissions of greenhouse gases from landfills is particularly dependant on methane emissions, which are at least 21 times more potent (in regards to their global warming impact) than carbon dioxide and are accounted for in the CO2e inventory when they are not captured and burned. Carbon dioxide emitted from landfills, which typically results from the decomposition of paper, food, and plant waste, is not accounted for in this inventory because it is not derived from the combustion of fossil fuels (CO2 is frequently not CO2e). See **Figures 5** and **6** below for more information on estimated gas generation at the Northside and Southside Landfills.

The Northside Landfill is estimated to contain 3,310,578 tons of waste accumulated between 1950 and 1991, which resulted in the release of 18,657 metric tons of non-captured CO2e emissions in 2005. The Southside Landfill, which is estimated to contain 886,000 tons of waste accumulated between 1960 and 1987, released 6,334 metric tons of non-captured CO2e emissions in 2005. In 1990, 145,312 metric tons of CO2e emissions were released from the Northside and Southside Landfills combined, due to the difference in landfill characteristics and the methane-capture technology at these sites. The Southside Landfill was covered and capped with a gas-extraction/flare system in 1988. The Northside Landfill's cap and associated gas-extraction/flare system was fully in place in 1992.

Escaped methane and carbon dioxide emissions from Avista Utilities natural gas service to residential, commercial, and industrial buildings is estimated to have released 12,171 metric tons of CO2e in 2005.

Escaped methane emission from the treatment of wastewater at the Riverside Park Water Reclamation facility is estimated to have released 382 metric tons of CO2e in 2005.

"Other" Source Notes

The landfill CO2e emissions result from the processes mentioned above and the capture efficiency of the gas-extraction systems put in place. For this inventory, we based our estimates of landfill gas-extraction efficiency on "best judgments" of Jay Dehner, a landfill engineer with CH2M-HILL who was involved in the initial designs and installations of the systems. According to Dehner:

> Capture efficiency of these systems have varied over their current life cycle. Given that the Southside Landfill has been in operation longer, and gas generation is reduced to the point where flare operation is intermittent, it likely has a lower efficiency compared to the Northside Landfill. The following ranges would be our best guess at the range of operating efficiencies for these systems:
>
> Northside Landfill: Historic Range 90% to 75%; Current Operation at least 75%
> Southside Landfill: Historic Range 90% to 60%; Current Operation at least 60%

Based on the above information, and the fact that the flaring system was not in place at the Northside Landfill until 1992, we chose the following capture efficiencies for our inventories: Northside Landfill 5 percent, 80 percent, and 75 percent; Southside Landfill 90 percent, 75 percent, and 70 percent; each 1990, 2000, and 2005, respectively. The CACP software's Waste-in-Place assistant was used to calculate the emissions for each of the landfills and their inventoried years using its default settings. Actual measurements from the field in 2005 indicate that the CACP software is likely underestimating the landfill gas generated by approximately 50 percent for both landfills. Information regarding waste volumes and active periods for each landfill were found in two CH2M-HILL reports: the "North Landfill Closure & Future Operations Plan," and the "Southside Landfill Closure Plan."

Information regarding escaped methane and carbon dioxide emissions from natural gas service to residential, commercial, and industrial buildings was provided by Avista Utilities. Avista calculated their corporate emissions based on an American Gas Association protocol[28] and indicated that the loss in Spokane could be estimated as 43.5 percent of the total.

[28] American Gas Association; Greenhouse Gas Emissions Estimation Methodologies, Procedures, and Guidelines For The Natural Gas Distribution Sector; prepared by innovative environmental solutions, inc.; April 18, 2008

Data used to estimate direct CO2e emissions associated with biogas loss from the City of Spokane Riverside Park Water Reclamation Facility was provided by Tim Pelton, Administrative Superintendent with the Riverside Park Water Reclamation Facility. He noted biogas loss from the digester system is typically less than one percent.

City Contacts
Lloyd Brewer
Environmental Programs Manager
Tim Pelton
Administrative Superintendent – Riverside Park Water Reclamation Facility
Outside Contacts
Kevin Booth
Avista Utilities
Jay Dehner
CH2M-HILL

Sources: 05-179 to 05-188

Figure 5: Estimated Gas Generation at the Northside Landfill
Source: CH2M-HILL: *North Landfill Closure & Future Operations Plan*

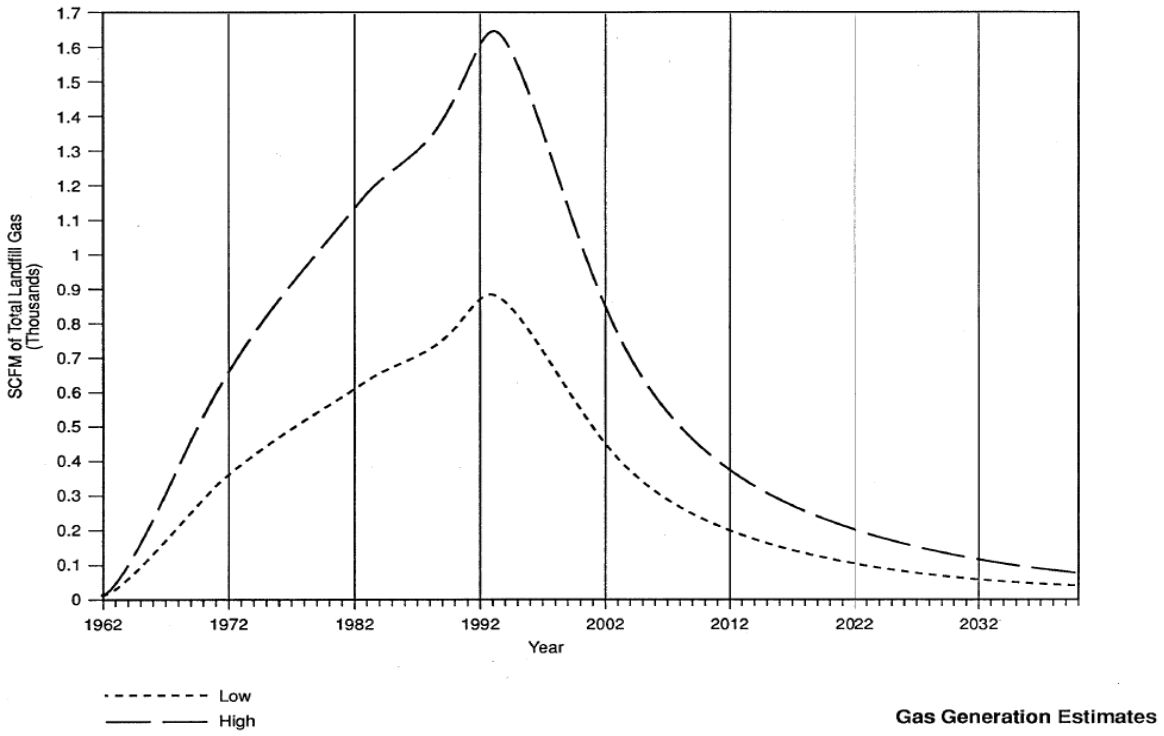
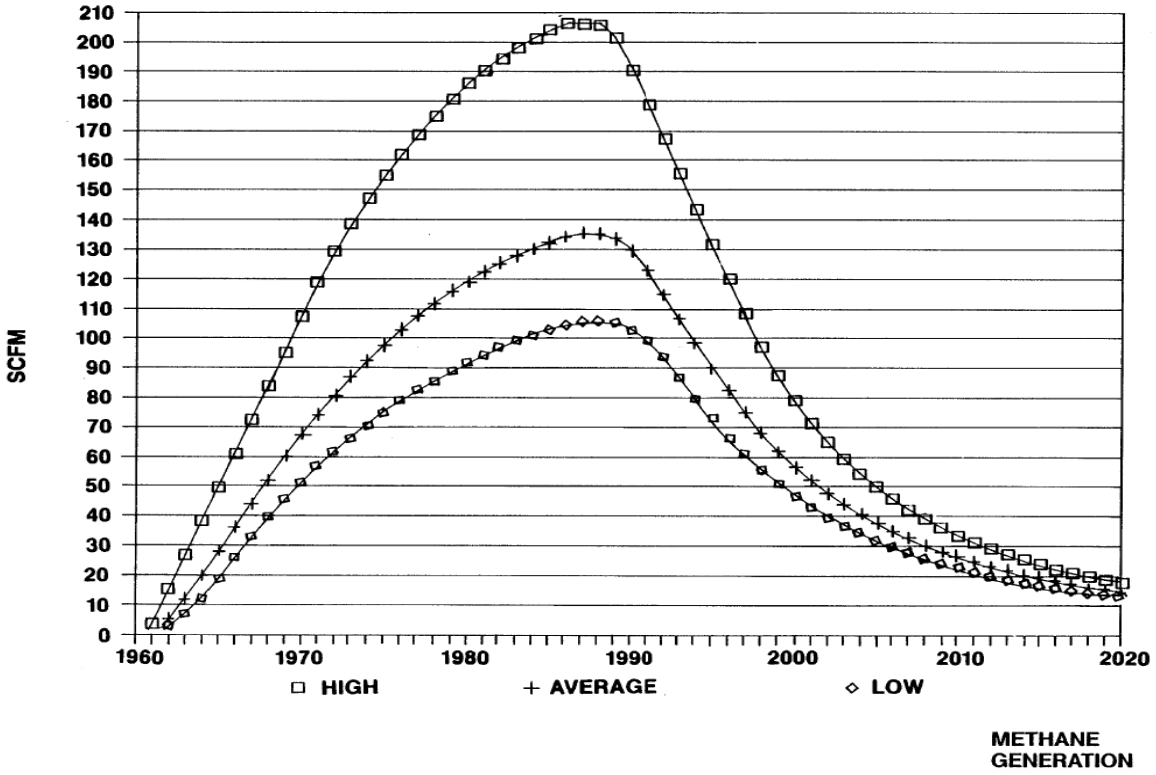


Figure 6: Estimated Gas Generation at the Southside Landfill
Source: CH2M-HILL: *South Landfill Closure Plan*



Community Emissions Comparison between 2005 and 1990:

Table 2: Comparison between 1990 and 2005 Community Emissions by Sector and Source

Sector & Source	2005 CO_2e Emitted (metric tons)	Est. 1990 CO2e Emitted (metric tons)	% Change
Residential - Electricity	465,098	427,469	8.8
Residential - Natural Gas	234,939	210,250	11.7
Residential - Other	43,985	80,856	-45.6
Comm./Industrial - Electricity	435,573	400,334	8.8
Comm./Industrial - Natural Gas	216,740	175,424	23.6
Comm./Industrial - Other	397	--[29]	( )
Transportation - Gasoline	1,380,536	1,399,862	-1.4
Transportation - Diesel	348,566	181,494	92.1
Waste	65,930	57,872	13.9
Other	37,545	145,916	-74.3

Table 3: Comparison between 2005 and 1990 Community Emissions by Sector

Sector	2005 CO_2e Emitted (metric tons)	Est. 1990 CO_2e Emitted (metric tons)	% Change
Total Residential	744,021	643,500	15.6
Total Comm./Industrial	652,710	546,191	19.5
Total Transportation - Gasoline and Diesel	1,729,102	1,581,356	9.3
Waste	65,930	57,872	13.9
Other	37,545	145,916	-74.3
All Sectors	3,229,308	2,974,835	8.6

Please note that the percentage change in the "All Sectors" category is not the sum of "% Change" across all previous rows, but the percent increase of CO2 between 1990 and 2005 in the "All Sectors" row.

[29] We do not have 1990 data. This parameter dropped from 5,736 metric tonnes CO2e in 2000 to 397 in 2005 largely reflecting a move away from petroleum based fuels to gas and electric. The value here then could be as high as 16,017.

C. Government Inventory

The City of Spokane government inventory consists of the following sectors:

Direct City Government Control

- **Buildings:** Electricity and natural gas consumption from government buildings and facilities.
- **Water & Sewer:** Electricity, natural gas, and fuel consumption for the operation of the Riverside Park Water Reclamation facility (wastewater treatment plant), wastewater pumps and drinking water pump stations, wells, and reservoirs.
- **Vehicle Fleets:** Gasoline and diesel fuel used by various City-owned motor vehicles and equipment, such as passenger cars, vans, light and heavy trucks, portable pumps, and generators.
- **Streetlights:** Electricity use resulting from the operation of outdoor lighting, such as streetlights, traffic signals, illuminated pedestrian signs, and floodlights, including those located in City Parks.
- **Solid Waste:** The amount and composition of waste generated by City employees at the buildings and facilities operated by the City, as well as the amount and composition of waste generated within all City Parks and during the wastewater treatment process.
- **Other:** Non-captured methane emissions generated from the decomposition of waste in the Northside and Southside Landfills, from the Riverside Park Water Reclamation Facility, and emissions from refrigerant used in the City's vehicle fleet.

Indirect City Government Impact

- **City Employee Commute:** Fuel used by City employees who commute to and from work in vehicles (assumed to be full-sized automobiles using gasoline).
- **Long-haul Export of Waste:** Fuel used by contracted vehicles hauling the City of Spokane's Waste-to-Energy facility flyash and "Clean Green" materials.
- **Urban Green Space:** The City of Spokane's parks and conservation land, as well as an estimate of the number of trees on these lands.

In 2005, emissions from the operation of the City of Spokane's government equaled 70,835 metric tons of CO_2e. Government emissions in the City of Spokane constitute approximately 2.2 percent of the City of Spokane's total emissions. In most other greenhouse gas inventories, local government emissions typically fall between 2 to 5 percent of overall community emissions. As a minor contributor to total emissions, actions to reduce government energy use may have a limited impact on the City of Spokane's overall community emissions levels. However, government action has symbolic value and demonstrates leadership that extends beyond the magnitude of emissions actually reduced. **Table 4** below shows the breakdown of government operations emissions by sector.

Table 4: City of Spokane 2005 Government Emissions Summary

Sector	Equiv CO_2 Emitted (metric tons)	% of Total	Energy Consumed[30] (million Btu)	Cost ($)
Buildings	11,938	16.9	132,280	$3,501,563.61
Water & Sewage	15,259	21.5	285,950	$2,449,697.48
Vehicle Fleet	10,399	14.7	131,368	$2,152,285.49
Streetlights	4,290	6.1	35,732	$1,783,421.81
Employee Commute	3,139	4.4	40,590	
Waste	285	0.4		$266,697.48
Other	25,525	36.0		
TOTAL	70,835	100%	625,918	$10,153,665.88

a. Government Buildings

In 2005, energy used in government buildings accounted for 16.9 percent of the City of Spokane's total government emissions. The top four emitters within this sector were the Parks & Recreation department (28.6 percent), Street department (50.8 percent), Fire department (14.5 percent), and City Hall (12.3 percent). Other departments and agencies included in this sector are the Library department (9.8 percent), the Solid Waste Management department (7.1 percent), the Fleet Services department (5.1 percent), Real Estate Services (i.e. the intermodal transportation facility) (4.9 percent), the Police department (1.6 percent), and the Public Defender department (1.0 percent). Emissions from the Police department do not take into account buildings used jointly by the City and County. Of the 11,938 metric tons of C02e emitted by the buildings sector, 71.1 percent was associated with the consumption of electricity, clearly highlighting the importance of energy efficiency measures in City buildings.

Government Buildings Source Notes

Most buildings owned and operated by the City of Spokane and City agencies and those that occupy leased space are served by Avista Utilities. City departments were asked to furnish their utility billing data for calendar years 1990, 2000, and 2005. A number of departments requested this data from Avista Utilities. Consumption and expenditure data were generally available for 2005, but 2000 data was available for only a few departments, and 1990 data was next to nonexistent. Available data was then separated into the following categories: electricity (kilowatt-hours), natural gas (therms), demand (another electricity billing parameter), streetlight (kilowatt-hours), and area light (kilowatt-hours). When a flat rate was provided, it was assumed to be either natural gas or electricity depending on circumstances and observation. In situations where multiple departments were located in the same building, the responsibility for greenhouse gas emissions was attributed to the utility bill holder.

City Contacts

Dorothy Webster	**Roger Sothen**	**Lorie Butz**
Director – Admin. Services	Info Analyst – Fire.	Accountant – Fleet Services

[30] The Waste and "Other" sector do not involve emissions generated from fuel combustion and therefore show no energy consumed.

Patricia Partovi Director – Library	**Judy Moss** Accountant – Parks & Rec.	**Patti Robbins** Accounting Clerk – Police.
Sue Rayman Accountant – Public Defender	**Lois Shields** Accountant – Solid Waste.	**Matt Doval** Accountant – Street.
Kevin Brooks Accountant – Wastewater Mgmt.	**Mary McIntyre** Accountant – Water Dept.	
Sources: 05-015 to 05-061		

b. Water and Sewage

Energy used in the distribution and treatment of water and sewage (wastewater) accounted for 15,259 metric tons of CO2e emissions, or 21.5 percent of the government total. The majority of emissions from this sector (59.3 percent) were attributable to wastewater operations. Although wastewater operations service a number of areas outside of the City of Spokane city limits, all CO2e emissions from the City facility have been included in this inventory due to the location of the wastewater treatment facilities within city limits. Of the emissions listed in this inventory, approximately 77.1 percent were attributable to actual wastewater from City of Spokane residents. The City of Spokane Valley portion was estimated at 16.2 percent, Spokane County 3.5 percent, Fairchild Air Force Base 1.7 percent, Airway Heights 1.2 percent, and Geiger Heights less than 1 percent.

In 2005, 71.3 percent of methane generated during the treatment of organic solids in anaerobic digesters was captured and used for energy, resulting in the avoidance of 3,571 metric tons of CO2e emissions. The remaining methane was flared. Carbon dioxide generated in the flaring or burning of methane from the wastewater anaerobic digesters does not count as emitted CO2e by the CACP software as the carbon dioxide equivalent released from methane flaring is at least 21 times less than that which would result if the methane were directly released, and no more than an equivalent amount if the organic matter decomposed on its own in an aerobic environment. In addition, the source organic material is considered “old carbon” (non-fossil-fuel based carbon) and thus a part of the current carbon cycle.

Energy used to run the City’s water operations in large part is derived from non-CO2e emitting hydroelectric power from Upriver Dam. The actual amount of Avista power used for this purpose varies from year to year, both due to the varing amounts of snow pack and timing of the run off, and due to the summer water demand which varies with precipitation and heat. In 2005 about 34.7% of the power use came from Avista without power compensation from Upriver Dam. Aside from 6,201 metric tons of CO2e emissions associated with Water department administrative and shop operations, CO2e emissions avoided in water operations due to hydroelectric power total 10,585 metric tons. This does not account for the 41,757,186 kilowatt hours of excess power from Upriver Dam sold to Avista.

In addition, approximately 3,294 dry tons (52,702 cubic yards) of wastewater biosolids were recycled onto farm land as fertilizer amendment in the Spokane region. Emissions associated with the fuel used for transporting this material is accounted for in the Vehicle Fleet sector.

Water and Sewage Source Notes

Water, wastewater, and stormwater pumping and treatment energy use data were broadly collected, but only the Water department, Wastewater department, and Parks & Recreation department's Indian Canyon Well energy use is included in this section. Other data collected but not included in this sector were sprinkler systems and water features from the Parks & Recreation and Solid Waste departments. Sprinkler systems and water feature consumption and expenses were not specifically labeled on utility bills and were therefore derived, through the assistance of department staff, as accounts providing energy for the movement and distribution of water.

Sewage (wastewater) data was provided by the Wastewater Management department, and includes the Avista utility billing information from the Riverside Park Water Reclamation Facility account. Other consumption and emissions data, such as diesel generators and methane production and use from boilers and flaring, are also included in the Sewage total. Tim Pelton, Administrative Superintendent at the Riverside Park Water Reclamation Facility, estimates that approximately 10 percent of the Avista utility billing from the Riverside Park Water Reclamation Facility account is attributable to facility space heating and cooling, while the remainder goes toward water treatment. These building-sector-type emissions have specifically been left in the Water and Sewage sector so that the full emissions from these departments could be accounted for in one place.

City Contacts
Timothy Pelton
Administrative Superintendent – Riverside Park Water Reclamation Facility
Mary McIntyre
Accountant – Water department
Mallur Nandagopal
Electrical Engineer – Water department

Sources: 05-044 to 05-061

c. Vehicle Fleet

City of Spokane government fleet vehicles and employee vehicles used for government business consumed a total of 684,822 gallons of diesel fuel and 371,699 gallons of unleaded gasoline in 2005, resulting in the release of 10,399 metric tons of CO2e emissions. This represents 14.7 percent of total government emissions.

When the amount of greenhouse gas emissions from government vehicles is broken down by department, the Solid Waste Management department was the largest contributor (40.5 percent). The next three highest emitters were the Police Department (14.6 percent), the Street department (11.4 percent), and the Wastewater Management department (9.7 percent).

Emissions associated with City of Spokane employee use of personal vehicles to conduct government business were also included in this sector. In 2005, it is estimated a total of 213 metric tons of CO2e were emitted as a result of this practice.

Vehicle Fleet Source Notes

The government vehicle fleet was examined by both vehicle turnover as well as fuel consumed. In 2005, three departments purchased fuel directly from wholesalers: Fleet Services, the Fire Department, and Wastewater Management. These fuel purchases by fuel type were accounted for in the inventory. In addition, other departments' fuel-use data was provided by Fleet Services. A breakdown of fuel use by department can be seen in Table 2 below. Information regarding departmental vehicle types is also listed in this table. Unfortunately, specific fuel-use data per vehicle was not available. To generate greenhouse gas data, it was assumed that gasoline was combusted in standard size autos and diesel was combusted in heavy trucks. In reality, the City fleet is quite diverse ranging from motorcycles to caterpillar tractors, and in 2005 even included two gas hybrid vehicles.

Four groups of data provided by the Fleet Services Department were used to determine types and number of City vehicles: the total inventory of vehicles in 2005, a list of vehicles sold between 1994 and 2005, the total inventory of vehicles in 2000, and a list of vehicles sold between 1994 and 2000. Sold vehicles have been subtracted from the totals to find the number of vehicles in the inventory for both 2000 and 2005. Vehicle totals for each department are also provided in **Table 5**.

Data concerning employee use of personal vehicles for City of Spokane government business was provided by Laura Roberson in the City's Vehicle Fleet department.

City Contacts

Lorie Butz
Accountant – Fleet Services

Laura Roberson
Accountant – Accounting

Sources: 05-062 to 05-077

Table 5: City of Spokane Vehicle Fleet Emissions Summary--Year 2005

	Gas-powered Vehicles	Diesel-powered Vehicles	Gasoline (gallons)	Diesel (gallons)	CO2e (metric tons)
Solid Waste Mgmt. Dept.	24	122	15,051	422,252	4,213
Police Dept.	276	4	155,294	279	1,514
Street Dept.	40	109	27,777	94,841	1,184
Wastewater Mgmt. Dept.	44	56	26,547	78,127	1,008
Water & Hydroelectric Services	95	70	41,951	43,722	829
Fire Dept.	31	42	11,385	57,194	660
Parks Dept.	50	32	27,612	11,866	383
Motor Pool	12	3	8,162	110	81
Code Enforcement	3	4	4,022	2,673	65
Engineering Services	14	0	6,602	0	64
Fleet Services	31	9	3,104	2,837	58

Please note that the table above includes only those departments that emitted more than 50 metric tons of C02e in 2005.

d. Streetlights and Traffic Signals

Electricity consumption from the City of Spokane streetlights, traffic and pedestrian signals, and area lights attached to buildings accounted for 6.1 percent of total government emissions in 2005, resulting in the release of 4,290 metric tons of CO2e emissions. The installation of LED bulbs in most red and green traffic lights has resulted in the avoidance of more than 510 metric tons of CO2e annually.

Streetlights and Traffic Signals Source Notes

Streetlight information was obtained from Avista utility billing as provided by each City department or agency. The types of outdoor lighting within the streetlight sector include streetlights, traffic lights, and area lights associated with buildings. Lights within government public parking lots and City parks were also included in this sector. In regards to area lights associated with buildings, this sector of the inventory only reflects those accounts that are metered and billed. In a number of locations throughout the City, energy used for lighting is combined with facility energy use and is therefore captured in the Government Buildings sector. In addition, other than traffic control lighting, Avista Utilities is under contract to maintain most of the City's street lighting.

City Contacts

Matt Doval
Accountant – Street department

Sources: 05-078 to 05-081

e. Employee Commute

In 2005, Employees commuting to work in personal vehicles consumed an estimated 323,159 gallons of unleaded gasoline, resulting in 3,139 metric tons of CO2e emissions, 4.4 percent of total government emissions. In deriving this estimate, it was assumed that all employees (1,870) commuted via gasoline-powered full-size automobile. Furthermore, it was assumed that they all traveled the same distance (6.7 miles) and did so 240 days of the year. Since the first employee commute trip reduction surveys were conducted in 1993, the average commute trip length has decreased from a high of 7.9 miles one way to the 2005 level of 6.7 miles.

Employee Commute Source Notes

Although technically outside the scope of direct government operations, emissions from City employees who drive to work were included to provide a more accurate depiction of government-related emissions. These emissions are included in the ICLEI methodology in part because they can be influenced by government policy and can thus provide a mechanism to help achieve adopted goals. Information for this section comes from the Civil Service department, which provided City government employee totals for 1990, 2000, and 2005. Additional information was taken from Department of Transportation Commute Trip Reduction 2005 Survey reports for three City facilities: City Hall, the Public Safety building, and the North Foothills complex. Utilizing Geographic Information System (GIS) technology, a standard commute length was determined by averaging the distance to work of four zip code areas where large numbers of City employees reside. This figure was then extrapolated for the entire City of Spokane government workforce and multiplied by the total number of workdays annually to determine emissions totals.

City Contacts

Lura Robson
Department Secretary II – Civil Service

Mary Ann Carey
Commute Trip Reduction Coordinator – City of Spokane
Gayle Tucker
Commute Trip Reduction Coordinator for Public Safety Building – City of Spokane

Sources: 05-169 to 05-178

f. Solid Waste

During 2005, the City of Spokane government is estimated to have generated 75,581 short tons of solid waste, resulting in 285 metric tons of CO2e emissions or 0.4 percent of the government total. Of the total waste, 461 short tons of yard waste were converted to compost, resulting in 84,524 metric tons of avoided CO2e emissions. In addition, 441 short tons of "grit" from sewage treatment were sent to the landfill. The remaining waste was disposed of via controlled incineration at the Waste-to-Energy facility.

In regards to recycling, City government employees recycled 79 tons of materials in 2005, resulting in the estimated avoidance of 201 metric tons of C02e emissions. This figure has not been used to adjust the inventory total; rather, it is listed here for reference.

The calculated CO2e emissions in this sector have been modified from the CACP software output to more align with a new government emissions protocol put out by ICLEI and others[31]. The new protocol assumes 35% of emissions are fossil fuel derived. This change has resulted in moderately higher emission levels. Use of the new protocol default fossil fuel quantity is supported by a single waste stream test conducted in Spring 2008 at the Waste-to-Energy Facility[32]. Emissions as output by the CACP software can be seen in Appendix C.

Solid Waste Source Notes

Solid Waste data was compiled from information provided by the City of Spokane Utilities Billing Office, the Parks & Recreation department, and the Wastewater Management department. Data from the Utilities Billing Office was provided in codes that signified types of containers, frequency of pick up, point of disposal, types of waste and recyclables, as well as additional costs. As this data for City government facilities was usually provided in volume rather than weight, conversions were necessary to make use of the data in the CACP software. A number of resources were used for determining these conversions, including a waste flow analysis from the *2007 Spokane County Comprehensive Solid Waste Management Plan Update*, the *Seattle Public Utilities 2001-02 Litter Composition Study: Final Report*, and the *1999 Statewide Waste Characterization Study* from the California Integrated Waste Management Board. Discussions with Jim Haynes, Industrial Recycling Consultant with Spokane Regional Solid Waste, who has extensive experience locally in waste quantities and types disposed, also provided information for this sector. The waste stream makeup was categorized into either broad (commercial waste) or focused (trucking/warehousing) waste. The initial waste stream consisted of 60 different waste products and their percentages. This total was refined to coordinate with the CACP software, resulting in five different waste streams and their percentages of paper products, food waste, plant debris, wood/textiles, and all other waste. The government waste was then allocated into one of 10 waste types, each varying in percentage combinations of the five waste streams mentioned above. A breakdown of these waste types can be seen in **Table 6** below.

[31] Appendix G, Table 2; *LocalGovernment Operations Protocol; Version 1, Sept. 2008; Developed in partnership by: California Air Resources Board, Galifornia Climate Action Registry, ICLEI-Local Governments for Sustainability, and The Climate Registry*
[32] Carbon Isotope Ratio Test, Spokane Regional Solid Waste, May 2008

In addition to standard solid waste pickup, solid waste from the Parks & Recreation department also included self-hauled yard waste. This data was provided in the form of receipts from the Spokane Waste to Energy facility and was categorized into either "yard waste," "compost," or "general."

"Special" solid waste data for wastes carried to the wastewater treatment plant via the sewage/stormwater collection systems, and then removed in the initial treatment steps, was provided by the Wastewater Management department.

Data for "Grit" (wastewater-contaminated gravels disposed of at the Northside Landfill) is included in the managed landfill figures and the "Screenings" (lighter, bulky material, such as wood chunks, paper, and cloth) data is included in the controlled incineration figures.

Waste recycling varied between departments and buildings, and was noted where data was available. Emissions associated with recycling were not included in the inventory except for the fuel used to collect and transport these materials.

City Contacts
Russ Menke
Director – Spokane Regional Solid Waste System
Jim Haynes
Industrial Recycling Consultant – Spokane Regional Solid Waste System
Ron Nicodemus
Manager – Utilities Billing
Damon Taam
System Contract Manager – Spokane Regional Solid Waste System
Judy Moss
Accountant- Park & Recreation Dept.

Sources: 05-044 to 05-061; 05-228 & 05-229

Table 6: Types of Waste and their Percent Makeup

	Paper	Food	Plant	Wood	Other
Type 1 (Office)	70.5	2.5	5.6	5	16.4
Type 2 (Fire Station)	44.6	7	1.1	11.6	35.7
Type 3 (Repair Shop)	26.4	6	3.1	6.7	57.8
Type 4 (Garage)	32.6	3.9	2.3	14.1	47.1
Type 5 (Parks)	8.1	0	0	0	91.9
Type 6 (Community Centers)	40.9	6.9	7.6	19.3	25.3
Type 7 (Golf)	11.9	0	0	0	88.1
Type 8 (Compost)	0	0	100	0	0
Type 9 (WTE Plant/Transfer Sts.)	31.1	21.3	5	8.1	34.5
Type 10 (Northside Landfill)	6	0	2.1	24	67.9

Source: *Spokane County Comprehensive Solid Waste Management Plan Update*, the *Seattle Public Utilities Litter Composition Study 2001-02*, and the *1999 Statewide Waste Characterization Study* from the California Integrated Waste Management Board.

g. "Other"

In 2005, emissions attributed to the "Other" sector were the largest contributor (25,525 metric tons of CO2e or 36.0 percent) to the City of Spokane's total government emissions. The sources included in this sector are direct CO2e emissions from the Northside and Southside landfills, biogass emissions from the treatment of wastewater, and emissions associated with the use of refrigerant in the City's vehicle fleet.

From the City of Spokane Northside and Southside Landfills, an estimated 24,991 metric tons of CO2e emissions were released in the form of direct methane emissions. These landfills continue to release greenhouse gas emissions as a consequence of the historic dumping of waste that occurred. These emissions are a function of the organic content and quantity of the waste that was dumped and the availability of moisture to help drive the biological reactions that convert the waste to greenhouse gas emissions, most notably methane. The rate of emissions of greenhouse gases from landfills is particularly dependant on methane emissions, which are at least 21 times more potent (in regards to their global warming impact) than carbon dioxide and are accounted for in the CO2e inventory when they are not captured and burned. Carbon dioxide emitted from landfills, which typically results from the decomposition of paper, food, and plant waste, is not accounted for in this inventory because it is not derived from the combustion of fossil fuels (CO2 is frequently not CO2e). See **Figures 5** and **6** above for more information on estimated gas generation at the Northside and Southside Landfills.

The Northside Landfill is estimated to contain 3,310,578 tons of waste accumulated between 1950 and 1991, which resulted in the release of 18,657 metric tons of non-captured CO2e emissions in 2005. The Southside Landfill, which is estimated to contain 886,000 tons of waste accumulated between 1960 and 1987, released 6,334 metric tons of non-captured CO2e emissions in 2005. In 1990, 145,312 metric tons of CO2e emissions were released from the Northside and Southside Landfills combined, due to the difference in landfill characteristics and the methane-capture technology at these sites. The Southside Landfill was covered and capped with a gas-extraction/flare system in 1988. The Northside Landfill's cap and associated gas-extraction/flare system was fully in place in 1992.

As a result of the wastewater treatment process digester, an estimated maximum of 382 metric tons of CO2e emissions were emitted in 2005 in the form of methane gas loss.

The Solid Waste Department collected refrigerant from various discarded household appliances (i.e. refrigerators and air conditioners) resulting in 102 metric tons CO2e emissions avoided. Fleet Services issued 85 pounds of refrigerant to fleet vehicles, reusing approximately 20 pounds of the captured refrigerant mentioned above. Assuming Fleet Services use of refrigerant is the result of prior refrigerant loss, an estimated 50 metric tons of CO2e were emitted in 2005.

"Other" Source Notes

The landfill CO2e emissions result from the processes mentioned above and the capture efficiency of the gas-extraction systems put in place. For this inventory, we based our estimates of landfill gas-extraction efficiency on "best judgements" Jay Dehner, a landfill engineer with CH2M-HILL who was involved in the initial designs and installations of the systems. According to Dehner:

Capture efficiency of these systems have varied over their current life cycle. Given that the Southside Landfill has been in operation longer, and gas generation is reduced to the point where flare operation is intermittent, it likely has a lower efficiency compared to the Northside Landfill. The following ranges would be our best guess at the range of operating efficiencies for these systems:

Northside Landfill: Historic Range 90% to 75%; Current Operation at least 75%
Southside Landfill: Historic Range 90% to 60%; Current Operation at least 60%

Based on the above information, and the fact that the flaring system was not in place at the Northside Landfill until 1992, we chose the following capture efficiencies for our inventories: Northside Landfill 5 percent, 80 percent, and 75 percent; Southside Landfill 90 percent, 75 percent, and 70 percent; each 1990, 2000, and 2005, respectively. The CACP software's Waste-in-Place assistant was used to calculate the emissions for each of the landfills and their inventoried years using its default settings. Actual measurements from the field in 2005 indicate that the CACP software is likely underestimating the landfill gas generated by approximately 50 percent for both landfills. Information regarding waste volumes and active periods for each landfill were found in two CH2M-HILL reports: the "North Landfill Closure & Future Operations Plan," and the "Southside Landfill Closure Plan."

Information regarding direct C02e emissions associated with biogas loss from the City of Spokane Riverside Park Water Reclamation Facility was provided by Tim Pelton, Administrative Superintendent with the Riverside Park Water Reclamation Facility.

Geoff Glenn, Hazardous Waste Coordinator with the Solid Waste Management Department, provided information on refrigerant collection, disposal, and reuse. Lorie Butz provided information on Fleet Services use, and reuse of refrigerant.

City Contacts
Tim Pelton
Administrative Superintendent – Riverside Park Water Reclamation Facility
Lorie Butz
Accountant – Fleet Services
Outside Contacts
Jay Dehner
CH2M-HILL

Sources: 05-179 to 05-188

h. Solid Waste Export

The use of container trucks and BNSF Railway Co.'s rail system to haul 68,219 short tons of incinerated solid waste ash 200 miles to Rabanco Regional Landfill in Roosevelt, WA, is estimated to have resulted in the emission of 293 metric tons of CO2e in 2005.

The use of container trucks to transport "Clean Green" composting materials 190 miles to Threemile Canyon Farms in Boardman, OR, is estimated to have resulted in the emission of 237 metric tons of CO2e in 2005. In 2007, the composting contractor was changed to Royal Organics in Royal City, WA, reducing the distance traveled by approximately one third.

The vehicles used to haul these wastes are not operated directly by the City, but are under private contract with Spokane Regional Solid Waste System. For this reason, their emissions are listed for reference but not included in government totals.

Local large-scale composting at Spokane Regional Solid Waste System's composting facility in Colbert, WA, was attempted twice using two different contractors. Both attempts failed, however. The first failure was due to an inability to control odors upsetting local residents, and the second time due to herbicide contamination carried through the composting process via grass clippings.[33]

Solid Waste Export Source Notes

Ash produced in the incineration of solid waste (MSW) at the Spokane Regional Solid Waste System Waste-to-Energy facility is exported to Rabanco Regional landfill in Klickitat County, WA. Via container truck, ash is transported at the average rate of eight to fifteen container trucks per day to the BNSF Intermodal Hub Center for rail delivery to the landfill. It was assumed that 15 heavy trucks traveled 12.5 miles per day from the Waste-to-Energy facility to the BNSF Intermodal Hub Center 365 days per year. In addition, emissions associated with the rail transport of this flyash were found by dividing the weight of the flyash (68,219 short tons) by the gross ton mileage of a BNSF train (756.7 gross ton miles per gallon). This figure was multiplied by the distance to Rabanco Regional Landfill in Klickitat County, WA (200 miles). This total was multiplied by the CACPS emissions factor for trains of ~0.0096 metric tons of CO2e per gallon of diesel fuel combusted.

Suzanne Tresko, Recycling Coordinator with the Spokane Regional Solid Waste System, provided information on the collection and export of "Clean Green" materials. "Clean Green" materials are collected at system sites and hauled under a contract with Waste Management of Spokane, Inc. Between 2003 and 2007, these materials were transported to Threemile Canyon Farms in Boardman, OR, at the average rate of two double-container trucks per day. Since 2007, these materials have been hauled to Royal Organics in Royal City, WA, where they are mixed with mint residue and marketed as compost material.

City Contacts
Suzanne Tresko
Recycling Coordinator – Spokane Regional Solid Waste System

Sources: 05-134 to 05-138, 05-142

[33] Spokane Regional Solid Waste System *2007 Annual Report*

i. Urban Green Space

The City of Spokane has more than 9,000 acres of open space, which includes more than 4,100 acres of parks and conservation land.[34] In addition, there are more than 78,000 trees on the City's parks and right-of-way land, including more than 29,000 park trees. There are a large number of trees existing on privately owned land, totaling an estimated 50,000 to 60,000. An additional 70,000 to 80,000 trees exist on the City's conservation land. It is estimated that roughly one half of the dry mass of a typical tree consists of carbon that was separated from CO2 by photosynthesis. As a tree grows, it converts CO2, releasing the oxygen but sequestering the carbon in the mass of its roots, trunk, branches, and leaves.

Urban Green Space Source Notes

Information regarding the City of Spokane's amount of open space was provided by the Planning Services department. An estimate for the number of trees in the City of Spokane was derived from a 1997 report from Natural Path Forestry Consultants, Inc. – *A Comprehensive Urban Forestry Management Plan for the City of Spokane, Washington* – and discussions with the City of Spokane Parks & Recreation department and Jim Flotts, Consulting Arborist for Community Forestry Consultants.

City Contacts
Steve Nittelo
Horticulture Supervisor – Parks & Recreation
Jeff Perry
City Arborist/Urban Forestry – Parks & Recreation
Jim Flotts
Consulting Arborist – Community Forestry Consultants

Sources: 05-189 to 05-197

[34] This figure includes approximately 1,000 acres from Camp Sekani Park, Indian Canyon Park, Palisades Park, and Upriver Park, which lie outside of the City of Spokane city limits.

Government Emissions Comparison Between 2005 and 1990:

Table 7: Comparison between 2005 and 1990 Government Emissions by Source

Sector & Source	2005 CO_2e Emitted (metric tons)	Est. 1990 CO_2e Emitted (metric tons)	% Change
Buildings - Electricity	8,489	8,489	0
Buildings - Natural Gas	3,450	3,450	0.0
Vehicle Fleet - Gasoline	3,535	5,132	-31.1
Vehicle Fleet - Diesel	6,433	1,152	458.4
Employee Commute	3,139	4,018	-21.9
Water/Sewage - Electricity	14,512	11,482	26.4
Water/Sewage - Natural Gas	735	180	308.8
Streetlights - Electricity	4,290	5,910	-27.4
Waste	285	-241	218.4
Other	25,525	145,530	-82.5
All Sectors	70,835	185,108	-61.7

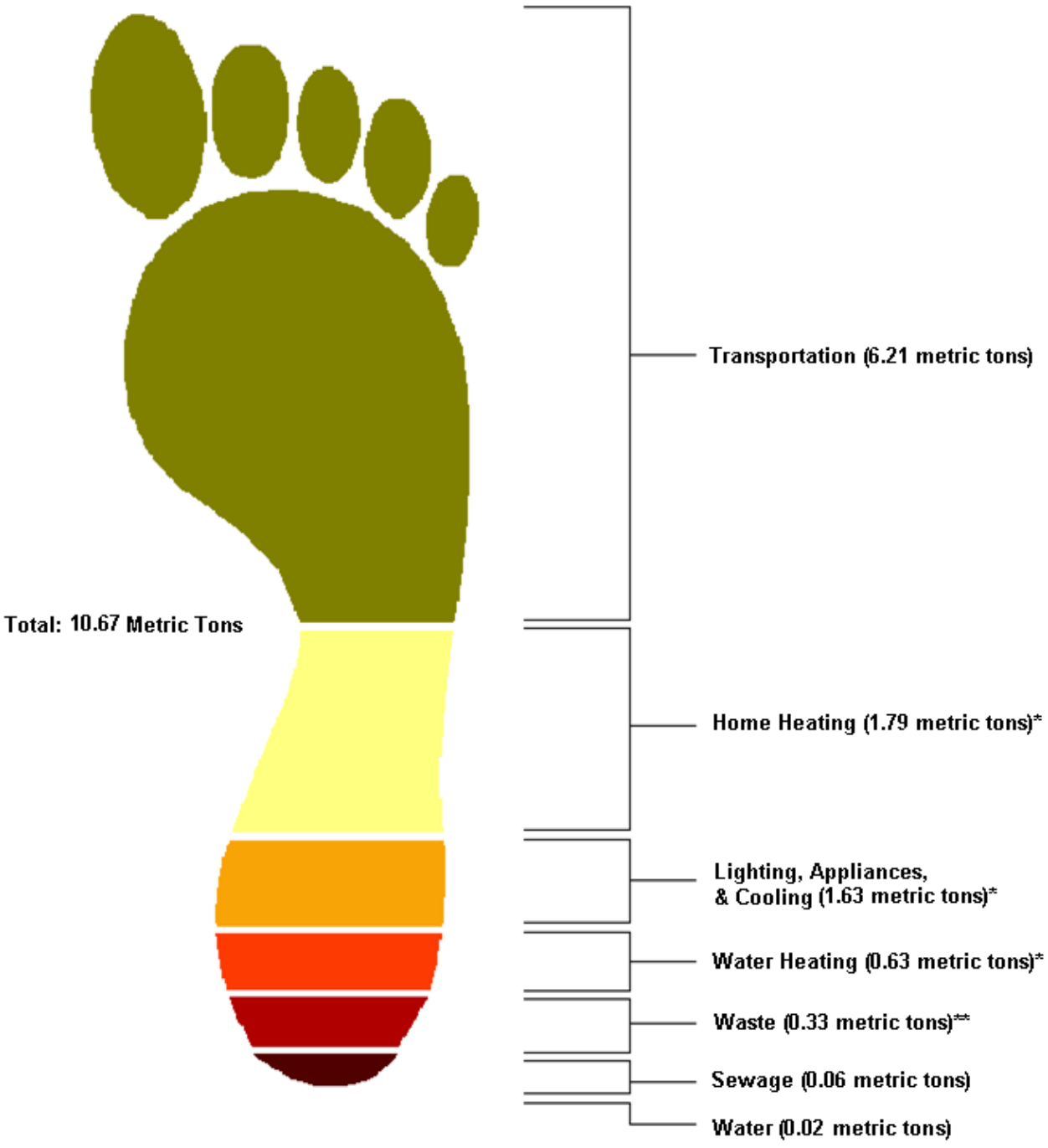
Please note that the percentage change in the "All Sectors" category is not the sum of "% Change" across all previous rows, but the percent increase of CO2e between 2000 and 2005 in the "All Sectors" row.

Table 7A: Comparison between 2005 and 1990 Government Emissions by Sector

Sector	2005 CO_2e Emitted (metric tons)	Est. 1990 CO_2e Emitted (metric tons)	% Change
Total Buildings – Electricity and Natural Gas	11,938	11,938	0.0
Total Vehicle Fleet – Gasoline and Diesel	10,399	6,284	65.5
Total Water/Sewage – Electricity and Natural Gas	15,259	11,670	30.8
Streetlights	4,290	5,910	-27.4
Employee Commute	3,139	4,018	-21.9
Waste	285	-241	218.4
Other	25,525	145,530	-82.5
All Sectors	70,835	185,108	-61.7

Please note that the percentage change in the "All Sectors" category is not the sum of "% Change" across all previous rows, but the percent increase of CO2e between 2000 and 2005 in the "All Sectors" row.

D. 2005 Emissions for a "Typical" City of Spokane Resident - Estimate



***Estimate reflects 2001 national end-use consumption of electricity averages provided by the Energy Information Administration.**
http://www.eia.doe.gov/emeu/recs/recs2001/enduse2001/figure1.html
****This figure does not include emissions associated with the transport of municipal solid waste and recyclables by the City's solid waste vehicle fleet.**

Transportation
The average resident of the City of Spokane emitted an estimated 6.21 metric tons of CO2e while traveling via automobile or mass transit in 2005. On a per-capita basis, assuming travel in a full-sized, gasoline-powered automobile, the average resident of the City of Spokane travels 10,040 miles per year or 193 miles per week. This equates to 400,334 gallons of fuel combusted annually for resident's transportation, or 12 gallons per week per resident.

Home Heating
Emissions associated with home heating accounted for 1.79 metric tons of CO2e per capita. Fuel types used for home heating include electricity, natural gas, fuel oil, and wood.

Lighting, Appliances, & Cooling
Per capita, emissions associated with electricity used in lighting, appliances, and cooling resulted in an estimated 1.63 metric tons of CO2e emissions. Of this total, lighting represents 14 percent, refrigerator use 21 percent, and all other appliances 65 percent.

Water Heating
Emissions associated with water heating accounted for 0.63 metric tons of CO2e emissions for the average City of Spokane resident in 2005.

Waste
The average City of Spokane resident was responsible for 1,620 pounds of waste, resulting in 0.33 metric tons of CO2e in 2005. The typical makeup of waste for a resident of the City of Spokane consists of 31.1 percent paper, 21.3 percent food, 5 percent plant matter, 8.1 percent wood material, and 34.5 percent other materials. In regard to recycling, the average resident recycled 91.6 pounds of material in 2005.

Sewage
The average City of Spokane resident was responsible for 51,743 gallons of sewage (wastewater) in 2005, resulting in the emission of 0.06 metric tons of CO2e.

Water
On average, a typical resident of the City of Spokane used 147 gallons of water per day in 2005. The average resident's use on an annual basis resulted in 0.018 metric tons if CO2e emissions. Due to the non-CO2e emitting nature of hydroelectric power from Upriver Dam, the City of Spokane essentially receives its water emissions-free for much of the year. However, during the summer and early fall when water use is high and river flows are low, significant amounts of purchased power are used. An important fact to consider is the amount of energy required to pump and distribute the City's water. Hypothetically speaking, if the non-CO2e emitting electricity was replaced with typical grid-based electricity, the emissions associated with pumping and distributing the City of Spokane's water needs would equal 16,203 metric tons of CO2e.

III. Scopes using Local Government Operations Protocol (2008) Version 1.0, September 2008, developed by ICLEI-Local Governments for Sustainability

A. GHG Emission Scopes

To separately account for direct and indirect emissions, to improve transparency, and to provide utility for different types of climate policies and goals, the City of Spokane government inventory has adopted scope accounting practices guided by ICLEI's *Local Government Operations Protocol* (2008).

This Protocol follows the World Business Council for Sustainable Development and the World Resources Institute *GHG Protocol Corporate Standard* in categorizing direct and indirect emissions into "scopes" as follows:

Scope 1: All direct GHG emissions (with the exception of direct CO2 emissions from biogenic sources) occurring within the City's limits (i.e. smokestacks and tailpipes).

Scope 2: Indirect GHG emissions associated with the consumption of purchased or acquired electricity, steam, heating, or cooling.

Scope 3: All other indirect emissions not covered in Scope 1 or 2, such as emissions resulting from transport-related activities in vehicles not owned or controlled by the government (e.g., employee commuting), outsourced activities, waste disposal, etc.

Together the three scopes provide a comprehensive accounting framework for managing and reducing direct and indirect emissions. Listed in the two tables below are emissions from each sector of the community and government and their respective scopes.

Table 8: Community Emissions-Scope 1

Sector	2005 CO_2e Emitted (metric tons)
Transportation	**1,729,102**
Residential	**278,924**
Commercial / Industrial	**217,137**
Waste	**72,669**
Other Emissions	**25,405**
Total	**2,323,237**

Table 9: Gov't Emissions-Scope 1

Sector	2005 CO_2e Emitted (metric tons)
Water & Sewage	**735**
Buildings	**3,450**
Vehicle Fleet	**10,399**
Streetlights	**N.A.**
Employee Commute	**N.A.**
Waste	**370**
Other Emissions	**25,525**
Total	**40,479**

Table 10: Community Emissions -Scope 2

Sector	2005 CO_2e Emitted (metric tons)
Transportation	N.A.
Residential	465,098
Commercial / Industrial	435,573
Waste	N.A.
Other Emissions	N.A.
Total	900,671

Table 11: Gov't Emissions - Scope 2

Sector	2005 CO_2e Emitted (metric tons)
Water & Sewage	14,512
Buildings	8,489
Vehicle Fleet	N.A.
Streetlights	4,290
Employee Commute	N.A.
Waste	N.A.
Other Emissions	N.A.
Total	27,291

Table 12: Community Emissions - Scope 3

Transportation	N.A.
Residential	N.A.
Commercial / Industrial	N.A.
Waste	-1,866
Other Emissions	13,419
Total	11,553

Table 13: Gov't Emissions - Scope 3

Water & Sewage	N.A.
Buildings	N.A.
Vehicle Fleet	N.A.
Streetlights	N.A.
Employee Commute	3,139
Waste	-85
Other Emissions	N.A.
Total	3,054

IV. Forecast for Greenhouse Gas Emissions

Based on the community and government operations emissions inventories developed for the base year of 2005, the next steps were to backcast 1990 emission levels and to forecast future emissions generated in the City of Spokane. These forecasts represent business-as-usual predictions of how greenhouse gas (GHG) emissions may grow in our community over time and from which sectors this growth is likely to occur. Conducting an emissions forecast is an essential step in deriving a reduction target, as the amount of GHG emissions the City of Spokane pledges to reduce can be approximated in this manner.

Community

The forecast year of 2012 was selected for the community to coincide with the goals of the Mayors Climate Protection Agreement and the Kyoto Protocol to reduce 2012 emission levels 7 percent below 1990 levels. An additional forecast year of 2030 was added to coincide with a proposed[35] long-range goal to reduce 2030 emission levels 30 percent below 2005 levels. Built in to this long-range reduction goal is a proposed annual reduction goal of 1.2 percent. These emissions forecasts were based on projected population growth for the City of Spokane using US average population growth, which was calculated to be 0.99 percent per year. Energy use trends by fuel type and sector were also included in the forecast model. These figures are from the US Energy Information Administration and the Spokane Regional Transportation Council and address larger trends, such as bigger homes and more energy efficient vehicles. Together, these sources were used to construct the community forecasts.

Government

The government forecast was created using the same forecast years as the community. Population growth was the primary factor in forecasting future government emissions, due in large part to the fact that as population grows so too does the demand for government services. In fact, the second largest contributor to government emissions, water and sewer operations, are directly tied to population and utility regulation.

Table 14: City of Spokane Emissions Summary

	Community Analysis	Government Operations Analysis
Base Year	**1990**	**1990**
CO_2e Emissions (metric tons) Total / Per Capita[36]	2,952,858 / 16.8	185,048 / 1.0
Target Year	**2012**	**2012**
Business-as-usual projection of CO2e Emissions (metric tons).	3,592,095	74,762
Base Year	**2005**	**2005**
CO_2e Emissions (metric tons) Total / Per Capita	3,229,308 / 16.3	70,835 / 0.4
Potential Target Year[35]	**2030**	**2030**
Business-as-usual projection of CO2e Emissions (metric tons).	4,884,594	86,621

[35] Please refer to Appendix A for detailed information about the proposed goals. Proposed goals will be brought forward to the City Council for their consideration.

[36] Population data from Washington Office of Financial Management; 1990 = 177,165; 2005 = 198,700

V. Greenhouse Gas Emissions Reduction Targets

Many factors were considered in providing these reduction targets. The City strives to choose targets that are both aggressive and achievable for its local circumstances.

The short-range reduction goal to reduce 2012 emission levels 7 percent below 1990 levels was inspired by the United States Kyoto Protocol agreement to reduce emission levels 7 percent below 1990 levels. This goal, which was agreed to in principle in 1997, has yet to be ratified by Congress. Several European nations set similar goals and some have begun action towards meeting them. The proposed long-range reduction goal to reduce 2030 emission levels 30 percent below 2005 levels was included for a number of reasons. First, base-year data from 2005 is much more available and therefore better serves the need of developing an accurate reduction goal for the future. In addition, this long-range reduction goal provides the City of Spokane more time to develop sustainable solutions to reducing its greenhouse gas emissions. Built into the proposed long-range reduction goal is an annual benchmark goal of a 1.2 percent reduction in emissions. It is intended that when emissions reduction goals have been reached, they not be exceeded in the future. IPCC research suggests that we would need to achieve as much as a 60% reduction below 1990 levels in order to reverse global warming and stabilize the climate.

Local factors considered in selecting the target reduction percentage included estimation of the effects of implemented and planned programs and policies, an approximate assessment of future opportunities to reduce emissions, and targets adopted by peer communities. To meet the reduction target of seven percent below 1990 levels by 2012, the community of Spokane should plan to reduce annual emissions by 845,937 metric tons by the year 2012. To meet the proposed reduction target of 30 percent below 2005 levels by 2030, the community of Spokane would need to plan to reduce annual emissions by 2,624,079 metric tons by the year 2030.

This inventory, in conjunction with the forecast and reduction targets, marks the completion of the first step necessary for drafting a local action plan to reduce emissions and become more energy efficient as a community. The Sustainability Task Force appointed by Mayor Mary Verner in early 2008 has been working to create a strategic action plan to identify and address the impacts of climate change and energy security on the City. The Task Force, in conjunction with four work groups dedicated to studying the topics of the built/un-built environment, procurement, transportation & mobility, and water, are paying particular attention to drafting measures to be implemented by the City of Spokane government.

Table 15: City of Spokane Emissions Summary

	Community Analysis	Government Operations Analysis
Base Year	**1990**	**1990**
CO_2e Emissions in 1990 (metric tons)	2,952,858	185,048
Target Year	**2012**	**2012**
Business-as-usual projection of CO_2e Emissions in 2012 (metric tons)	3,592,095	74,762
Reduction Target 7% below 1990 Levels	2,746,158	172,095
Percent CO2e reduction needed based on 2012 projection	23.5%	-130.2%
Quantity of CO_2e Reduction Targeted (metric tons)	845,937	-97,333
Base Year	**2005**	**2005**
CO_2e Emissions in 2005 (metric tons)	3,229,308	70,835
Potential Target Year[37]	**2030**	**2030**
Business-as-usual projection of CO_2e Emissions in 2030 (metric tons)	4,884,594	86,621
Potential Reduction Target 30% below 2005 Levels	2,260,515	49,584
Percent CO2e reduction needed based on 2030 projection	53.7%	42.8%
Quantity of CO_2e Reduction Targeted (metric tons)	2,624,079	37,036

VI. Existing Reduction Efforts

At both the community and government levels, the City of Spokane has undertaken a number of programs, policies and projects resulting in reduced greenhouse gas emissions. These are an excellent first step toward meeting the City of Spokane's reduction goals and account for an estimated 62,318 metric tons of CO2e avoided annually.

A. Existing Community Reduction Efforts

According to estimates produced using the CACP software, community measures taken already account for 47,991 metric tons of CO_2e avoided annually. They have been broken down by sector and are outlined below in **Table 16**.

[37] Please refer to Appendix A for detailed information about the proposed goals. Proposed goals will be brought forward to the City Council for their consideration.

Table 16: Existing Community Greenhouse Gas Emissions Reduction Efforts

Reduction Effort	Year Initiated	Annual Tons CO2e Reduction
Residential		
Avista Utilities "Buck-A-Block" Green Power Purchase	2002	9,836
Commercial		
Avista Utilities "Buck-A-Block" Green Power Purchase	2002	4,502
Waste		
Residential Recycling	1990	29,306
Commercial Recycling	1991	2,495
"Clean Green" Composting	1993	1,852
Total Reduction		47,991

Existing Community Reduction Efforts Notes

Since its inception in 2002, Avista Utilities' "Buck-A-Block" Green Power Purchase program has experienced solid growth amongst residential and commercial customers alike. In 2007 there were approximately 1,420 Spokane residents purchasing renewable energy through the Buck-A-Block program and 40 businesses. Participating residential customers average just over 4 blocks per month, businesses average over 65 blocks per month. At 300 kWh of renewable energy per block, residential customers in Spokane purchased 20,448,000 kWh and businesses purchased 9,360,000 kWh in 2007. Below is a breakdown of residential and commercial kWh purchases since 2002.

	Residential	Commercial
2007	20,448,000	9,360,000
2006	17,194,000	7,725,200
2005	15,674,000	7,015,000
2004	7,896,000	3,547,000
2003	1,888,000	849,000
2002	918,000	412,000

Outside Contacts
Chris Drake
Energy Solutions Program Manager – Avista Utilities

Sources: 05-210

B. Existing Government Reduction Efforts

According to estimates produced using the CACP software, government reduction efforts taken already account for 14,327 metric tons of CO_2e avoided annually. They have been broken down by sector and are outlined below in **Table 17**.

Table 17: Existing Government Greenhouse Gas Emissions Reduction Efforts

Reduction Effort	Year Initiated	Annual Tons CO2e Reduction	Annual Cost Savings
Buildings			
City Hall			
Appliances	2001	31	$5,098
HVAC	2001	417	$117,000
Lighting	2001	73	$11,255
Motors	2001	98	$10,000
Vending Miser	2001	28	$5,349
Fire Dept.			
HVAC	2001	266	$14,739
Lighting	2001	86	$22,111
Motors	2002	18	$1,800
Rooftop Maintenance	2001	91	$10,050
Shell	2004	3	$950
Fleet Services Dept.			
Lighting	2001	18	$7,400
Opera House/Convention Center			
CFL Promotion	2001	142	$15,067
HVAC	2001	326	$122,056
Police Dept.			
Appliances	2001	1	$274
Lighting	2001	13	$3,165
Parks & Recreation Dept.			
Lighting	2006	36	$10,346
Public Defender			
Lighting	2001	1	$163
Street Dept.			
Lighting	2001	364	$65,369
Solid Waste Dept.			
Lighting	2001	11	$2,750
Water & Wastewater Depts.			
HVAC	2000	439	$21,429
Lighting	2001	156	$36,520
Water/Sewage			
Industrial Process	2000	2,143	$274,532
Motors	1999	2,152	$231,256
Miscellaneous	2000	2,081	$216,305
Streetlights			
LED Traffic Signals	2000	510	$45,879
Waste			
Government Recycling	1990	301	$0
Government Composting	1990	80	$0
Motors	2001	4,442	$0
Total Reduction/Savings		14,327	$1,250,863

VII. Proposed Reduction Efforts

After careful consideration of the distribution of emissions production across various sectors of the community, as well as resources available and potential costs and co-benefits, the most beneficial and feasible measures were chosen to reduce greenhouse gas emissions by 7 percent below 1990 levels by 2012. Where possible, CACP Software was used to calculate the greenhouse gas reductions both in tons and percentage. However, these measures will not only result in reduced greenhouse gas emissions, but additionally will improve the health, livability, and environmental quality of the community. The measures have been broken down by sector and are described in **Tables 19** and **20** below.

Note: The CO2e reductions and savings discussed below as Community and Government Reduction Efforts are based on estimates using 2005 figures. All CO2e reductions and savings are annual.

A. Proposed Community Reduction Efforts

Residential

Community Green Power Challenge: Avista Utilities, which serves the City of Spokane electricity needs, offers a Green Power Purchase program. The "Buck-A-Block" program offers customers the option of purchasing the electricity they use from renewable sources. Avista Utilities currently offers renewable energy from wind and biomass projects. To a lesser extent, the renewable energy portfolio of Avista Utilities also includes solar, geothermal, and landfill gas projects. The net rate for purchasing green power through the "Buck-A-Block" program is $1.00 per 300 kWh, or approximately $0.0033 cents per kWh, more than the cost of regular electricity. More information on Avista Utilities "Buck-A-Block" program is available at www.avistautilities.com .

The Community Green Power Challenge encourages individuals to sign up for Avista Utilities "Buck-A-Block" program. A number of City of Spokane residents are already participating in this program (see "Existing Community Efforts"). By offering additional incentives for participants, the City of Spokane can encourage residents to make this purchase and share in a sense of community pride. A number of cities throughout Washington State, including Seattle and Bellingham, have begun to implement such programs. This effort provides the City of Spokane an excellent opportunity to emerge as a regional leader in green power use.

If a minimum goal of 10 percent of residential electricity from renewable energy sources was met, 113,543,175 kWh would need to be purchased through Avista Utilities "Buck-A-Block" program. This purchase would result in the collective avoidance of 46,510 metric tons of CO2e emissions.

ENERGY STAR Buildings and Appliances: The average ENERGY STAR rated building, which may include properly installed insulation, high performance windows, tight construction and ducts, energy efficient cooling and heating systems, and Energy Star appliances, lighting, and water heaters, uses at least 15% less energy than standard homes. If 25 percent of the homes (21,399 homes) in the City of Spokane achieved an ENERGY STAR rating, a minimum of 27,901 metric tons of CO2e would be avoided annually.

***Promote LEED Certification in New Construction*:** Leadership in Environmental and Energy Design (LEED) is a building rating system developed and promoted by the U.S. Green Building Council. New buildings constructed to LEED certification standards are estimated to be 5 percent

to 40 percent more energy efficient than a new building simply constructed "to code." According to the City of Spokane's most recent Comprehensive Plan, a total of 31,618 new housing units will be needed between 1998 and 2020 to accommodate population growth. This is the equivalent of 1,437 new housing units constructed each year. Assuming average electricity use remains consistent with 2005 levels (14,296 kWh per household), 421 metric tons of CO2e would be avoided annually if these new housing units were constructed to the lowest specifications of LEED certification. Assuming this rate of growth continues until the target year of 2030, a minimum of 9,257 metric tons of CO2e would be avoided annually.

Commercial

Community Green Power Challenge: Increased participation by the commercial sector in Avista Utilities "Buck-A-Block" program (see description under the "Residential" sector above) holds considerable potential for reducing the City of Spokane's greenhouse gas emissions. If the commercial sector matched the goal of the residential sector, 10 percent of electricity from renewable energy sources, 106,335,423 kWh would need to be purchased through Avista Utilities "Buck-A-Block" program. This purchase would result in the collective avoidance of 43,557 metric tons of CO2e emissions. Business participating in this program would gain the added advantages of improved status in the community and "green" advertising opportunities.

ENERGY STAR Buildings and Appliances: Matching the residential sector's level of participation (25 percent) in the ENERGY STAR program, the commercial sector could eliminate 23,685 metric tons of CO2e emissions.

Transportation

Community Trip Reduction Program: The largest source of CO2e emissions in the City of Spokane come from the transportation sector. Although a number of community trip reduction programs exist within the City, further development of these programs is needed to significantly lower CO2e emissions in this sector. A community wide, ten percent reduction in annual vehicle miles traveled would result in the collective avoidance of 172,910 metric tons of CO2e missions annually. The use of alternative forms of transportation, including carpooling, biking, walking, and public mass transit, will not only reduce CO2e emissions but save the community money, improve the quality of the environment, and make the City of Spokane a more livable city. **Table 18** below provides a comparison of the CO2e emissions of different vehicle types per 1,000 vehicle miles traveled

Table 18: Select Emissions per 1,000 Vehicle Miles Traveled

Vehicle Type	Gallons Of Fuel Combusted	CO2e Emissions (metric tons)
Motorcycle	25.2	.380
Passenger Vehicle (gasoline)	56.5	.551
Light Truck/SUV (gasoline)	72.9	.709
Bus (diesel)	201.2	1.754
Heavy Truck (gasoline)	206.5	1.982

Source: CACP Output

Waste

Expand Residential and Commercial Recycling Efforts: In 2005, curbside recycling for the residential and commercial sectors of the City of Spokane totaled 11,594 short tons, including 9,099 from the residential sector and 2,495 from the commercial sector. These efforts resulted in the estimated annual avoidance of 38,615 metric tons of CO2e emissions. A 25 percent increase in the amount of material recycled in the residential and commercial sectors would result in a total estimated annual avoidance of 46,677 metric tons of CO2e emissions.

Table 19: Proposed Community Greenhouse Gas Emissions Reduction Efforts

Reduction Effort	Estimated Annual Tons CO2e Reduction
Residential	
Community Green Power Challenge	46,510
ENERGY STAR Buildings and Appliances	27,901
Promote LEED Certification in New Construction	9,257
Commercial	
Community Green Power Challenge	43,557
ENERGY STAR Buildings and Appliances	23,685
Transportation	
Community Trip Reduction Program	172,910
Waste	
Expand Residential and Commercial Recycling Efforts	46,677
Total Reduction	361,661

B. Proposed Government Reduction Efforts

The Mayor's Sustainability Task Force will recommend further steps City government can take to reduce its carbon footprint and to mitigate for the effects of Peak Oil. It is anticipated that the recommendations will also include things the City can do to assist the Community in meeting the goals. The Task Force report is expected to be finalized in the first half of 2009.

VIII. Conclusion

Climate change is an issue of growing concern for communities across the United States and around the world. This Community and its elected officials have displayed leadership and foresight in choosing to confront this issue now. By reducing the amount of greenhouse gases emitted by Spokane, the City joins hundreds of other American cities in stemming the tide of global warming and the numerous threats associated with it, such as increased droughts and flooding, disrupted agricultural systems and rising sea levels.

In addition to mitigating the destabilization of the climate and its associated effects, the City of Spokane stands to benefit in many other ways from the Task Force's findings and the proposed community measures outlined in this report. Some of these benefits include financial savings resulting from improved energy efficiency, improved air quality and community health, and increased energy security.

Meeting the City of Spokane's reduction targets will require both persistence and adaptability. It provides an excellent opportunity for collaboration between City government and the private sector. A number of communities, in setting greenhouse gas emission reduction goals and working to achieve them, have been rewarded not only by becoming more sustainable communities, but also rewarded with new jobs and community expertise developed in meeting the challenge.

To allow the City to monitor its progress toward achieving its reduction targets, it is necessary to institutionalize the inventory process. By developing and implementing data compilation and analysis protocols, the City will be able to complete annual updates to its inventory. This will also require the development of infrastructure necessary to allow ease of data reporting and analysis.

Appendix A: Memo Regarding Proposed Reduction Targets

ENVIRONMENTAL PROGRAMS
Dave Mandyke, Director -Division of Public Works & Utilities
Lloyd Brewer, Environmental Programs Manager

Date: 23 December 2008

To: Mayor Mary Verner, Ted Danek & the Sustainability Task Force
Fr: Lloyd Brewer, Environmental Programs Manager LRB
Re: Greenhouse Gas (GHG) Reduction Goal Joint Recommendation
Cc: Susanne Croft

This memo summarizes the existing and proposed City GHG reduction goals and provides context regarding their technical basis. With short, medium, and longer term goals the City will more closely align with Washington State.

1. Existing Greenhouse Gas Emissions Reduction Goal:
The current City goal is a 7% reduction of greenhouse gas emissions below 1990 levels by 2012 both for city government and for the community. On May 7, 2001 the City joined in ICLEI's Cities for Climate Protection Campaign (RES 2001-32). In February 2007 Spokane signed the US Mayor Climate Protection Agreement, and the City Council passed the Near Nature Quality of Life Initiative (RES 2007-09), each of which contained the greenhouse emissions reduction goal.

2. Proposed Goal Adjustments:
An additional longer term goal is recommended for a greenhouse gas emissions reduction of 30% below 2005 levels by 2030 for both City government and for the Spokane community. There is also recommended an annual short term goal of at least a 1.2 % reduction per year beyond 2005, with an understanding that the greater and earlier the reductions can be made, the better. Finally, it should be noted that when emission goals are reached, it is intended they not be exceeded in the future.

3. Reasons for Considering a Change in the City's GHG Reduction Goal
City GHG emission inventory data for 1990 is very sparse so that having a goal with a 1990 base is problematic. The City's Northside Landfill was capped and a methane gas collection system installed in the early 1990's. This action significantly reduced City government emissions such that the current goal was already met, but not so for the Community. The current goal is to be met by 2012, but this gives precious little time for the Community to make significant GHG emission reductions. Finally, as the City's first GHG Inventory nears completion and is intended to provide calculations of the reduction in emissions required to meet City goals; and as the Sustainability Task Force is at a critical point in the writing of a plan to address government emissions, it seems an appropriate time to re-evaluate the City's goals.

4. Task Force Recommendations
In considering goal adjustment proposals, the Mayor's Sustainability Task Force was consulted, along with the City Administration. The Task Force made the following recommendations:

a) Keep the City's goal(s) current and aligned with Washington State Goal(s)
b) Calibrate the goal around the most accurate City inventory data
c) Use a dual goal system with both long term and short term goals such as to elicit continuous improvement
d) In setting and working to achieve the goals equitable consideration should be given to the overall interests of the community

5. Rationale for Existing City Goal:

The City's current goal is one consistent with the US negotiated Kyoto protocol. In that negotiation some European countries agreed to reduce GHG emissions by 15 % below 1990 levels by 2012. Other governments, particularly from developing nations, were not requested to, and did not volunteer to reduce emissions below 1990 levels. United States negotiators reached an agreement for the 7% reduction below 1990 levels by 2012, but to date, this agreement at the Federal level has only been ratified by the US Senate. The City of Spokane joined more than 710 other Mayors in signing on to the US Mayors Climate Agreement committing to implement the Kyoto reductions.

The Kyoto Protocol was developed to try and control GHG emissions such that the predicted heating near the earth surface, and of ocean water, would not exceed levels detrimental to man and the environment. Figure 1 graphically shows the change in carbon dioxide levels that have been experienced over the last 10,000 years.

Figure 1 From ***Climate Change 2007: Synthesis Report***; IPCC, Nov 2007; pg 38

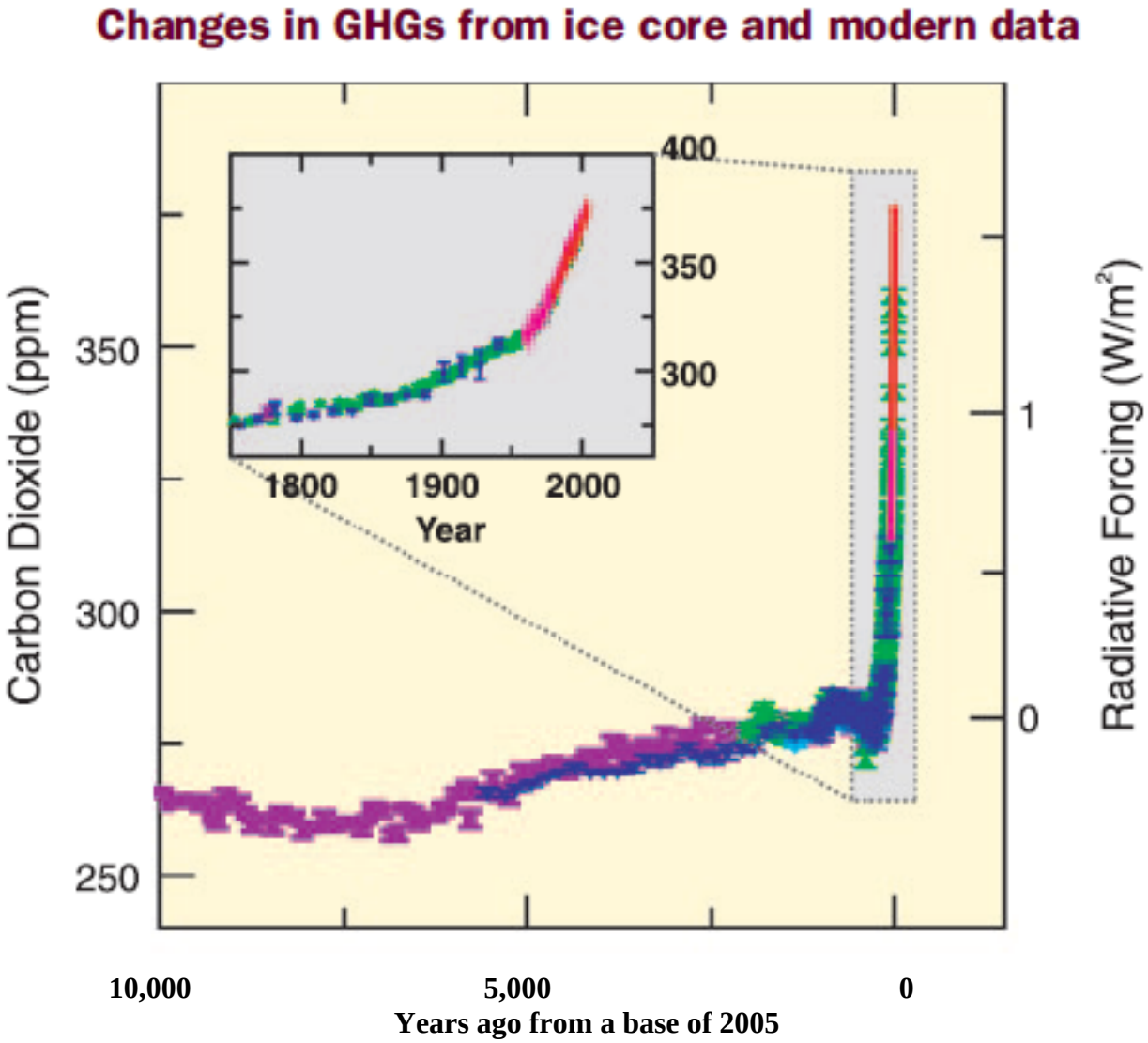
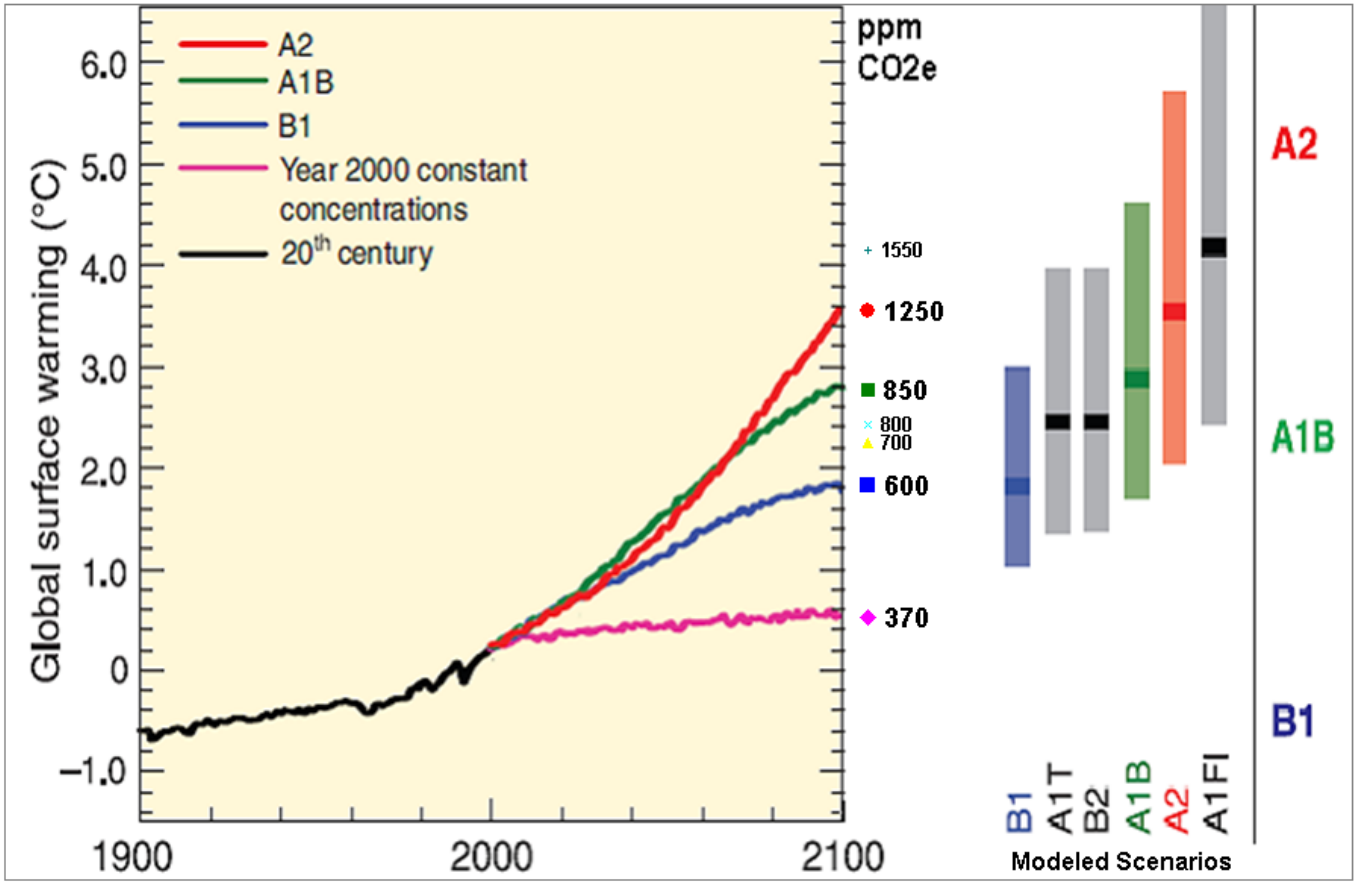


Figure 2 shows global average temperature levels as determined by the Intergovernmental Panel on Climate Change (IPCC) and as predicted to rise in the future (see the right side of Figure 2). The IPCC uses a number of scenarios in the development and running of computer models predicting future temperature change resulting from greenhouse gas emissions (see the left side of Figure 2). The average carbon dioxide equivalent(CO2e) level in parts per million that is predicted to exist by various average model results is listed between the Figure 2 graph portions. For each of the scenarios the models averaged output of predicted global average temperature change in 2100 as compared to 1990 is shown as a dark band within a lighter column indicating the range of modeled results for the given scenario.

University of Washington professor and Washington State Climatologist, Dr. Phil Mote, in his presentation at the City's Sustainability Symposium indicated a general recognition by climate scientists of something in the range of 450 to 550 ppm CO2e, by volume, as a level that represents a "dangerous" human "interference in the climate system" that would result in harm to people and the environment because it would certainly result in at least a 2^{o} C increase in average global surface temperature. It can be seen below that most model prediction summary results fall within this range and/or exceed it. (www.greenspokane.org/strategic.htm)

Figure 2 Adapted from ***Climate Change 2007: Synthesis Report***; IPCC, Nov 2007; pg 45 & 46, Table 3.1, Note c) and Figure 3.2, left panel, respectively.



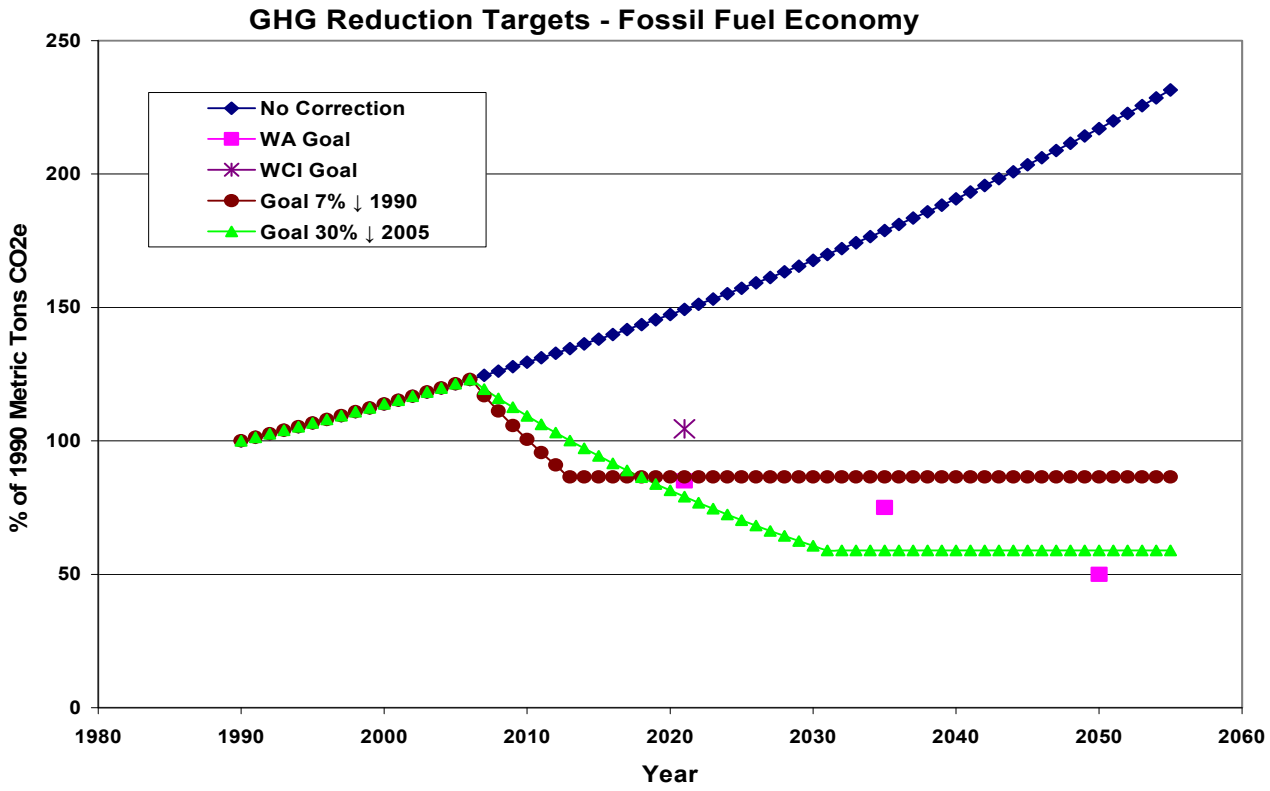
6. Rationale for New Proposed Goals:

Adopting and then meeting the proposed goals assures our Community and City government will have taken proportionally significant steps to help curb global warming and its adverse impacts. The intent of the new dual goal is to set a) a clear future target to strive for; and b) an annual goal to help measure progress and to guide adaptive measures over the shorter run. Leaving the original goal in place as well helps emphasize the need for as much 'immediate' progress as is reasonably possible.

The need for more immediate action can best be appreciated by looking again at Figures 1 & 2, while keeping in mind that the greenhouse gases persist for some time in the atmosphere and so impact temperatures for many years after they are emitted. The pink line in figure 2 gives some indication of what can be expected with regard to increasing temperature when GHG emissions are leveled off. Temperature increases melt snow & ice, and heat the oceans over time, all impacts that once made take very long times to reverse. Finally, we know we are a small part of the problem and solution. We also know there is no guarantee others will act in a timely manner with regard to their own reductions.

Figure 3 provides comparative information about the current and proposed City goals as well as their relationship to Washington State(WA) and the Washington Climate Initiative(WCI) goals. The graph title is a reminder that it is fossil fuel use that must be reduced not all energy use.

Figure 3 by L. Brewer, City of Spokane Environmental Programs, Dec 2008



In proposing these goals it is understood that the emissions inventory necessary to determine if the goals are being met is not currently being done on an annual basis and will require additional resources. Ideally the inventory would be taken in a systematic way at least annually with the results used to adaptively adjust to at least meet the annual goal.

Given City Administration/Mayoral approval and with Task Force acceptance I will document this proposal and its consequence in terms of necessary reductions in the Final Draft Inventory Report. This proposed change in goals would then be brought forward to the City Council before the final Sustainability Task Force recommendations. Any Council action on the goal could then be documented in the Task Force Report.

Appendix B: CACP Software Report – Community[35]

Spokane

Community Greenhouse Gas Emissions in 2005
Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Residential	744,021	23.2	8,859,837
Commercial	631,597	19.7	7,126,624
Industrial	21,113	0.7	385,317
Transportation	1,729,102	54.0	22,271,692
Waste	37,107*	1.2	
Other Direct Emissions	37,545	1.2	
Total	**3,200,485**	**100.0**	**38,643,470**

[38] This report is adapted from one generated for Spokane, Washington using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.

Spokane Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Residential			
Spokane, Washington			
Residential Avista-City est.			
Electricity {**1,135,431,748 kWh**}	465,097	14.5	3,875,194
Natural Gas {**41,917,524 therms**}	234,939	7.3	4,191,752
Subtotal Residential Avista-City est.	700,036	21.8	8,066,946

IN CITY ESTIMATE

Includes 81,490 electrical accounts using an average 14,296 kWh/account-year, and 53,731 natural gas accounts using an average 800 Therms/account year.

These data are generated from winter 2006 and 2007 Avista data corrected for population change and assuming an average 5,735 kw/person-year (electric) and 212 therms/person-year.

Used US Census Bureau and Washington State Office of Financial Management Population Statistics Data adjusted from 2000 census. Estimates beyond the Federal/State projections were based on a 1.3% per year population increase.

The Avista data was furnished by zip code area and where necessary was trimmed using parcel counts in and outside the City limits. Two potentially signifcant zipcode areas (the Spokane County Facilities area, and Gonzaga University area) were not provided by Avista, but some information on these areas was provided by Spokane Regional Clean Air Agency and is included under the industrial tab here.

Residential Other - City Est.			
Light Fuel Oil {**3,585,171 gallons**}	37,629	1.2	501,771
Propane {**700,601 therms**}	4,600	0.1	70,060
Fuelwood (Air Dry) {**9,329 cords**}	1,756	0.1	221,060
Subtotal Residential Other - City Est.	43,985	1.4	792,891

Data calculated from: "Number of homes that use 5 specific kinds of heating fuel"--"Spokane city" & "Washington State" Table, Factfinder U.S. Census Bureau, Spokane city, Washington, Selected Housing Characteristics: 2005, 2005 American Community Survey obtained on 4/24/2008; and

Energy Information Administration website: Table 8. Residential Sector Energy Consumption Estimates 1960-2005, Washington obtained on 4/24/2008.

SEE: "Spreadsheet Calculation Spokane as Percent of Washington on 20080425.xls."

Light Fuel Oil 85,352 barrels, Propane 700,601 therms, and Fuelwood (Air Dry) 9,329 cords.

Quality Control: Electricity estimated 648.688 million kilowatt-hours equals 2,213,952 MMBtu; Natural Gas estimated at 4.45 billion cu. ft. equals 4,539,481 MMBtu.

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Subtotal Residential	**744,021**	**23.2**	**8,859,837**

Commercial			
Spokane, Washington			
Electricity Avista-City est.			
Electricity {**1,063,354,231 kWh**}	435,573	13.6	3,629,195
Subtotal Electricity Avista-City est.	435,573	13.6	3,629,195

IN CITY ESTIMATE

Includes 7445 electrical accounts using an average 142820 kWh/account-year.

These data are generated from winter 2006 and 2007 Avista data corrected for population change and assuming an average 5371 kw/person-year (electric) .

Used US Census Bureau and Washington State Office of Financial Management Population Statistics adjusted from 2000 census. Estimates beyond the State/Federal projections were based on a 1.3% per year population increase.

The Avista data was furnished by zip code area and was trimmed using parcel counts in and outside the City limits.

Spokane Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu
Gas Avista-City est.			
Natural Gas {**34,974,285 therms**}	196,023	6.1	3,497,429
Subtotal Gas Avista-City est.	196,023	6.1	3,497,429

IN CITY ESTIMATE
Includes 4881 natural gas accounts using an average 7165 Therms/account year.
These data are generated from winter 2006 and 2007 Avista data corrected for population change and result in an average 177 therms/person-year.
Used US Census Bureau and Washington State Office of Financial Management Population Statistics adjusted from 2000 census. Estimates beyond the State projections were based on a 1.3% per year population increase.
The Avista data was furnished by zip code area and was trimmed to City limits using parcel counts in and outside the City limits.

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Subtotal Commercial	**631,596**	**19.7**	**7,126,624**
Industrial			
Spokane, Washington			
City- Northside Landfill			
Natural Gas {**2,642,451 therms**}	14,810	0.5	264,245
Subtotal City- Northside Landfill	14,810	0.5	264,245

2,642,451 therms Natural Gas used.

City-RPWRF Biogas Boiler			
Biomethane {**1,368 therms**}	0	0.0	137
Subtotal City-RPWRF Biogas Boiler	0	0.0	137

1,368 therms Biogas used at Riverside Park Water Reclamation Facility (Wastewater Main Plant).

City-RPWRF Biogas Flare			
Biomethane {**102,577 therms**}	0	0.0	10,258
Subtotal City-RPWRF Biogas Flare	0	0.0	10,258

102,577 therms Biomethane gas flared at Riverside Park Water Reclamation Facility (Wastewater Main Plant).

City-Southside Landfill Flare			
Natural Gas {**1,597 therms**}	9	0.0	160
Subtotal City-Southside Landfill Flare	9	0.0	160

1,597 therms Natual Gas used.

County Gov. (in City)			
Light Fuel Oil {**930 gallons**}	10	0.0	130
Natural Gas {**206,228 therms**}	1,156	0.0	20,623
Subtotal County Gov. (in City)	1,166	0.0	20,753

Diesel (10.7 tons CO2, 930 gallons) and Natural Gas(1274.3 tons CO2, 206,228 therms) used in County Facilities within Spokane from Spokane Regional Clean Air Agency records.

Spokane Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Diesel Heating			
Light Fuel Oil {**60 gallons**}	1	0.0	8
Subtotal Diesel Heating	1	0.0	8

60 gallons from Spokane Regional Clean Air Agency.

Federal Gov. Fuel Oil			
Light Fuel Oil {**23,000 gallons**}	241	0.0	3,219
Subtotal Federal Gov. Fuel Oil	241	0.0	3,219

23,000 gallons Actual Light Fuel Oil used for the Office of Veteran's Affairs Medical Center.

Gonzaga University			
Natural Gas {**845,893 therms**}	4,741	0.1	84,589
Subtotal Gonzaga University	4,741	0.1	84,589

845,893 therms from Spokane Regional Clean Air Agency records.

Hospital Fuel Oil			
Light Fuel Oil {**6,453 gallons**}	68	0.0	903
Subtotal Hospital Fuel Oil	68	0.0	903

Spokane Regional Clean Air Agency- MIXED FUEL FACILITIES - FUEL OIL USE
6,453 gallons for actual fuel oil used Deaconess Medical Center(6208 gallons) and St. Luke's Rehabilitation Center (245).

Other - Diesel Engines			
Light Fuel Oil {**7,465 gallons**}	78	0.0	1,045
Subtotal Other - Diesel Engines	78	0.0	1,045

7,465 gallons of Light Fuel Oil used in diesel engines from Spokane Regional Clean Air Agency.

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Subtotal Industrial	**21,113**	**0.7**	**385,317**

Transportation			
Spokane, Washington			
Limited Access - I-90			
Gasoline	99,874	3.1	1,286,383
Diesel	20,891	0.7	265,316
Subtotal Limited Access - I-90	120,765	3.8	1,551,699

Considers 2-way vehicle counts in 8 segments of I-90. **Total distance 6.58 miles**. Daily car counts varied from 68,000 to 109,000. **VMT = 202,489,225**. Used "Transport Assistant" defaults to allocate VMT to vehicle & fuel types.

Limited Access - SR-195			
Gasoline	11,854	0.4	152,675
Diesel	2,479	0.1	31,489
Subtotal Limited Access - SR-195	14,333	0.5	184,164

Considers 2-way vehicle counts in 2 segments of SR-195. **Total distance 4.76 miles**. Daily car counts varied from 13,000 to 17,000. **VMT= 24,032,512.5.** Used "Transport Assistant" defaults to allocate VMT to vehicle & fuel types.

Spokane Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Rail-Amtrak			
Diesel	234	0.0	2,978
Subtotal Rail-Amtrak	234	0.0	2,978

Used "Rail-Commuter" coefficient, gallons of diesel fuel provided by Amtrak, **24,411 gallons**.

Rail-Freight			
Diesel	20,939	0.7	266,147
Subtotal Rail-Freight	20,939	0.7	266,147

Calculated using "Rail-Commuter" and gallons of diesel calculated for BNSF and Union Pacific Freight trains that travel through Spokane, **2,181,284 gallons**.

Street Diesel Bus			
Diesel	5,287	0.2	67,197
Subtotal Street Diesel Bus	5,287	0.2	67,197

Washington State Department of Ecology Methodology: ADVMT = 9,134 *330=AYVMT
Computation Based on Transit Bus Coefficient; Spokane Transit Authority buses are included in this count. Estimated from passenger miles traveled, 34,288,907 PMT or 5,674 Metric tonnes CO2e inside Spokane County.

Street Diesel Heavy Truck			
Diesel	288,685	9.0	3,668,872
Subtotal Street Diesel Heavy Truck	288,685	9.0	3,668,872

Washington State Department of Ecology Methodology: ADVMT = 498,708 *330=AYVMT (**164,573,511 VMT**)
Includes: Heavy Duty Trucks Class 2b, 3,4,5,6,7,8a, & 8b

Street Diesel Light Truck/SUV			
Diesel	2,494	0.1	31,439
Subtotal Street Diesel Light Truck/SUV	2,494	0.1	31,439

Washington State Department of Ecology Methodology: ADVMT = 12,787 *330=AYVMT (**4,219,833.62 VMT**)
Includes: Light Duty Trucks Class 1,2,3, & 4

Street Diesel Passenger Vehicle			
Diesel	1,916	0.1	24,242
Subtotal Street Diesel Passenger Vehicle	1,916	0.1	24,242

Washington State Department of Ecology Methodology: ADVMT = 10,352 *330=AYVMT
Computation Based on Passenger Vehicle Coefficient

Street Diesel School Bus			
Diesel	5,287	0.2	67,197
Subtotal Street Diesel School Bus	5,287	0.2	67,197

Washington State Department of Ecology Methodology: ADVMT = 9,133.8 *330=AYVMT
Computation Based on Transit Bus Coefficient

Street Gasoline Bus			
Gasoline	427	0.0	5,520
Subtotal Street Gasoline Bus	427	0.0	5,520

Washington State Department of Ecology Methodology: ADVMT = 1,826.8 *330=AYVMT
Computation Based on Vanpool Van Coefficient

Spokane Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Street Gasoline Heavy Truck			
Gasoline	166,081	4.9	2,173,299
Subtotal Street Gasoline Heavy Truck	166,081	4.9	2,173,299

Washington State Department of Ecology Methodology: ADVMT = 253,920.7 *330=AYVMT
Includes: Heavy Duty Trucks (Class 2b, 3,4,5,6,7,8a,8b)

Street Gasoline Light Truck/SUV			
Gasoline	636,369	18.9	8,223,047
Subtotal Street Gasoline Light Truck/SUV	636,369	18.9	8,223,047

Washington State Department of Ecology Methodology: ADVMT = 2,721,275.1 *330=AYVMT
Includes: Light Duty Trucks (0-6,000 lbs & 6,000-8,500)

Street Gasoline Motorcycle			
Gasoline	3,662	0.1	48,100
Subtotal Street Gasoline Motorcycle	3,662	0.1	48,100

Washington State Department of Ecology Methodology: ADVMT = 29,228 *330=AYVMT

Street Gasoline Passenger Vehicle			
Gasoline	462,269	14.4	5,953,306
Subtotal Street Gasoline Passenger Vehicle	462,269	14.4	5,953,306

Washington State Department of Ecology Methodology: ADVMT = 2,542,252 *330=AYVMT
Computation Based on Passenger Vehicle Coefficient

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Subtotal Transportation	**1,729,102**	**53.5**	**22,271,692**

Spokane Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Waste			
Spokane, Washington			
Commercial/Indus./Const. MSW	*{ **77,078 tons**}*	*Disposal Method - Controlled Incineration*	
Paper Products {37.9%}	2,138	0.1	
Food Waste {21.8%}	1,230	0.0	
Plant Debris { 3.8%}	214	0.0	
Wood/Textiles { 7.5%}	423	0.0	
All Other Waste {29.0%}	9,817	0.3	
Subtotal Commercial/Indus./Const. MSW	13,823	0.4	

COMMERCIAL / INDUSTRIAL / CONSTRUCTION - MUNICIPAL SOLID WASTE
Includes Frontloader loads, Downtown Frontloader loads, & Roll-off loads (drop boxes & compactors).

North County Transfer Station	*{ **18,168 tons**}*	*Disposal Method - Controlled Incineration*	
Paper Products {31.1%}	414	0.0	
Food Waste {21.3%}	283	0.0	
Plant Debris { 5.0%}	66	0.0	
Wood/Textiles { 8.1%}	108	0.0	
All Other Waste {34.5%}	2,753	0.1	
Subtotal North County Transfer Station	3,624	0.1	

Includes only that portion of waste from City of Spokane residents.

Northside Landfill	*{ **6,097 tons**}*	*Disposal Method - **Managed Landfill***	
Paper Products { 6.0%}	402	0.0	
Food Waste { 0.0%}	0	0.0	
Plant Debris { 2.1%}	-19	0.0	
Wood/Textiles {24.0%}	-321	0.0	
All Other Waste{67.9%}	0	0.0	
Subtotal Northside Landfill	62	0.0	

Waste into new (1992) cell.

Residential North Side	*{ **43,346 tons**}*	*Disposal Method - Controlled Incineration*	
Paper Products {32.4%}	1,028	0.0	
Food Waste {26.6%}	844	0.0	
Plant Debris { 3.5%}	111	0.0	
Wood/Textiles { 5.4%}	171	0.0	
All Other Waste {32.1%}	6,111	0.2	
Subtotal Residential North Side	8,265	0.2	

Residential South Side	*{ **25,154 tons**}*	*Disposal Method - Controlled Incineration*	
Paper Products {32.4%}	597	0.0	
Food Waste {26.6%}	490	0.0	
Plant Debris { 3.5%}	64	0.0	
Wood/Textiles { 5.4%}	99	0.0	
All Other Waste {32.1%}	3,546	0.1	
Subtotal Residential South Side	4,797	0.1	

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Spokane Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Valley Transfer Station	*{ **5,039 tons**}*	*Disposal Method - Controlled Incineration*	
Paper Products {31.1%}	115	0.0	
Food Waste {21.3%}	79	0.0	
Plant Debris { 5.0%}	18	0.0	
Wood/Textiles { 8.1%}	30	0.0	
All Other Waste {34.5%}	764	0.0	
Subtotal Valley Transfer Station	1,005	0.0	

Includes only that waste from City of Spokane residents.

Waste-to-Energy Plant	*{ **36,879 tons**}*	*Disposal Method - Controlled Incineration*	
Paper Products {31.1%}	840	0.0	
Food Waste {21.3%}	575	0.0	
Plant Debris { 5.0%}	135	0.0	
Wood/Textiles { 8.1%}	219	0.0	
All Other Waste {34.5%}	5,588	0.2	
Subtotal Waste-to-Energy Plant	7,356	0.2	

Waste from City of Spokane arriving from other than regular City refuse collection process. Does not account for the carbon offset from 143,323 MWhr of excess power produced in by the WTE facility in 2005 and sold under contract WTE Plant total CO2 emissions wer 289,052 tonnes in 2005. As estimated from the stack test data taken (date) in 2005 and corrected by average annual steam pressure and hours of unit operation over the year. Unit 1 average steam 105 over 8,327.0 hours of operation. Unit 2 average steam 105.4 over 8,071.8 hours of operation.

Yard Waste - North Side	*{ **6,166 tons**}*	*Disposal Method - **Compost***	
Paper Products	0	0.0	
Food Waste	0	0.0	
Plant Debris {100.0%}	-1,128	0.0	
Wood/Textiles	0	0.0	
All Other Waste	0	0.0	
Subtotal Yard Waste - North Side	-1,128	0.0	

"6,503.77 tons" reduced to "6,166 tons" because 5.2 percent by weight of "Clean Green" incinerated at WTE facility.

Yard Waste - South Side	*{ **4,029 tons**}*	*Disposal Method - **Compost***	
Paper Products	0	0.0	
Food Waste	0	0.0	
Plant Debris {100%}	-737	0.0	
Wood/Textiles	0	0.0	
All Other Waste	0	0.0	
Subtotal Yard Waste - South Side	-737	0.0	

"4,249.52 tons" reduced to "4,029 tons" because 5.2% by weight of Clean Green is incinerated at WTE facility.

Yard Waste to Incineration	*{ **559 tons**}*	*Disposal Method - Controlled Incineration*	
Plant Debris { 100%}	41	0.0	
Subtotal Yard Waste to Incineration	41	0.0	

"559.17 tons" of Yard waste that is swept from tipping floor and incinerated at WTE Facility. Calculated 5.2 percent of North Side Yard Waste (6,504 tons) and South Side Yard Waste (4,250 tons).

Subtotal Waste	**37,107**	**1.2**

Spokane Community Greenhouse Gas Emissions in 2005
Detailed Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Other			
Spokane, Washington			
Avista-Commercial/Industrial Gas Loss			
Methane	1,038	0.0	
Subtotal Avista-Commercial/Industrial Gas Loss	1,038	0.0	

Estimated loss from delivery of Natural Gas to commerical and industrial facilities, "49.41502 metric tonnes Methane" provided by Avista Utilities.

Avista-Residential Natural Gas Loss			
Methane	11,134	0.3	
Subtotal Avista-Residential Natural Gas Loss	11,134	0.3	

Estimated loss from delivery of Natural Gas to residential properties; "530.1754 metric tonnes Methane" statistic provided by Avista Utilities.

Northside Landfill fugitive emissions			
Methane	18,657	0.6	
Subtotal Northside Landfill fugitive emissions	18,657	0.6	

Uncaptured methane loss from landfill. Assumes 75% capture. Methane generation by "Waste In Place" assistant using years of operation 1950 - 1991 and 3,310,578 tons in place. This includes waste from 1990 and 1991, so it is 204,000 tons more waste than the 1990 GHG Inventory waste figure. Used defaults: time constant of 0.05 1/year and 2.7228 cu-ft/ pound.

Southside Landfill fugitive emissions			
Methane	6,334	0.2	
Subtotal Southside Landfill fugitive emissions	6,334	0.2	

Uncaptured methane loss from landfill (302 metric tonnes). Assumes 70% capture. Methane generation by "Waste In Place" assistant using years of operation 1960 - 1987 and 886,000 tons in place. Used defaults: time constant of 0.05 1/year and 2.7228 cu-ft/ pound. BTUs burned estimates based on actual readings of collected landfill gas indicate 1,818 metric tonnes of Methane were produced in 2005. This would result in 545 metric tonnes Methane (CH4) lost.

Wastewater Biogas Loss <= 1%			
Methane	382	0.0	
Subtotal Wastewater Biogas Loss <= 1%	382	0.0	

Digester biogas loss which is estimated to not to exceed 1%. A 2005 analysis indicated the biogas was 60% methane and 38% carbon dioxide. Wastewater data indicate this translates into 18,212 kg of methane, and 31,719 kg of carbon dioxide. Carbon Dioxide is not reported in this Inventory because it is from biogenic source. This test showed real net BTU value of 546 BTU per cubic foot and an ideal value of 604 BTU per cubic foot.

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)
Subtotal Other	**37,545**	**1.2**	
Total	**3,200,484**	**100.0**	**38,643,470**

Appendix C: CACP Software Report - City Government[39]

Spokane

Government Greenhouse Gas Emissions in 2005
Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Buildings	**11,939**	**16.9**	**132,280**	**1,890,247**
Vehicle Fleet	**10,399**	**14.7**	**133,002**	**2,293,542**
Employee Commute	**3,139**	**4.4**	**40,590**	
Streetlights	**4,290**	**6.1**	**35,742**	**2,405,160**
Water/Sewage	**15,264**	**21.6**	**311,992**	**2,447,303**
Waste	**270**	**0.4**		**404,857**
Other Direct Emissions	**25,525**	**36.0**		
Total	**70,826**	**100.0**	**653,606**	**9,441,109**

[39] This report is adapted from one generated for Spokane, Washington using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.

Spokane Government Greenhouse Gas Emissions in 2005
Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Buildings				
Spokane, Washington				
City Hall				
Electricity {**3,331,200 kWh**}	1,365	1.9	11,369	184,248
Natural Gas { **18,228 therms**}	102	0.1	1,823	19,903
Subtotal City Hall	1,467	2.1	13,192	204,151
Account number: 2002828				
Fire Department				
Electricity {**2,351,597 kWh**}	963	1.4	8,026	99,474
Natural Gas {**137,560 therms**}	771	1.1	13,756	72,145
Subtotal Fire Department	1,734	2.4	21,782	171,619
Includes 16 Accounts.				
Fleet - N Normandie & W Sinto				
Electricity { **264,000 kWh**}	108	0.2	901	15,348
Natural Gas {**89,964 therms**}	504	0.7	8,996	94,139
Subtotal Fleet - N Normandie & W Sinto	612	0.9	9,897	109,487
Account number: 2404110--- 1424 N. Normandie / 124 W. Sinto				
Library Department				
Electricity {**1,999,833 kWh**}	819	1.2	6,825	134,309
Natural Gas {**62,216 therms**}	349	0.5	6,222	75,798
Subtotal Library Department	1,168	1.6	13,047	210,107
Seven account numbers--- Total Costs given for seven accounts - $210,107.51. Using Street Dept costs: $1.0528/therm Natural Gas and $0.05799/kWh. Difference $28,636.19 was prorated based on ratio of Electricity to Total Cost and Natural Gas to Total Cost.				
Parks & Rec Department				
Electricity { **4,788,725 kWh**}	1,962	2.8	16,344	380,733
Natural Gas {**248,074 therms**}	1,390	2.0	24,807	243,299
Subtotal Parks & Rec Department	3,352	4.7	41,151	624,032
Includes at least 19 buildings, 53 parks with electricity only. Information provided by Avista Utilities in a spreadsheet for 2005.				
Police Dept.				
Electricity {**379,120 kWh**}	155	0.2	1,294	37,504
Natural Gas {**7,024 therms**}	39	0.1	702	2,767
Subtotal Police Dept.	195	0.3	1,996	40,271
Includes 20 Accounts including COPSs & the Academy. Does not include joint City-County buildings.				
Public Defender's Office				
Electricity {**204,302 kWh**}	84	0.1	697	11,971
Natural Gas {**7,161 therms**}	40	0.1	716	0
Subtotal Public Defender's Office	124	0.2	1,413	11,971
Account number: 2402178---Not represented in 2005				
824 N. Monroe / 901 W. Mallon				

Spokane Government Greenhouse Gas Emissions in 2005
Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Real Estate				
Electricity {**1,090,080 kWh**}	447	0.6	3,720	67,172
Natural Gas {**24.884therms**}	139	0.2	2,488	21,868
Subtotal Real Estate	586	0.8	6,209	89,040
From City Real Estate utility bills, including Intermodal Transit Center.				
Solid Waste Management				
Electricity {**1,987,336 kWh**}	814	1.1	6,783	146,306
Natural Gas { **7,001 therms**}	39	0.1	700	7,880
Subtotal Solid Waste Management	853	1.2	7,483	154,187
Includes 16 Accounts.				
Street Department				
Electricity {**4,328,440 kWh**}	1,773	2.5	14,773	261,320
Natural Gas { **13,358 therms**}	75	0.1	1,336	14,063
Subtotal Street Department	1,848	2.6	16,109	275,384
Includes 22 Accounts.				
Subtotal Buildings	**11,939**	**16.9**	**132,280**	**1,890,247**

Spokane Government Greenhouse Gas Emissions in 2005
Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Vehicle Fleet				
Spokane, Washington				
Employee Vehicle Use				
Gasoline {**21,958 gallons**}	213	0.3	2,758	264,492
Subtotal Employee Vehicle Use	213	0.3	2,758	264,492
Estimate of 101 employees using full-size gasoline-powered autos; 408,639 VMT.				
Fire Dept.				
Gasoline {**4,605 gallons**}	45	0.1	578	9,992
Diesel {**56, 943 gallons**}	547	0.8	6,948	127,945
Subtotal Fire Dept.	591	0.9	7,526	137,937
Records of fuel not purchased through Fleet. Gasoline emissions calculated as used in "full size auto" and Diesel as used in "heavy truck."				
Fleet Diesel				
Diesel {**569,966 gallons**}	5,472	7.7	69,544	1,369,905
Subtotal Fleet Diesel	5,472	7.7	69,544	1,369,905
Calculated as used in "heavy truck".				
Fleet Gasoline(UL)				
Gasoline {**347,771 gallons**}	3,378	4.9	43,681	785,700
Subtotal Fleet Gasoline(UL)	3,378	4.9	43,681	785,700
Calculated as used in "full size auto".				
Wastewater Generators Diesel				
Diesel {**740 gallons**}	7	0.0	90	0
Subtotal Wastewater Generators Diesel	7	0.0	90	0
Wastewater Stationary Emergency Backup Generators; Calculated as used in "heavy truck"				
Wastewater Sewer Maintenance				
Gasoline {**12,162 gallons**}	118	0.2	1,528	0
Diesel { **36,986 gallons**}	355	0.5	4,513	0
Subtotal Wastewater Sewer Maintenance	473	0.7	6,040	0
Calculated all diesel as used in "heavy truck", all gasoline as used in "full size auto".				
Wastewater RPWRF (Main Plant)				
Gasoline { **7,161 gallons**}	70	0.1	899	0
Diesel { **20,187 gallons**}	194	0.3	2,463	0
Subtotal Wastewater RPWRF (Main Plant)	263	0.4	3,363	0
Calculated all diesel as used in "heavy truck", all gasoline as used in "full size auto".				
Subtotal Vehicle Fleet	**10,399**	**14.7**	**133,002**	**2,558,034**

Spokane Government Greenhouse Gas Emissions in 2005
Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Employee Commute				
Spokane, Washington				
City Hall 808 W. Spokane Falls Blvd.				
Gasoline { **59,447 gallons**}	577	0.8	7,467	
Subtotal City Hall 808 W. Spokane Falls Blvd.	577	0.8	7,467	

Assuming 344 employees with average commute trip 6.7 miles; 4,610 Vehicle Miles Traveled per day. [NOTE: Commute Trip was average of Top 4 concentrations of employees:24 in Zip code 99026 (Suncrest - 8 miles); 51 in Zip Code 99208 (7.8 miles); 27 in Zip Code 99205 (5 miles); 18 in Zip Code 99223 (6 miles) or "6.7 miles." Assuming each employee drives alone in full-size auto, convert Annual Vehicle Miles to equivalent US Gallons of Gas. Assuming 240 days per each working year: **1,106,304 Vehicle Miles Traveled**.

Other Departments				
Gasoline { **196,833 gallons**}	1,912	2.7	24,723	
Subtotal Other Departments	1,912	2.7	24,723	

Total of Employees in City of Spokane minus City Hall (344) and Public Safety (387) equals
1370 - 344 - 387 = 1139. Average commute trip length is 6.7 miles. Average trips is 480 (Assume each employee works 240 days per year, times 2). Assume each employee drives a full size auto, **3,663,024 Vehicle Miles Traveled**.

Public Safety Bldg.				
Gasoline { **66,881 gallons**}	650	0.9	8,400	
Subtotal Public Safety Bldg.	650	0.9	8,400	

Assuming 387 employees traveling an average of 6.7 miles one-way. 5,186 Vehicle Miles Traveled per day. Assume each employee works 240 days per year. **Annual Vehicle Miles Traveled is 1,244,640**. Assume each employee travels in a full size auto.

Subtotal Employee Commute	**3,139**	**4.4**	**40,590**	
Streetlights				
Spokane, Washington				
Parks & Recreation				
Electricity { **164,893 kWh**}	68	0.1	563	656,719
Subtotal Parks & Recreation	68	0.1	563	656,719

Includes 56 Lighting Accounts.

Streets - Traffic Control Lights				
Electricity { **959,099 kWh**}	393	0.6	3,273	27,638
Subtotal Streets- Traffic Control Lights	393	0.6	3,273	27,638

20 Budget Accounts identified as "Traffic Control," Avista rate schedule 11. Total is 959,099 kWh at $27,638.00. Most "red" and "green" lamps have been converted to LEDs in 2006 and 2007.

Streets -Street Lights				
Electricity { **9,345,359 kWh**}	3,828	5.4	31,895	1,720,392
Subtotal Streets -Street Lights	3,828	5.4	31,895	1,720,392

8 meters and six rate schedules; Does not include Traffic Control lights accounts.

Water & Hydroelectric				
Electricity { **3,114 kWh**}	1	0.0	11	411
Subtotal Water & Hydroelectric	1	0.0	11	411

Account number: 614903

Subtotal Streetlights	**4,290**	**6.1**	**35,742**	**$2,405,160**

Spokane Government Greenhouse Gas Emissions in 2005
Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Water/Sewage				
Spokane, Washington				
Parks & Rec - Indian Canyon Well				
Upriver Hydro { **79,170 kWh**}	0	0.0	272	0
Electricity { **42,236 kWh**}	17	0.0	144	7,967
Subtotal Parks & Rec - Indian Canyon Well	17	0.0	416	7,967
Account number: 505082 Well used for Golf course irrigation.				
Wastewater - BioGas to Flares				
Biomethane {**256,369 therms**}	0	0.0	25,637	0
Subtotal WasteWater - BioGas to Flares	0	0.0	25,637	0
Wastewater - Boiler BioGas				
Biomethane {**637,212 therms**}	0	0.0	63,721	0
Subtotal WasteWater - Boiler BioGas	0	0.0	63,721	0
Assumes 1 cu ft = 0.006 Therms; In 2005 there were 11,768.4 cu ft of biogas generated per million gallons of sewage into the plant & 71.5% of captured methane was used. The remainder 256,368.5 Therms was flared.				
Wastewater - Pump Stations				
Electricity {**1,575,089 kWh**}	645	0.9	5,376	97,790
Subtotal WasteWater - Pump Stations	645	0.9	5,376	97,790
Includes 27 separate accounts. Proportioned for flow, City residents 77.11% or 584 MTCO2e; Spokane Valley 16.36%, Airway Heights 1.17% and Fairchild AFB 1.72%.				
Wastewater - RPWRF(Main Plant)				
Electricity {**19,333,431 kWh**}	7,919	11.2	65,984	873,220
Natural Gas {**65,229 therms**}	366	0.5	6,523	66,660
Subtotal WasteWater - RPWRF(Main Plant)	8,285	11.7	72,507	939,880
Account Number 1900002. Natural Gas used in Boilers 72,873 therms by WWM records not including biogas used. Proportioned for flow, City residents 77.11% or 7,451 MTCO2e; Spokane Valley 16.36%, Airway Heights 1.17%, Fairchild AFB 1.72%.				
Wastewater – Sewer Maintenance				
Electricity {**116,089 kWh**}	48	0.1	396	9,560
Natural Gas {**12,339 therms**}	69	0.1	1,234	12,639
Subtotal Wastewater Sewer Maintenance	117	0.2	1,630	22,200
Account Number 2544990. Gas Meter 53677. Electricity Meter 50805.				
Water & Hydroelectric Admin/Shops				
Electricity {**683,994 kWh**}	280	0.4	2,334	68,921
Natural Gas {**53,652 therms**}	301	0.4	5,365	68,921
Subtotal Water & Hydroelectric Admin/Shops	581	0.8	7,700	118,713
Includes 12 Accounts.				

Spokane Government Greenhouse Gas Emissions in 2005
Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Water Dept. - Distribution				
Upriver Hydro { **5,455,032 kWh**}	0	0.0	18,618	0
Electricity { **2,895,725 kWh**}	1,186	1.7	9,883	494,101
Subtotal Water Dept. - Distribution	1,186	1.7	28,501	494,101
Includes 37 accounts.				
Water Dept. - Well Stations				
Upriver Hydro { **20,384,782 kWh**}	0	0.0	69,573	0
Electricity { **10,820,968 kWh**}	4,433	6.3	36,932	766,653
Subtotal Water Dept. - Well Stations	4,433	6.3	106,504	766,653
Includes 4 Accounts and Upriver Dam Meter.				
Subtotal Water/Sewage	**15,264**	**21.6**	**311,992**	**$2,447,303**

Waste

Spokane, Washington

City Hall - 808 W. Spokane Falls Blvd (1)		*{ **90 tons**}*	*Disposal Method - Controlled Incineration*	
Paper Products {70.5%}	5	0.0		17,638
Food Waste { 2.5%}	0	0.0		625
Plant Debris { 5.6%}	0	0.0		1,401
Wood/Textiles { 5.0%}	0	0.0		1,251
All Other Waste {16.4%}	6	0.0		4,103
Subtotal City Hall - 808 W. Spokane Falls Blvd (1)	12	0.0		25,018

Account number: 67655 Does not include 20 tons of recycled office paper with an offset value of 48 tonnes CO2e.

Fire Dept. (Type 2 waste)		*{ **99 tons**}*	*Disposal Method - Controlled Incineration*	
Paper Products {44.6%}	3	0.0		13,525
Food Waste { 7.0%}	1	0.0		2,123
Plant Debris { 1.1%}	0	0.0		334
Wood/Textiles {11.6%}	1	0.0		3,518
All Other Waste {35.7%}	16	0.0		10,826
Subtotal Fire Dept. (Type 2 waste)	20	0.0		30,325

Includes 15 Account numbers. Does not include 47.5 cu yds (2.97 tons, assuming 125 pounds per cu. yd.) of yard waste to Clean Green compost disposal, but does include the cost.

Fleet Services (Type 1 waste)		*{ **1 ton**}*	*Disposal Method - Controlled Incineration*	
Paper Products {70.5%}	0	0.0		189
Food Waste { 2.5%}	0	0.0		7
Plant Debris { 5.6%}	0	0.0		15
Wood/Textiles { 5.0%}	0	0.0		13
All Other Waste {16.4%}	0	0.0		44
Subtotal Fleet Services (Type 1 waste)	0	0.0		268

Account number: 69362 - 1410 N. Normandie

Spokane Government Greenhouse Gas Emissions in 2005
Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Fleet Services (Type 3 waste)	*{ **36 tons**}*	*Disposal Method - Controlled Incineration*		
Paper Products {26.4%}	1	0.0		2,641
Food Waste { 6.0%}	0	0.0		600
Plant Debris { 3.1%}	0	0.0		310
Wood/Textiles { 6.7%}	0	0.0		670
All Other Waste {57.8%}	9	0.0		5,781
Subtotal Fleet Services (Type 3 waste)	10	0.0		10,002

Account number: 69323- Body Shop - 103 W. Mission

Fleet Services (Type 4 waste)	*{ **97 tons**}*	*Disposal Method - Controlled Incineration*		
Paper Products {32.6%}	2	0.0		8,861
Food Waste { 3.9%}	0	0.0		1,060
Plant Debris { 2.3%}	0	0.0		625
Wood/Textiles {14.1%}	1	0.0		3,833
All Other Waste {47.1%}	20	0.0		12,803
Subtotal Fleet Services (Type 4 waste)	24	0.0		27,182

Account Number: 69359—Garage—104 W. Sinto.

Legal (Type 1 waste)	*{ **6 tons**}*	*Disposal Method - Controlled Incineration*		
Paper Products {70.5%}	0	0.0		1,241
Food Waste { 2.5%}	0	0.0		44
Plant Debris { 5.6%}	0	0.0		99
Wood/Textiles { 5.0%}	0	0.0		88
All Other Waste {16.4%}	0	0.0		289
Subtotal Legal (Type 1 waste)	1	0.0		1,760

Account Number: 69523. Public Defender-Prosecutor—824 N. Monroe. Does not include 7.13 cu. yds. (0.446 tons, assuming 125 pounds per cu. yd.) of recyclables in quantity; but does in cost. Offsets for recycling: 1 tonne CO2e.

Litter Control - Yard Waste	*{ **1.70 tons**}*	*Disposal Method - **Compost***		
Plant Debris {100%}	0	0.0		0
Subtotal Litter Control - Yard Waste	0	0.0		0

Solid Waste reported “1.79 tons” of yard waste delivered to the system. This amount was reduced to "1.70 tons" assuming the remainder was incinerated at the WTE plant.

Litter Yard Waste Incinerated	*{ **0.09 tons**}*	*Disposal Method - Controlled Incineration*		
Plant Debris {85.6%}	0	0.0		0
Subtotal Litter Yard Waste Incinerated	0	0.0		0

Assuming 5.2 percent of Yard Waste is incinerated in WTE facility operations, 0.09 tons.

Parks Dept. (Type 3 waste)	*{ **0 tons**}*	*Disposal Method - Controlled Incineration*		
Paper Products {26.4%}	0	0.0		31
Food Waste { 6.0%}	0	0.0		7
Plant Debris { 3.1%}	0	0.0		4
Wood/Textiles { 6.7%}	0	0.0		8
All Other Waste {57.8%}	0	0.0		67
Subtotal Parks Dept. (Type 3 waste)	0	0.0		116

Account Number: 69446. Central Park Maintenance (CPM).

Spokane Government Greenhouse Gas Emissions in 2005
Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Parks Dept. (Type 5 waste)		*{ **313 tons**}*	*Disposal Method - Controlled Incineration*	
Paper Products { 8.1%}	2	0.0		3,469
Food Waste	0	0.0		0
Plant Debris	0	0.0		0
Wood/Textiles	0	0.0		0
All Other Waste {91.9%}	126	0.2		39,356
Subtotal Parks Dept. (Type 5 waste)	128	0.2		42,825
Parks Dept. (Type 6 waste)		*{ **27 tons**}*	*Disposal Method - Controlled Incineration*	
Paper Products {40.9%}	1	0.0		3,944
Food Waste { 6.9%}	0	0.0		665
Plant Debris { 7.6%}	0	0.0		733
Wood/Textiles {19.3%}	0	0.0		1,861
All Other Waste {25.3%}	3	0.0		2,440
Subtotal Parks Dept. (Type 6 waste)	5	0.0		9,643

Assume 125 pounds per cu. yd. Does not include quantities for 168 cu yds (11 tons) of cardboard; 16.2 cu yds (1 ton) of office paper; and 7.13 cu yds (0.445625 tons) of other recyclables. Cardboard recycled has offset value of 28 tonnes CO2e, paper -2 tonnes CO2e, and 1 tonne CO2e for mixed recyclables.

Parks Dept. (Type 7 waste)		*{ **314 tons** }*	*Disposal Method - Controlled Incineration*	
Paper Products {11.9%}	3	0.0		4,405
Food Waste	0	0.0		0
Plant Debris	0	0.0		0
Wood/Textiles	0	0.0		0
All Other Waste {88.1%}	121	0.2		32,614
Subtotal Parks Dept. (Type 7 waste)	124	0.2		37,019

Does not include: 60 cu. yds.(3.75 tons) cardboard; 16.2 cu. yds. (1 ton) office paper; 21.4 cu. yds.(1.3375 tons) other recyclables - but does include the disposal costs. Recycled cardboard has 10 tonnes CO2e offset value; mixed recyclables offset 4 tonnes CO2e; office paper 2 tonnes CO2e.

Parks Dept. hauled refuse (Type 7)		*{ **85 tons** }*	*Disposal Method - Controlled Incineration*	
Paper Products {11.9%}	1	0.0		1,342
Food Waste	0	0.0		0
Plant Debris	0	0.0		0
Wood/Textiles	0	0.0		0
All Other Waste {88.1%}	33	0.0		9,933
Subtotal Parks Dept. (Type 7 waste)	34	0.0		11,275

Waste share: 11.9% paper; no food; no plant; no wood/textile; 88.1% all other waste. From various parks.

Spokane Government Greenhouse Gas Emissions in 2005
Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Parks Dept. hauled yard waste		*{ **585 tons**}*	*Disposal Method - **Compost***	
Paper Products	0	0.0		0
Food Waste	0	0.0		0
Plant Debris {100.0%}	-107	-0.2		10,323
Wood/Textiles	0	0.0		0
All Other Waste	0	0.0		1,737
Subtotal Parks Dept. - Yard Waste	-107	-0.2		12,060

From various parks hauled as Clean Green to compost. Parks had records for "509 tons," while Solid Waste had records for "617.38 tons." We use Solid Waste number here and reduce by 5.2 % to "585.28 tons" for yard waste incinerated at the WTE plant.

Parks Yard Waste Incinerated		*{ **32.38 tons**}*	*Disposal Method - Controlled Incineration*	
Plant Debris {85.6%}	2	0.0		0
All Other Waste {14.4%}	2	0.0		0
Subtotal Parks Yard Waste Incinerated	4	0.0		0

"32.38 tons" is 5.2 % of hauled yard waste that was incinerated in WTE facility.

Police Dept. (Type 6 waste)		*{ **6 tons**}*	*Disposal Method - Controlled Incineration*	
Paper Products {40.9%}	0	0.0		581
Food Waste { 6.9%}	0	0.0		98
Plant Debris { 7.6%}	0	0.0		108
Wood/Textiles {19.3%}	0	0.0		274
All Other Waste {25.3%}	1	0.0		360
Subtotal Police Dept. (Type 6 waste)	1	0.0		1,421

Spokane Public Library (Type 1 Waste)		*{ **68 tons**}*	*Disposal Method - Controlled Incineration*	
Paper Products {70.5%}	4	0.0		12,340
Food Waste { 2.5%}	0	0.0		438
Plant Debris { 5.6%}	0	0.0		980
Wood/Textiles { 5.0%}	0	0.0		875
All Other Waste {16.4%}	5	0.0		2,871
Subtotal Spokane Public Library (Type 1 Waste)	9	0.0		17,504

A total of six accounts- excluding Eastside Library that has an agreement with East Central Community Center. Assuming 125 pounds per cu. yd. of waste; 68.25 tons. Type 1 – office waste.

Streets Dept. (Type 4 waste)		*{ **18 tons**}*	*Disposal Method - Controlled Incineration*	
Paper Products {32.6%}	0	0.0		1,946
Food Waste { 3.9%}	0	0.0		233
Plant Debris { 2.3%}	0	0.0		137
Wood/Textiles {14.1%}	0	0.0		842
All Other Waste {47.1%}	4	0.0		2,812
Subtotal Streets Dept. (Type 4 waste)	4	0.0		5,970

Does not include recycling: 96 cu. yds. (6 tons) of cardboard; 96 cu. yds. (6 tons) of office paper; & 7.13 (0.445625 tons) other recyclables, but is included in cost. Assume 125 pounds per cu. yd. Emissions avoided for recycling: 16 MTCO2e, 14 MTCO2e and 1MTCO2e. Total Emissions avoided: 31 MTCO2e.

Spokane Government Greenhouse Gas Emissions in 2005
Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Streets Dept. - Yard Waste		*{ **646 tons**}*	*Disposal Method - **Compost***	
Plant Debris {100.0%}	-118	-0.2		0
Subtotal Streets Dept. - Yard Waste	-118	-0.2		0

"681.34 tons" yard waste was reduced to "645.91 tons" (94.8%) because 5.2 percent is incinerated at WTE facility.

Streets Yard Waste Incinerated		*{ **35.43 tons**}*	*Disposal Method- Controlled Incineration*	
Plant Debris {85.6%}	2	0.0		0
All Other Waste {14.4%}	2	0.0		0
Subtotal Streets Yard Waste Incinerated	4	0.0		0

Wastewater hauled Grit		*{ **441 tons**}*	*Disposal Method - **Managed Landfill***	
Paper Products {4%}	19	0.0		0
Food Waste {4%}	18	0.0		0
Plant Debris {4%}	-3	0.0		0
Wood/Textiles {4%}	-4	0.0		0
All Other Waste {4%}	0	0.0		0
Subtotal WasteWater hauled Grit	31	0.0		0

Does not include 52,702 cu yds of biosolids trucked to farmland in 2005, which in 1980 was going to the landfill. Waste share was assumed 80 percent rock and sediment, inert ingredients that would not generate emissions.

Wastewater (Type 4 waste)		*{ **11 tons**}*	*Disposal Method - Controlled Incineration*	
Paper Products {32.6%}	0	0.0		1,002
Food Waste { 3.9%}	0	0.0		120
Plant Debris { 2.3%}	0	0.0		71
Wood/Textiles {14.1%}	0	0.0		433
All Other Waste {47.1%}	2	0.0		1,447
Subtotal WasteWater (Type 4 waste)	3	0.0		3,072

Account Number: 69602—Sewer Maintenance—909 E. Sprague.

Wastewater hauled Screenings		*{ **407 tons**}*	*Disposal Method - Controlled Incineration*	
Paper Products {20%}	6	0.0		0
Food Waste {20%}	6	0.0		0
Plant Debris {20%}	6	0.0		0
Wood/Textiles {20%}	6	0.0		0
All Other Waste {20%}	36	0.1		0
Subtotal Wastewater hauled Screenings	60	0.1		0

Water Dept. Upriver (Type 4 waste)		*{ **22 tons**}*	*Disposal Method - Controlled Incineration*	
Paper Products {32.6%}	1	0.0		45,040
Food Waste { 3.9%}	0	0.0		5,388
Plant Debris { 2.3%}	0	0.0		3,178
Wood/Textiles {14.1%}	0	0.0		19,480
All Other Waste {47.1%}	4	0.0		65,073
Subtotal Water Dept. Upriver	5	0.0		138,159

Account Number: 71247. 21.56 tons of waste was hauled for disposal 12 times in 2005. Type 4 – garage waste.

Spokane Government Greenhouse Gas Emissions in 2005
Summary Report

	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Water Dept. (Type 4 waste)		*{ **56 tons**}*	*Disposal Method - Controlled Incineration*	
Paper Products {32.6%}	1	0.0		5,736
Food Waste { 3.9%}	0	0.0		686
Plant Debris { 2.3%}	0	0.0		405
Wood/Textiles {14.2%}	1	0.0		2,481
All Other Waste {47.1%}	11	0.0		8,287
Subtotal Water Dept. (Type 4 waste)	14	0.0		17,595

Does not include 384 cu. yds. (24 tons) of cardboard; 6 cu. yds. (0.375 tons) of paper; & 49.9 cu. yds. (3.11875 tons) of other recyclables. Offset value of cardboard is 63 tonnes CO2e; paper - 1 tonne CO2e and other recyclables 10 tonnes CO2e.

Water Dept. Yard Waste		*{ **6.23 tons**}*	*Disposal Method - **Compost***	
Plant Debris {100.0%}	-1	0.0		0
Subtotal Water Dept. Yard Waste	-1	0.0		0

"6.57 tons" yard waste reduced to "6.23 tons," assuming remainder was incinerated at WTE facility.

Water Yard Waste Incinerated		*{ **0.34 tons**}*	*Disposal Method - Controlled Incineration*	
Plant Debris	0	0.0		0
All Other Waste	0	0.0		0
Subtotal Water Yard Waste Incinerated	0	0.0		0

This "0.23 tons" of yard waste is assumed incinerated.

Subtotal Waste	**270**	**0.4**		**$404,857**

Other Direct Emissions

Spokane, Washington

Fleet Refrigerant Purchased & Used		
HFC-134a	50	0.1
Subtotal Fleet Refrigerant Purchased & Used	50	0.1

Refrigerant purchased and used in City Fleet vehicles.

Fleet Refrigerant Recycled		
HFC-23	102	0.1
Subtotal Fleet Refrigerant Recycled	102	0.1

Fleet Services is estimated to have used about 20 pounds of CFC-12 in 2005. We have allocated it here under HFC-23. This refrigerant was collected from community sources (refrigerators, air conditioners, etc.) and recycled through the City's vehicle fleet. An additional 543 pounds of refrigerant was otherwise collected and appropriately disposed. Deborah Bisenius 8/28/2008

Northside Landfill Gas Loss		
Methane { **888.45 tonnes**}	18,657	26.3
Subtotal Northside Landfill Gas Loss	18,657	26.3

Methane data derived from CACP "Waste in Place" calculator assuming Methane capture 75%, and methane loss 25%. Carbon Dioxide is prorated from the methane level based on Solid Waste Management field readings. CO2 quantity based on actual measurements of gas volumetric proportions and corrected for molecular weight (CH4:CO2 ratio is 30.4:29.0). Calculated loss based on estimated energy flared in 2005 was 1,766 metric tonnes of methane. Carbon Dioxide is not reported in this Inventory because it is biogenic origin.

Spokane Government Greenhouse Gas Emissions in 2005
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	Equiv CO_2 (tonnes)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Southside Landfill Gas Loss				
Methane { **301.60 tonnes**}	6,334	8.9		
Subtotal Southside Landfill Gas Loss	6,334	8.9		

Assumes 30% methane gas loss (70% methane capture). Methane production data derived from CACP "Waste In Place" calculator using defaults. CO2 quantity based on actual measurements of gas volumetric proportions and corrected for molecular weight (CH4:CO2 ratio is 24.3:25.9). Calculated loss based on estimated energy flared in 2005 was 545 metric tonnes of methane.

Wastewater Biogas Loss (<=1%)				
Methane { **18.21 tonnes**}	382	0.5		
Subtotal Wastewater Biogas Loss (<=1%)	382	0.5		

Estimated biogas loss of no more than 1 percent from the organic solids digester/gas collection system. (18.2121 metric tonnes Methane & 31.71942 metric tonnes Carbon Dioxide) Carbon Dioxide is not included in this Inventory because it is from biogenic origin.

Subtotal Other	**25,525**	**36.0**		

	Equiv CO_2 (tonnes)	*(%)*	*Energy (MMBtu)*	*Cost ($)*
Total	***70,826***	***100.0***	***653,606***	***$9,518,238***

Data Sources

Call #	Extension	Document Title or <file name as received>	Source (person or URL)	Received
05-001	.xls	Copy of US Census Population Estimate Table for Spokane City SUB-EST-2007-01.xls	http://www.census.gov/popest/cities/tables/SUB-EST2007-01.xls	7/17/2008
05-002	.doc	Table P001 Census 1990 for US and Spokane City.doc	http://factfinder.census.gov/servlet/DTTable?_bm=y&-context=dt&-ds_name=DEC_1990_STF3_&-CONTEXT=dt&-mt_name=DEC_1990_STF3_P001&-tree_id=101&-redoLog=false&-all_geo_types=N&-geo_id=01000US&-geo_id=04000US53&-geo_id=16000US531220&-search_results=16000US531220&-format=&-_lang=en	12/15/2008
05-003	.xls	<Survey of Fuel Oil Companies on 20080501.xls>	Deborah Bisenius	5/1/2008
05-004	.mht	Table 8_ Residential Sector Energy Consumption Estimates, 1960-2005, Washington.htm	http://www.eia.doe.gov/emeu/states/sep_use/res/use_res_wa.html	4/24/2008
05-005	.mht	Washington - Selected Housing Characteristics 2005.htm	http://factfinder.census.gov/servlet/ADPTable?_bm=y&-geo_id=04000US53&-gr_name=ACS_2005_EST_G00_DP4&-ds_name=ACS_2005_EST_G00_&-_lang=en&-redoLog=false	4/24/2008
05-006	.mht	Spokane city, Washington - Selected Housing Characteristics 2005.htm	http://factfinder.census.gov/servlet/ADPTable?_bm=y&-geo_id=16000US5367000&-gr_name=ACS_2006_EST_G00_DP4&-ds_name=ACS_2006_EST_G00_&-_lang=en&-redoLog=false&-_sse=on	4/24/2008
05-007	.xls	<DL Spokane County & Cities CO & CO2 Emissions.xls>	Ron Edgar	9/7/2007
05-008	.doc	Table 6.5 Natural Gas Consumption by Sector, 1949 to 2007 on 20081210.doc	http://www.eia.doe.gov/emeu/aer/txt/ptb0605.html	12/10/2008

05-009	.mht	Washington - DP-4_ Profile of Selected Housing Characteristics 2000.htm	http://factfinder.census.gov/servlet/QTTable?_bm=y&-geo_id=04000US53&-qr_name=DEC_2000_SF3_U_DP4&-ds_name=DEC_2000_SF3_U&-_lang=en&-_sse=on	4/24/2008
05-010	.htm	<Notes for Home Heating Oil etc in 2005>	Deborah Bisenius	7/10/2008
05-011	.xls	<City Data Requests.xls>	Pat Ehrbar	10/8/2007
05-012	.htm	<FW: city wide number update.htm>	Pat Ehrbar	10/8/2007
05-013	.htm	<City Utility Payments.htm>	Pat Ehrbar	8/21/2007
05-014	.xls	<CompleteCityDataa.xls>	Avista	10/9/2007
05-015	.htm	<FW 2005 Park Avista bills.htm>	Judy Moss	5/29/2007
05-016	.htm	<FW: Attached Image>	Patti Robbins	5/4/2007
05-017	.xls	<Avista Info - 909 E Sprague.xls>	Sharon Bowers	10/5/2007
05-018	.xls	<AVISTA 2005 YTD.xls>	Judy Moss	5/9/2007
05-019	.xls	<AVISTA 2000 YTD.xls>	Judy Moss	5/9/2007
05-020	.xls	<AVISTA USAGE HISTORY.xls>	Bobbe Moxley	2/13/2007
05-021	.xls	<AVISTA USAGE HISTORY2.xls>	Bobbe Moxley	2/13/2007
05-022	.doc	<Avista 2005 Consolidated.doc>	Mathew Doval	3/14/2007
05-023	.pdf	<2000 AvistaUtils Part 1A.pdf>	Mathew Doval	3/14/2007
05-024	.pdf	<2000 AvistaUtils Part 1B.pdf>	Mathew Doval	3/14/2007
05-025	.pdf	<2000 AvistaUtils Part 2A.pdf>	Mathew Doval	3/14/2007
05-026	.pdf	<2000 AvistaUtils Part 2B.pdf>	Mathew Doval	3/14/2007
05-027	.pdf	<2000 AvistaUtils Part 3A.pdf>	Mathew Doval	3/14/2007
05-028	.pdf	<2000 AvistaUtils Part 3B.pdf>	Mathew Doval	3/14/2007
05-029	.pdf	<Kiemle & Hagood.pdf>	Kim Orlob	12/12/2008
05-030	.pdf	<Intermodal Facility - Avista.pdf>	Kim Orlob	12/12/2008
05-031	.pdf	<Intermodal Facility – City Billing.pdf>	Kim Orlob	12/12/2008
05-032	.xls	<intermodal.xls>	Lloyd Brewer	12/12/2008
05-033	.pdf	<2005 City Utilities 103434 - 901 N Nelson St.pdf>	Mathew Doval	3/14/2007
05-034	.pdf	<2005 City Utilities 69361 - 1433 N Normandie St.pdf>	Mathew Doval	3/14/2007
05-035	.pdf	<2005 City Utilities 69328 - 1420 N Normandie St.pdf>	Mathew Doval	3/14/2007
05-036	.pdf	<2005 City Utilities 69327 - 1433 N Normandie St.pdf>	Mathew Doval	3/14/2007
05-037	.pdf	<2005 City Utilities 69323 - 103 W Mission Ave.pdf>	Mathew Doval	3/14/2007
05-038	.pdf	<2005 City Utilities 65968 - 5224 N Myrtle St.pdf>	Mathew Doval	3/14/2007
05-039	.pdf	<2005 City Utilities 65922 - 5216 N Myrtle St.pdf>	Mathew Doval	3/14/2007
05-040	.pdf	<2005 City Utilities 65917 - 4101 E Queen Ave.pdf>	Mathew Doval	3/14/2007

05-041	.pdf	<2000 Street CityUtilBills part 1.pdf>	Mathew Doval	3/14/2007
05-042	.pdf	<2000 Street CityUtilBills part 2.pdf>	Mathew Doval	3/14/2007
05-043	.xls	<Spokane Public Library Costs for Building Category 2005.xls>	Steve Shagina	5/1/2007
05-044	.xls	<Annual Usage Summary Notes.xls>	Mathew Doval	3/14/2007
05-045	.doc	<Meeting Summary Streets on April 30 2008.doc>	Deborah Bisenius	4/30/2008
05-046	.doc	<Meeting Summary Library on April 25 2008Revised 20080430.doc>	Deborah Bisenius	4/25/2008
05-047	.doc	<Meeting Summary Fleet Dept on April 24 2008.doc>	Deborah Bisenius	4/24/2008
05-048	.doc	<Meeting Summary Water Dept Supervisors on April 22 2008.doc>	Deborah Bisenius	4/22/2008
05-049	.doc	<Meeting Summary Spo Fire Dept on April 16 2008.doc>	Deborah Bisenius	4/16/2008
05-050	.doc	<Meeting Summary WW RPWRF Supervisors on April 14 2008.doc>	Deborah Bisenius	4/14/2008
05-051	.doc	<Meeting Summary Parks Dept on April 11 2008.doc>	Deborah Bisenius	4/11/2008
05-052	.doc	<Meeting Summary Water Dept on April 10 2008 amended 20080418.doc>	Deborah Bisenius	4/10/2008
05-053	.htm	<CO2 Exercise.htm>	Brad Blegen	2/1/2007
05-054	.doc	Meeting Summary Solid Waste on April 8 2008.doc>	Deborah Bisenius	4/8/2008
05-055	.doc	<Meeting Summary Gen Admin on April 8 2008.doc	Deborah Bisenius	4/8/2008
05-056	.doc	<WW with Tim Pelton April 1 2008 Rev 20080403.doc>	Deborah Bisenius	4/1/2008
05-057	.doc	<Meeting Summary Spo Police Dept on April 14 2008.doc>	Deborah Bisenius	4/14/2008
05-058	.htm	<Avista Bills – Engineering Services (normandie complex)	Kim Orlob	2/13/2007
05-059	.doc	<List of using departmens for Matrix reports.doc>	Lloyd Brewer	12/12/2008
05-060	.htm	<FW: Inventory of Desk Top Computers?>	Susan Patterson	7/3/2008
05-061	.xls	<address&uselb.xls>	Lloyd Brewer	1/22/2007
05-062	.htm	<FW: vehicle-related information.htm>	Lorie Butz	4/3/2007
05-063	.htm	<RE: Initial Draft - City of Spokane GHG Inventory.htm>	Gene Jacubczak	9/5/2008
05-064	.htm	<Police Vehicles.htm>	Ben Braudrick	12/12/2007
05-065	.htm	<RE: Police Vehicle Data.htm>	Lloyd Brewer	12/12/2007
05-066	.htm	<FW: Greenhouse Gas Assessment.htm>	Timothy Pelton	10/8/2007

05-067	.xls	<Fleet fuel estimates for 1990 from 2005 amd 2000 values on 20080811.xls>	Deborah Bisenius	8/11/2008
05-068	.pdf	<Fuel Usage 2000.pdf>	Lorie Butz	4/3/2007
05-069	.pdf	<Fuel Usage 2005.pdf>	Lorie Butz	4/3/2007
05-070	.xls	<units 2005.xls>	Lorie Butz	4/3/2007
05-071	.xls	<sold 1994-2000.xls>	Lorie Butz	4/3/2007
05-072	.xls	<sold 1994-2005.xls>	Lorie Butz	4/3/2007
05-073	.xls	<units 2000.xls>	Lorie Butz	4/3/2007
05-074	.xls	<Fuel Usage 2000 and 2005.xls>	Kevan Brooks	11/7/2007
05-075	.xls	<Cenex 2000.xls>	Art Nichols	3/28/2008
05-076	.xls	<Whitley2005.xls>	Art Nichols	3/28/2008
05-077	.xls	<FuelHistoryPurchases05-02.xls>	Art Nichols	5/28/2008
05-078	.htm	<RE: Important: Info on Traffic Lights (Greenhouse Gas Data).htm	Mathew Doval	6/25/2007
05-079	.xls	<LED Updates.xls>	Dave Shaw	7/9/2007
05-080	.htm	<Traffic Control Lights segregated.htm>	Deborah Bisenius	8/21/2008
05-081	.xls	<Avista Account Groups from Matt Doval on 20080805.xls>	Mathew Doval	8/5/2008
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05-083	.tif	<Upriver 1983.tif>	Kim Claar	12/14/2007
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05-085	.tif	<Upriver 1985.tif>	Kim Claar	12/14/2007
05-086	.tif	<Upriver 1986.tif>	Kim Claar	12/14/2007
05-087	.htm	<Document phone conversation - Percent of Wastewater Treatment from Residential.htm>	Deborah Bisenius	8/22/2008
05-088	.xls	<Calculation of Spokane residential wastewater GHG emissions 20080813.xls>	Deborah Bisenius	8/13/2008
05-089	.pdf	<Annual Biosolids Report - 2006 - with Attachments.pdf>	Michael Coster	2/15/2007
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05-092	.xlw	<Copy of 2006 Water.xlw>	Mary McIntyre	11/14/2007
05-093	.xls	<Energy Statistics for Environmental ProgramsLB.xls>	Lloyd Brewer	12/12/2008
05-094	.xls	<Energy Statistics for Environmental Programs.xls>	Mary McIntyre	12/12/2008
05-095	.xls	<2005 PUMP STATION CONSUMPTIONnm.xls>	Mallur Nandagopal	12/12/2008
05-096	.xls	<Book 1.xls>	Mary McIntyre	12/14/2007
05-097	.xls	<Book 2.xls>	Mary McIntyre	12/14/2007
05-098	.xls	<Book 3.xls>	Mary McIntyre	12/14/2007
05-099	.xls	<Book 4.xls>	Mary McIntyre	8/9/2007
05-100	.xls	<Avista2005.xls>	Kevan Brooks	2/9/2007
05-101	.tif	<Avista Power Agreement - OPR 2004-0586Page 1 to 30.tif>	Mary McIntyre	12/14/2008

05-102	.xls	<Flow Readings 1996-Present.xls>	Linda Kibbey	7/29/2008
05-103	.xls	<2000Flow.xls>	Timothy Pelton	7/29/2008
05-104	.xls	<2005Flow.xls>	Timothy Pelton	7/29/2008
05-105	.xls	<Valflow 1990-1999.xls>	Timothy Pelton	
05-106	.htm	<FW: Request for Meter Flow Information>	Deborah Bisenius	8/7/2008
05-107	.xls	<Solids 2005.xls>	Linda Kibbey	10/4/2007
05-108	.xls	<Solids 2000.xls>	Linda Kibbey	10/4/2007
05-109	.doc	<ORGCHART 1990.doc>	Linda Kibbey	10/4/2007
05-110	.xls	<Emptable 2000 and 2005.xls>	Linda Kibbey	10/4/2007
05-111	.htm	<RE:.htm>	Sharon Bowers	10/9/2007
05-112	.xls	<scapa registration.xls>	Timothy Pelton	10/4/2007
05-113	.xls	<Calculation of Percentage of Yard Waste Disposed by Incineration on 20080827.xls>	Deborah Bisenius	8/27/2008
05-114	.pdf	<code enforcement waste.pdf>	John Henry	8/5/2008
05-115	.xls	<Govt Solid Waste estimate for 1990 from 2005 figures to open dump 20080811.xls>	Deborah Bisenius	8/11/2008
05-116	.htm	<FW: Solid Waste Data.htm>	Amy Shatzkin	11/6/2007
05-117	.pdf	<ASTM-D6866Report_245158_061108 Spokane.pdf>	Timothy Porter	6/3/2008
05-118	.htm	<Financial Model 11-07.xls.htm>	Suzanne Tresko	10/10/2008
05-119	.xls	<Financial Model 11-07.xls>	Spokane Regional Solid Waste System	10/8/2008
05-120	.pdf	2005 annual report final.pdf	Spokane Regional Solid Waste System	1/1/2005
05-121	.htm	<FW: Conversation with damon taam.htm>	Ben Braudrick	10/31/2007
05-122	.htm	<RE: Questions.htm>	Lois Shields	10/26/2007
05-123	.htm	<RE: Spokane Waste Volumes.htm>	Damon Taam	8/21/2007
05-124	.htm	<FW: Waste Volumes etc..htm	Mollie Mangerich	10/22/2007
05-125	.xls	<City 2005 Recycling.xls>	Maralee Barto	8/22/2008
05-126	.htm	<Email from Kevan Brooks WWM about Solid Waste no charge for disposal on 20080904.htm>	Deborah Bisenius	9/4/2008
05-127	.htm	<FW: April 10 2008 Proposed new regulations of power generators.htm>	Russ Menke	4/10/2008
05-128	.htm	<FW: April 14 2008 Proposed new regulations of power generators.htm>	Russ Menke	4/14/2008
05-129	.htm	<FW: GHG Inventory - Correction.htm>	Russ Menke	9/12/2008
05-130	.htm	<FW: Initial Draft - City of Spokane GHG Inventory.htm>	Russ Menke	9/5/2008
05-131	.xls	<Parks Green Waste.xls>	Ben Braudrick	10/10/2007
05-132	.htm	<FW: WASTE STATS>	Jim Haynes	8/21/2007

05-133	.xls	<Spokane Public Library Solid Waste Costs 2005.xls>	Steve Shagina	5/1/2007
05-134	.htm	<FW: Yard Waste statistics 2005.xls>	Suzanne Tresko	7/30/2008
05-135	.htm	<RE Yard Waste statistics 2005.xls - UPDATED.htm>	Suzanne Tresko	8/5/2008
05-136	.xls	<Copy of WARM for flyash for 2005 on 20080711.xls>	Leon Letson	7/11/2008
05-137	.txt	<RE: FW: WARM Model - City of Spokane.txt>	Jennifer Brady	8/27/2008
05-138	.pdf.	<FlyAsh_11_07.pdf>	Jennifer Brady	8/27/2008
05-139	.xls	<YrEnd2005.xls>	Maralee Barto	8/25/2008
05-140	.htm	<FW: Waste Protocol>	Amy Shatzkin	11/5/2007
05-141	.doc	<RE City Hall Recycling rate or amount in past years.doc>	Ann Murphy	7/2/2008
05-142	.htm	<RE: Message from Refuse Voicemail 2.htm>	Suzanne Tresko	8/21/2008
05-143	.xls	<Solid Waste Statistics (2).xls	Jane Shaw	7/31/2008
05-144	.htm	<FW: Greenhouse Gas Inventory Request for Waste Stream Composition>	Timothy Pelton	8/7/2008
05-145	.htm	<FW: Request for Monetary costs for Grit and Screenings disposal>	Linda Kibbey	8/1/1978
05-146	.doc	Table 2.1e Transportation Sectory Energy Consumption, 1949-2007 in trillion BTU on 20081210.doc	http://www.eia.doe.gov/emeu/aer/txt/ptb0201e.html	12/15/2008
05-147	.htm	<Spokane County Vehicle Miles Traveled (VMT) data.htm>	Ann Ragaza-Bourassa	10/8/2008
	.htm	<FW: Spokane County Vehicle Miles Traveled (VMT) dataDB.htm>	Deborah Bisenius	10/8/2008
05-148	.pdf	Flow91-92.pdf	City of Spokane Streets Dept.	10/8/2008
05-149	.pdf	Flow2000-01.pdf	City of Spokane Streets Dept.	10/8/2008
05-150	.pdf	Flow2003-04.pdf	City of Spokane Streets Dept.	10/8/2008
05-151	.pdf	Flow2006-07.pdf	City of Spokane Streets Dept.	10/8/2008
05-152	.pdf	<Spokane_GTEC_Plan_Summary_2-08.pdf>	City of Spokane	2/1/2008
05-153	.htm	<FW: Freeway Vehicle % Spokane Greenhouse Gas Study.htm>	Christopher Cafaro	11/6/2007
05-154	.xls	<BREWER.xls>	Sally Otterson	5/3/2006
05-155	.htm	<FW:VMT data>	Anna Ragaza-Bourassa	5/2/2006
05-156	.htm	<RE: Request for Information - City of Spokane.htm>	Jeffrey White	9/10/2008
05-157	.htm	<RE: Train Diesel Use.htm>	Deborah Bisenius	9/11/2008
05-158	.doc	<WA Spokane.doc>	Lyle Staley	8/22/2008

05-159	.xls	<UPRR Spokane Est Fuel Consumption 2005.xls>	Jon Germer	9/11/2008
05-160	.xls	<UPRR Spokane Est Fuel Consumption 2000.xls>	Jon Germer	9/11/2008
05-161	.htm	<FW: Greenhouse gas study.htm>	Don Reimer	10/8/2007
05-162	.htm	<Union Pacific Railroad estimated fuel usage request - Spokane.htm>	Jon Germer	9/11/2008
05-163	.htm	<CACP Software Results for STA.htm>	Deborah Bisenius	9/11/2008
05-164	.htm	<FW: Data Request for Greenhouse Gas Inventory Report.htm.>	Molly Myers	9/8/2008
05-165	.htm	<FW: Request for Greenhouse Gas Emissions Information from Spokane Washington.htm>	Jon Germer	8/26/2008
05-166	.htm	<Ratio of City of Spokane to Spokane County Rail Road Tracks.htm>	Deborah Bisenius	8/21/2008
05-167	.xls	<UPRR Spokane Est Fuel Consumption 2005.xls>	Jon Germer	9/11/2008
05-168	.xls	<UPRR Spokane Est Fuel Consumption 2000.xls>	Jon Germer	9/11/2008
05-169	.htm	<CTRannualreportform.2005.doc .htm>	Mary Ann Carey	4/3/2008
05-170	.htm	<FW: City Employee Totals.htm>	Lura Robson	5/14/2008
05-171	.xls	<2005AUTOALLOW(2).xls>	Kim Orlob	8/19/2008
05-172	.pdf	<2007 City Hall employee total.pdf>	Lloyd Brewer	10/3/2008
05-173	.pdf	<2005 CTR Survey_001.pdf>	Gayle Tucker	4/3/2008
05-174	.doc	<2005annualreportform.doc>	Gayle Tucker	4/3/2008
05-175	.htm	<Commute Trip Reduction--Congratulations.htm	Pamella Piro	2/15/2007
05-176	.rtf	<Important Update on Commute Trip Reduction.rtf>	Pamella Piro	7/16/2007
05-177	.htm	<FW: CTRannualreportform.2005.doc. htm>	Mary Ann Carey	4/3/2008
05-178	.xls	<Employee commute 1990 using assumptions from 2005 20080811.xls>	Deborah Bisenius	12/8/2008
05-179	.htm	<FW: estimates of natural gas loss in distribution system>	Lloyd Brewer	7/30/2007
05-180	.xls	<GHG Inv_WANGlosses.xls>	Kevin Booth	9/24/2008
05-081	.pdf	<0805GHGGUIDELINES.pdf>	Kevin Booth	9/24/2008
05-182	.htm	<FW: NG System Losses in City.htm>	Kevin Booth	9/24/2008
05-183	.htm	<FW: City of Spokane Landfills.htm>	Jay Dahner	8/28/2008

05-184	.htm	<FW: Final Gas Analysis Memo.htm>	Robert Darilek	8/26/2008
05-185	.htm	<FW: Freon.htm>	Lorie Butz	8/21/2008
05-186	.pdf	Gas Analysis memo--final.pdf	Robert Darilek	8/26/2008
05-187	.htm	<Communications about Electricity Generation at Northside Landfill.htm>	Deborah Bisenius	9/10/2008
05-188	.htm	<FW: Spokane Issues.htm>	Amy Shatzkin	9/12/2008
05-189	.doc	<Highlights for 2005 Urban Forestry Program.doc>	Jeff Perry	8/25/2008
05-190	.doc	<Highlights for 2007 Urban Forestry Program.doc>	Jeff Perry	8/25/2008
05-191	.doc	<Removals and Plantings.doc>	Jeff Perry	8/25/2008
05-192	.doc	<VacantLand.doc>	Joe Sacco	8/25/2008
05-193	.htm	<RE: City of Spokane Undeveloped Land.htm>	Joe Sacco	8/25/2008
05-194	.doc	<What we do in the Urban Forestry Department.doc>	Jeff Perry	8/25/2008
05-195	.htm	<RE: Jeff Perry>	Jeff Perry	10/31/2008
05-196	.pdf	<Annual CO2 Benefits.pdf>	Jeff Perry	10/31/2008
05-197	.htm	<Cost/benefits of Urban Forestry.htm>	Jeff Perry	10/29/2008

References

Call#	Title	Author	Publisher or Jounal	Year
05-200	The Impact of Municipal Solid Waste Management on Greenhouse Gas Emissions in the United States	Thornloe, Susan A.; Weitz, Keith; Nishtala, Subba R.; Yarkosky, Sherry; Zannes, Maria	Journal of the Air & Waste Management Assoc.	2002
05-201	RE: Software handling of solid waste in controlled incineration	Ramel, Alex	ICLEI	2007
05-202	1999 Statewide Waste Characterization Study: Results and Final Report	Cascadia Consulting Group, Inc.; Sky Valley Associates, Inc.; Sheri Eiker-Wiles Associates; Pacific Waste Consulting Group; Veterans Assistance Network; E. Tseng Associates; E. Ashley Steel; California Integrated Waste Management Board staff	California Integrated Waste Management Board	1999
05-203	Seattle Public Utilities 2001-02 Litter Composition Study: Final Report	Cascadia Consulting Group, Inc.; Sky Valley Associates, Inc.; Seattle Public Utilities Staff; Seattle Parks and Recreation	City of Seattle	2001
05-204	2007 Spokane County Comprehensive Solid Waste Management Plan Update: Appendix B Waste Flow Analysis	SCS Engineers; CH2MHILL; Cascadia Consulting Group	Spokane Regional Solid Waste System	2007
05-205	CITY ENERGY SAVINGS - AVISTA.xls	Kelly, Doug	Avista Utilities	2007
05-206	Copy of citydensity.xls		WA Office of Financial Management	2008
05-207	FW: Urgent Request for Specific Units in Energy Savings.htm	Kelly, Doug	Avista Utilities	2008
05-208	FW: Water Stewardship goals vs. pumpage through the end of July.htm	Rickard, Bill	Water Stewardship - City of Spokane	2008
05-209	Kraemer LFG Beneath Geomembrane 1993.pdf	Kraemer, Thomas A.; Herbig, H. H.; Cordery-Cotter, Susan	CH2M-HILL	1993
05-210	RE: Buck-A-Block Program - City of Spokane.htm	Drake, Chris	Avista Utilities	2008
05-211	District History.htm	Spokane Public Facilities District	Spokane Public Facilities District	2008
05-212	Spokane Water Stewardship Strategic Plan 4-12-06.pdf	Water Stewardship - City of Spokane	Water Stewardship - City of Spokane	2006

05-213	SWANA - LFG Collection System Efficiencies.pdf	Los Angeles County Sanitation Districts	Appllied Research Foundation	2007
05-214	2007 Key Facts	Washington State Dept. of Transportation	Washington State Dept. of Printing	2007
05-215	Gov's Executive Order 07-02 on Climate Change.pdf	Christine Gregoire	Office of the Governer	2007
05-216	Climate Change 2007 - The Physical Science Basis - Global Climate Projections.pdf	Meehl, G.A.; T.F. Stocker; W.D. Collins; P. Friedlingstein; A.T. Gaye; J.M. Gregory; A. Kitoh; R. Knutti; J.M. Murphy; A. Noda; S.C.B. Raper; I.G. Watterson; A.J. Weaver and Z.-C. Zhao	Cambridge University Press	2007
05-217	Climate Change 2007 - The Physical Science Basis - Summary for Policymakers.pdf	Solomon, S.; D. Qin; M. Manning; Z. Chen; M. Marquis; K.B. Averyt; M.Tignor and H.L. Miller	Cambridge University Press	2007
05-218	A Comprehensive Urban Forestry Management Plan for the City of Spokane, Washington	Natural Path Forestry Consultants, Inc.	Natural Path Forestry Consultants, Inc.	1997
05-219	City of Spokane Initial Urban Growth Boundary Proposal and Residential Land Capacity Summary	City of Spokane - Planning Services	City of Spokane - Planning Services	2006
05-220	FW: CAPPA.htm	Amy Shatzkin		2008
05-221	swmp final draft may 2008 amended 9-18-2008	Spokane Regional Solid Waste System	Spokane Regional Solid Waste System	2008
05-222	Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change	Houghton, J.T.,Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell, and C.A. Johnson (eds.)	Cambridge University Press	2001
05-223	FW: Target Years for CACP Software.htm	Justus Stewart		2008
05-224	City of Spokane Greenhouse Gas Inventory 10.27_AS.doc	Amy Shatzkin		2008
05-225	FW: Comments on Inventory.htm	Amy Shatzkin		2008
05-226	FW: GHG targets	Lloyd Brewer		2008
05-227	WA State Network conference call notes.htm	Justus Stewart		2008
05-228	Local Government Operations Protocol	Various	Developed in Partnership by: CA Air Resources Board; CA Climate Action Registry; ICLEI; & The Climate Registry	2008
05-229	Summary of Results: Biomass Determination using ASTM-D6866	Beta Analytic Inc.	For Wheelabrator Technologies Inc.	2008

Workbooks

Call#	Document Title
05-300	CityGHG.xls
05-301	Community - Transportation Emissions by Source
05-302	Vehicle Fleet Information
05-303	Wasteweights&percentages.xls
05-304	Calculation of 2005 GHG Emissions from City of Spokane Residents for WW Treatment on 20080730.xls
05-305	Estimation of Escaped Methane as Direct Emissions Community GHG 2005 20080729.xls
05-306	LED Updates on 08052008.xls
05-307	CFL to Water connection on 20080828.xls
05-308	Per Capita Greenhouse Gas Emissions for 2005 on August 22 2008.xls
05-309	vehicle fleet.xls
05-310	Growth Projections for Spokane City 2005 to 2050
05-311	CACP forecast after eGRID and VMT Transportation changes 20081208DB.xls
05-312	Community Detailed Report 2020 from CACP on 11132008.RTF
05-313	Community Summary 2020 from CACP on 11132008.RTF
05-314	Spokane Community Indicators 3_21 on 20081208.xls
05-315	CACP backcast after eGRID and VMT Transportation changes 20081208DB.xls
05-316	Employment growth rates compiled from Wash State Employment Security 20081002
05-317	Back cast 1990 using Puget Sound CAA procedure 20081215DB.xls
05-318	CACP forecast for 2020 from 2005_waste sector not corrected_20081215DB.xls
05-319	Forecast for 2012 based on 2005 with Annual Growth Rates 20081216DB.xls
05-320	Forecast for 2030 based on 2005 through 2020 Dec 17 2008.xls

Appendix E: Brief User's Guide – CityGHG.xls

The spreadsheet file "CityGHG.xls" contains most of the calculations and summary data compiled and used in this inventory process. It serves several purposes, but for the reader it offers a place to dig into the data and see how it has been manipulated. It can also be used to do some "what if" analysis. The ICLEI CACP software operates somewhat like a black box. We put data in and it spits results out. The spreadsheet has inserted CACP factors and algorithms which helps make more obvious the calculations being used. Never-the-less, the spreadsheet file itself is large and complex and does not have all the functionality of the CACP software.

"CityGHG.xls" is made up of a number of interconnected sheets within one workbook. There are purple tabbed sheets for each of the government sectors and orange tabbed sheets for each of the community sectors. The one red tabbed sheet is the Summary sheet at the top of which is a toggle section where the data in the sheets can be manipulated in several ways. For example with the toggle and the percentage entry point one can change how much power is assumed being used from the City's Upriver Dam versus power from the grid as defined by EPA's e-grid or from Avista to power the Water Department's pumps. Another toggle lets one calculate with an updated waste protocol or change back to the CACP model outputs. Other sheets include graphs, calculations for the personal footprint, a Scopes calculation page, and a recycling page.

It is our intent to have this spreadsheet available for download from the City of Spokane's Environmental Programs website and/or the www.GreenSpokane.org website upon this inventory document finalization. Should you want it and not find it available call Spokane Environmental Programs at 509-625-6570.