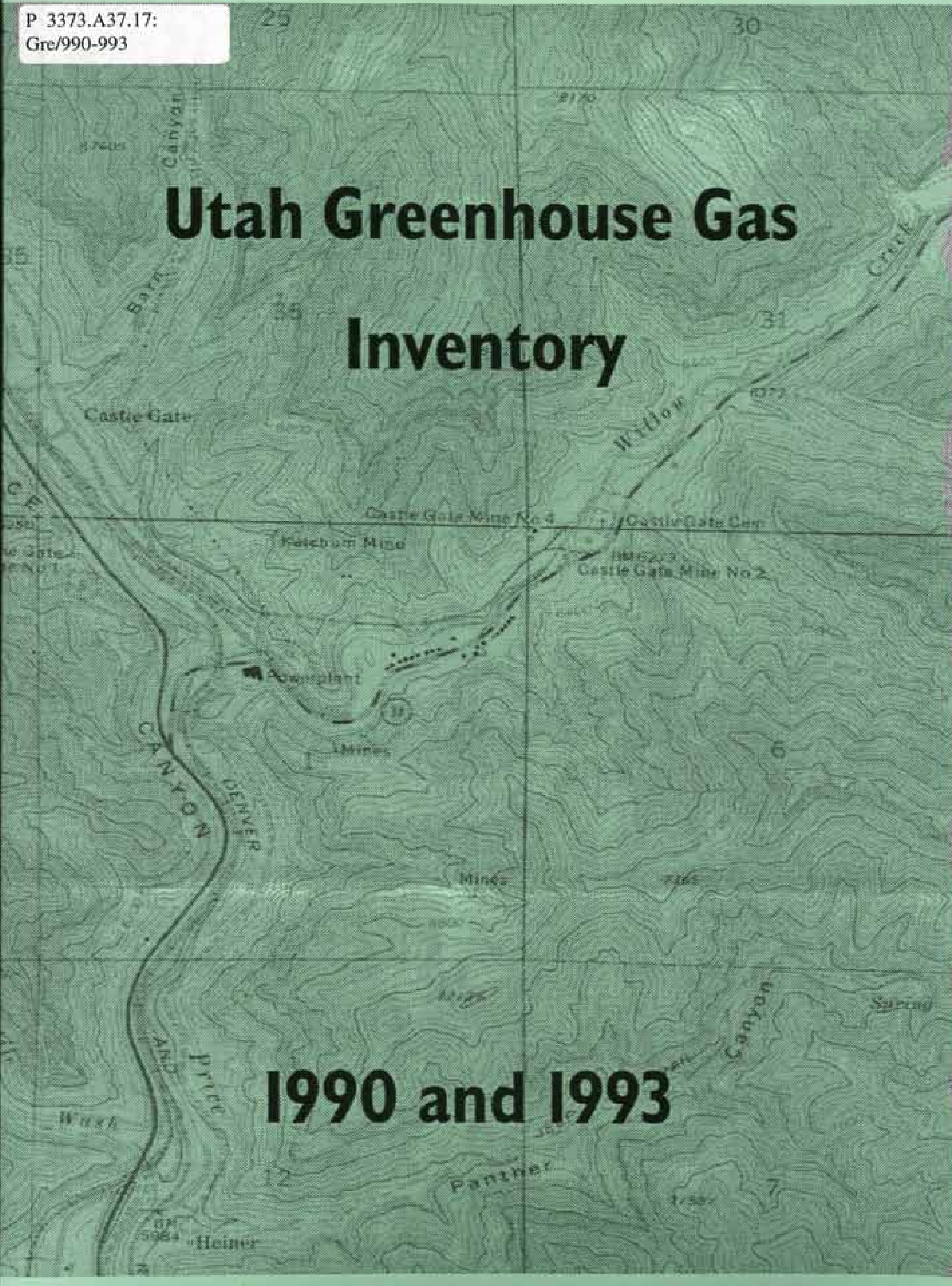
Utah Greenhouse Gas Inventory

1990 and 1993



UTAH GREENHOUSE GAS EMISSIONS

Estimates for 1990 and 1993

by

The Utah Department of Environmental Quality
Division of Air Quality

and

The Utah Department of Natural Resources
Office of Energy and Resource Planning

FOREWORD

The most casual observer of current events cannot fail to notice the media's increasing attention devoted to the problem of greenhouse gas emissions. Accounts of its possible effects occupy our evening news and grace the editorial pages of our local newspapers. Indeed, barely a month passes without a story of new research confirming suspicions that, in fact, human activity contributes measurably to the Earth's warming. Seemingly, with each new report, yet another heart in the scientific community is won over and the public's interest is heightened.

It is in the spirit of this growing consensus that the Division of Air Quality (DAQ) and the Office of Energy and Resource Planning (OERP) undertake this inventory of greenhouse gas emissions in the state of Utah. This effort marks the state's initial step in the identification and documentation of the natural and anthropogenic (human caused) sources of greenhouse gases. Albeit a seemingly basic task, this undertaking is critical for it will establish the baseline data against which competing policy decisions and costs of mitigation strategies may be compared.

This multi-phase study is a joint effort among several agencies both state and federal. As such, the authors of this and successive reports must extend their gratitude to the many individuals who have supported this research effort. First and foremost, the state of Utah respectfully acknowledges the financial and institutional support of the EPA, without which this study would not be possible.

The Division of Air Quality and the OERP also wish to thank the many members of their staff who have contributed to this report as well as several state agencies including the Department of Agriculture, the Division of Plant Industry, the Department of Natural Resources, and the Department of Transportation. The authors would also like to extend their gratitude to the many utilities and private sector firms who have provided state agencies with the data described in this report.

Executive Summary

This report provides a comprehensive inventory of greenhouse gas emissions for Utah. The greenhouse gases included are the four primary greenhouse gases emitted as a result of human activity. These are carbon dioxide, methane, nitrous oxide and ozone-depleting compounds (primarily chlorofluorocarbons).

Emissions of these gases are estimated for 1990 and 1993. Emissions were estimated by using the methodologies given in the EPA *State Workbook.*

The second phase will evaluate current and potential policies to reduce greenhouse gas emissions, including the estimated cost of implementing those policies. The results of phase one will be used as a basis for completing phase two of the study.

Table 4 provides the results of the emissions inventory. For the sake of simplicity, the 1993 levels will be referred to throughout the report. On a ton per year basis, Utah produced slightly more than 64 million tons of greenhouse gases. Carbon dioxide from fossil-fuel combustion accounts for over 62 million of this total, followed by limestone use, cement production, and limestone production. Aside from nominal amounts of CO_2 released from soda ash processing, forestry and land use changes account for most of the remaining sources of carbon gases.

Methane represents the next largest fraction of greenhouse gases at 409,554 tons. Underground coal mines are responsible for over half of the emissions from this category, followed by domestic animals. Oil and gas consumption and methane from landfills account for most of the remainder. Nitrous oxide, associated with fertilizer use, registered only 450 tons.

Due to the presence of coal burning power plants, Millard and Emery counties produce the largest portion of greenhouse emissions in the state. Salt Lake county, the most densely populated county in the state, produces the third largest amount of emissions in Utah. Counties containing underground coal mines (Emery, Sevier and Carbon) release the most methane. While an almost insignificant source of emissions, fertilizer-based nitrous oxide is distributed among the middle and northern counties.

Contents

Appendix

List of Tables

List of Figures

Figures		Page

Introduction

A. Purpose of the Greenhouse Gas Study

This study is intended to provide a set of methodologies to estimate the emissions of greenhouse gases using a formal set of guidelines to characterize these emissions in the state of Utah. Compiling an emissions inventory is a critical first step toward developing policies and strategies to mitigate greenhouse gas emissions and to assess the various options available for responding to the effects of climate change.

B. Greenhouse Gases and Climate Change

The climate of the earth is affected by changes in radiative forcing attributable to several sources including the concentrations of radiatively active (greenhouse) gases, solar radiation, aerosols, and albedo.[1] Greenhouse gases in the atmosphere are virtually transparent to sunlight (shortwave radiation), allowing it to pass through the air and to heat the Earth's surface. The Earth's surface absorbs the sunlight and emits thermal radiation (longwave radiation) back to the atmosphere. In turn, the atmosphere emits thermal radiation both outward into space and downward to the Earth, further warming the surface. This process, known as the "greenhouse effect," enables the Earth to maintain enough warmth to support life. Indeed without this natural process, our planet would be approximately 55°F colder than it is today. However, increasing concentrations of these greenhouse gases are projected to result in increased average temperatures, with the potential to warm the Earth to a level that could disrupt the activities of today's natural systems and human societies.

The British Meteorological Office and the University of East Anglia reported that 1995 was the warmest year since consistent record keeping began in 1856. The 5-year period from 1991 through 1995 was also documented as the warmest on record. This finding is considered particularly troubling, since the Earth benefited from cooler temperatures for nearly two years after the 1991 eruption of Mt. Pinatubo, the volcano located in the Philippines. The Goddard Institute, analyzing a different set of global weather data, also determined that 1995 was the warmest year ever but could not conclude that it was significantly warmer than 1990.

It is now generally accepted that the Earth is being warmed by human activities, in particular greenhouse gas emissions from the burning of fossil fuels. Carbon dioxide emissions were reported to be 1,430 million metric tons of carbon in 1994 for the United States. Of this, energy consumption contributed 1,396 million metric tons of carbon, while other industries accounted for

---

[1] Albedo is the fraction of light or radiation that is reflected by a surface or a body. For example, polar ice and cloud cover increase the Earth's albedo. "Radiative forcing" refers to changes in the radiative balance of the Earth (i.e., a change in the existing balance between incoming and outgoing radiation). This balance can be upset by natural causes, such as volcanic eruptions as well as by anthropogenic activities, for example greenhouse gas emissions.

about 34 million metric tons. World carbon emissions in 1994 were approximately 6,000 million metric tons and it is anticipated that the growth of China will significantly increase global carbon emissions.

Naturally occurring greenhouse gases include water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (NO_2), and ozone (O_3).[2] Some human-made compounds, including chlorofluorocarbons (CFCs) and partially halogenated fluorocarbons (HCFCs), their substitutes hydrofluorocarbons (HFCs), and other compounds such as per fluorinated carbons (PFCs), are also greenhouse gases. In addition, there are photochemically important gases such as carbon monoxide (CO), oxides of nitrogen (N_2O), and non-methane volatile organic compounds (NMVOCs) that, although not considered greenhouse gases per se, contribute indirectly to the greenhouse effect. These are commonly referred to as "tropospheric ozone precursors," because they influence the rate at which ozone and other gases are created and destroyed in the atmosphere.[3]

Although CO_2, CH_4, and N_2O occur naturally in the atmosphere, their recent atmospheric buildup appears to be the result of anthropogenic activities. The buildup has altered the composition of the earth's atmosphere, and possibly will affect future global climate. Since 1800, atmospheric concentrations of carbon dioxide have increased about 25 percent, methane concentrations have more than doubled, and nitrous oxide concentrations have risen approximately eight percent (IPCC, 1992). Furthermore, beginning in the 1950s until the mid-1980s, when international concern over CFCs grew, the use of these gases increased nearly 10 percent per year. The consumption of CFCs is declining quickly as these gases are phased out under the *Montreal*

---

[2] Ozone exists in the stratosphere and troposphere. In the stratosphere (about 12.4 - 31 miles above the Earth's surface), ozone provides a protective layer shielding the Earth from ultraviolet radiation and subsequent harmful health effects on humans and the environment. In the troposphere (from the Earth's surface to about 6.2 miles above), ozone is a chemical oxidant and major component of photochemical smog. Most ozone is found in the stratosphere, with some transport occurring to the troposphere (through the tropopause, i.e., the transition zone separating the stratosphere and the troposphere) (IPCC, 1992).

[3] For convenience, all gases discussed in this document are generically referred to as "greenhouse gases," although the reader should keep in mind the distinction between actual greenhouse gases and photochemically important trace gases.

Protocol of Substances that Deplete the Ozone Layer.[4] Use of CFC substitutes is expected to grow substantially.

Despite these increases, it is impossible at this juncture to predict with certainty the timing, magnitude, or regional distribution of any climatic change. Uncertainty about the climatic role of oceans and clouds as well as the climate feedback from oceans, clouds, vegetation, and other factors make it difficult to predict the exact amount of warming that a given level of greenhouse gases, such as doubled CO_2 concentration, would cause and the rate at which any climate change would occur.

If the predicted level of climate change occurs (an average global temperature change between 1.5 and 4.5°F by 2050 (IPCC, 1992), however, the areas most vulnerable to this disruption include forests, fisheries, coastal zones, agriculture, water resources, energy demand and supply, air quality, and human health. Potential impacts on these sectors include: loss of tree species and reduced land area of healthy forests resulting from drier soils or increased pestilence and disease; reduced shellfish productivity; increased annual demand for electricity for summer cooling thereby increasing the need for total generating capacity; water use conflicts, as water availability declines and demand for water, such as for irrigation and power plant cooling, increases; and increased air pollution, as air quality is directly affected by weather variables such as higher temperatures which speed reaction rates among chemicals in the atmosphere, causing higher ozone pollution and urban smog (Smith and Tirpak, 1989).

Drastic cuts in emissions would be required to stabilize atmospheric composition. Because greenhouse gases remain in the atmosphere for decades to centuries, merely stabilizing emissions at current levels would allow the greenhouse effect to intensify for more than a century. For example, emissions of carbon dioxide might have to be reduced by 50 to 80 percent to hold current concentration constant. While it is not possible to stabilize greenhouse gas concentration immediately, implementation of measures to reduce emissions would decrease the risk of global warming, regardless of the uncertainties about the response of the climate system (Lashof and Tirpak, 1990).

---

[4] Recognizing the harmful effects of chlorofluorocarbons and other halogenated fluorocarbons on the atmosphere, many governments signed the *Montreal Protocol on Substances that Deplete the Ozone Layer* in 1987 to limit the production and consumption of a number of these compounds. As of June 1994, 133 countries had signed the *Montreal Protocol*. The United States furthered its commitment to phase out these substances by signing and ratifying the Copenhagen Amendments to the Montreal Protocol in 1992. Under these amendments, the United States committed to eliminating the production of all halons by January 1, 1994, and all CFCs by January 1, 1996.

C. International, National, and State Actions

Scientific consensus that the threat of climate change is real has triggered a wave of responses by governments at the international, national, and state levels. For example, since the mid-1980s, the United States has taken an active role in fostering international cooperation and furthering research into understanding the causes and effects of climate change. Initially, the United States worked with technical experts from over 50 countries and the Organization for Economic Cooperation and Development (OECD) to develop methods for estimating emissions and uptake of greenhouse gases. This cooperative effort supported the charge of the Intergovernmental Panel on Climate Change (IPCC), a committee jointly established by the United Nations Environment Program (UNEP) and the World Meteorological Organization (WMO) in 1988 to assess scientific information related to climate change issues. These activities culminated in the compilation of a set of internationally accepted methods for conducting national emission inventories, the *IPCC Guidelines for National Greenhouse Gas Inventories: Vols 1-3* (IPCC, 1994).

In June 1992, the United States further demonstrated its concern about climate change by joining with 154 other nations at the United Nations Conference on Environment and Development in signing the Framework Convention on Climate Change (FCCC). Later, in October 1992, the United States became the first industrialized nation to ratify the treaty, which came into force on March 21, 1994. The FCCC commits signatories to stabilizing anthropogenic greenhouse gas emissions to "levels that would prevent dangerous anthropogenic interference with the climate system." To facilitate this, Article 4-1 requires that all parties to the FCCC develop, periodically update, and make available to the Conference of Parties, national inventories of anthropogenic emissions of all greenhouse gases not controlled by the *Montreal Protocol*, using comparable methodologies to fulfill its obligation under the FCCC, the U.S. government published the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-1993* (U.S. EPA, 1994) and the *U.S. Climate Action Report* (U.S. Government, 1994).[5]

At the national level, the Clinton Administration developed and published the *Climate Change Action Plan* (CCAP, Clinton and Gore, 1993) to assist the United States in meeting its obligation under the FCCC - to return greenhouse gas emissions to 1990 levels by the year 2000. The *Climate Change Action Plan* promotes the development and expansion of approximately 50 initiatives that span all sectors of the economy and focus on reducing emissions of greenhouse gases in a cost-effective manner. These initiatives call for cooperation between government, industry, and the public, and since they are primarily voluntary in nature, are designed for rapid

---

[5] The *Climate Action Report* represents the first formal U.S. communication under the FCCC as required by Articles 4.2 and 12 and describes the current U.S. program. The report neither identifies additional policies or measures that might ultimately be taken as the United States continues to move forward in addressing climate change, nor serves as a revision to the *Climate Change Action Plan*. It is intended to identify existing policies and measures, and assist in establishing a basis for considering future actions.

implementation. Also, the U.S. Department of Energy has recently released a set of draft guidelines for entities to report voluntarily their reductions of greenhouse gas emissions and fixation of carbon, achieved through any measure. The guidelines serve several purposes such as: 1) providing a database of information for entities seeking to reduce their own greenhouse gas emissions; 2) establishing a formal record of emissions and emission reductions and carbon sequestration achievements; and 3) informing the public debate regarding future discussions on national greenhouse gas policy.

At the state level, the U.S. EPA's Climate Change Division, State and Local Outreach Program, has been working with states to assist them in: 1) identifying their greenhouse gas emission sources and estimating their overall contribution to radiative forcing; 2) assessing the areas of the state that are most vulnerable to climate change; and 3) developing state-specific greenhouse gas mitigation strategies. In November 1992, the Climate Change Division published the original version of this document, *State Workbook: Methodologies for Estimating Greenhouse Gas Emissions* (U.S. EPA, 1992). As part of the next phase of the State and Local Outreach Program, the Climate Change Division will publish the *States Guidance Document: Policy Planning to Reduce Greenhouse Gas Emissions* (forthcoming). In addition to these activities, the National Governor's Association Task Force on Global Warming has proposed more than 20 strategies, consistent with international goals, for responding to the threat of global warming (NGA, 1991). Also, the Council of State Governments' Global Change Task Force has published a plan that recommends 30 ways for Northeastern states to reduce emissions of greenhouse gases (Environmental Information Networks, Inc., 1944a).

D. The Role of the States

States will need to consider a variety of issues, ranging from mass transit to reforestation, and from the recycling of wastes to the reduction of energy use, in order to develop climate change policies that reduce emissions of greenhouse gases while maintaining economic growth and development. Many states have already begun to address these issues. Examples include: a California law calling for the California Energy Commission to study the potential impact of climate change on the state's energy supply/demand, economy, environment, and agricultural and water resources; a Connecticut law establishing a broad range of energy conservation measures; the program focused on the reduction of CO_2 emissions by the Energy Division of the Minnesota Department of Public Service; and, an Oregon law requiring the Oregon Department of Energy to develop strategies for reducing greenhouse gas emissions (Silbiger and Gongring, 1992 and Environmental Information Networks, Inc., 1994b).

There are several reasons why states can significantly affect their emissions of greenhouse gases. First, state governments hold direct regulatory authority over the sources of more than half of all CO_2 emissions: gas and electric utilities. Second, states also determine the acceptability of building specifications and land-use planning, thereby affecting emissions from the residential, commercial, and transportation sectors. Third, states also have jurisdiction over determining regulations concerning the use and recycling of paper, glass, and plastic products, the management of municipal solid wastes (and consequently methane emissions), and the promotion of energy savings from secondary manufacturing. Finally, many states currently regulate forestry practices on non-federal lands.

A wide variety of policy options are available that have the technical potential to reduce greenhouse gas emissions. Many appear to be consistent with other economic, development, environmental, and social goals. One such policy includes identifying and implementing opportunities for cost-effective energy improvements. For example, efficiency investments that pay for themselves over the life of the equipment, through reduced energy costs, suggest that the accompanying reduction in carbon dioxide emissions may be essentially a cost-free by-product of a more efficient economy.[6] Efficiency improvements can also reduce emissions of other pollutants, improve economic competitiveness, and enhance U.S. environmental quality, energy independence, capturing and reusing methane from landfills and coal mines, and increasing afforestation and reforestation efforts are other possible policy options with multiple benefits.

Policymakers and planners will need to design policies and strategies to deal with the uncertainties of climate change, the potentially significant impacts climate change could have on their region's natural resources, and ways to reduce emissions of greenhouse gases to help curb climate change.[7] This requires a three-step process: 1) an assessment of the vulnerability of resources to climate change impacts; 2) an evaluation of adaptation options; and 3) an evaluation of mitigation options.

Assessing the vulnerability of a state or region to climate change impacts involves estimating a range of regional climate change scenarios. After vulnerability assessments have been completed, a state can weigh its vulnerabilities against the economic, environmental, and social changes in rainfall and temperature, water conservation, forest health and production, and protection of biological diversity. The efficient implementation of these policies can best be achieved through the establishment of priorities among suggested anticipatory options (U.S. EPA, 1991).

---

[6] According to the National Academy of Science report "Policy Implications of Greenhouse Warming Mitigation Panel" NAS Press, 1991, as quoted by Richard Kerr, "the most cost-effective measures for reducing emissions involve increasing the energy efficiency of residential and commercial buildings and activities, vehicles, and industrial processes that use electricity." (*Science*, Vol 252, 21 June 1991, p. 252).

[7] Adaptation options will be necessary in the future if current and planned capabilities are found to be insufficient to address the adverse impacts of climate change. Under these options falls the debate over anticipatory versus reactive measures. Reactive measures are those which are made as climate change impacts occur, anticipatory measures are made before climate change impacts are felt. Crucial to this debate is the analysis of the economic, environmental, and social costs and benefits of any suggested option (U.S. EPA, 1991).

Considerable uncertainty exists, however, regarding the economic and social costs and benefits associated with preventive measures to combat the potential effects of climate change and strategies to mitigate greenhouse gas emissions. Some estimates show that the costs associated with stabilizing greenhouse gas emissions will range anywhere from zero to six percent of the U.S. GNP (Manne and Richels, 1989), while a National Academy of Sciences panel has concluded that the potential exists to reduce greenhouse gas emissions in the United States by 10 to 40 percent of 1990 levels at a very low cost and possibly a net savings (NAS, 1991). The actual costs and benefits of alternative mitigation and adaptation strategies in an individual state will, of course, depend on the particular sources of emissions, currently available technologies, and the vulnerability of the agricultural, forestry, energy, and other important sectors in that state.

E. Global Warming Potential (GWP)

When discussing greenhouse gases in a policy context, especially when attempting to estimate the costs and benefits of greenhouse gas emission reduction strategies, it is useful to have some means of estimating the relative effects of each greenhouse gas on radiative forcing of the atmosphere over some future time horizon, without performing the complex and time-consuming task of calculating and integrating changes in atmospheric composition over the period. In short, an index is needed that translates the level of emissions of various gases into a common metric in order to compare the climate forcing effects without directly calculating the changes in atmospheric concentrations (Lashof and Tirpak, 1990). This information can then be used for calculation of the cost-effectiveness of reductions (e.g., CO_2 emissions compared to CH_4 emissions).

A number of approaches, called Global Warming Potential (GWP) indices, have been developed in recent years. These indices account for the direct effects of growing concentrations of carbon dioxide, methane, chlorofluorocarbons, nitrous oxide, hydorfluorocarbons, and per fluorinated carbons in the atmosphere on radiative forcing. They also estimate indirect effects on radiative forcing due to emissions which are not themselves greenhouse gases, but lead to chemical reactions that create other greenhouse gases. These emissions include carbon monoxide, nitrogen oxides, and non-methane volatile organic compounds, all of which contribute to formation of tropospheric ozone, which is a greenhouse gas (Lashof and Tirpak, 1990).

This report follows the methodology used by the IPCC (IPCC, 1992). However, there is no universally accepted methodology for combining all the relevant factors into a single global warming potential for greenhouse gas emissions. In addition to the IPCC, there are several other noteworthy attempts to define a concept of global warming potential, including Lashof and Ahuja (1990), Rodhe (1990), Derwent (1990), WRI (1990), and Nordhaus (unpublished).

The concept of the global warming potential, as developed by the IPCC, is based on a comparison of the radiative forcing effect of the concurrent emissions into the atmosphere of an equal quantity of CO_2 and another greenhouse gas. Each gas has a different instantaneous radiative forcing effect. In addition, the atmospheric concentration attributable to a specific quantity of each gas declines with time. In general, other greenhouse gases have a much stronger instantaneous radiative effect than does CO_2; however, CO_2 has a longer atmospheric lifetime and a slower decay rate than most other greenhouse gases. Atmospheric concentrations of certain greenhouse gases may decline due to atmospheric chemical processes, including latitudinal and temporal variations that make it impossible to quantify how certain gases may indirectly affect the climate. Due to these uncertainties over indirect effects, these concentrations have not been included in the GWP of each gas at this time (IPCC, 1992). Only the ability of gases to directly affect radiative forcing is included here.[8]

Table 1. Global Warming Potentials for Various Greenhouse Gases (Direct Effects Only)

Trace Gas	GWP (100 years)	Indirect Effect
Carbon Dioxide	1	none
Methane [a]	11/22	positive
Nitrous Oxide	270	uncertain
CFC-11 [b]	-	uncertain
CFC-12 [b]	-	uncertain
CFC-113 [b]	-	uncertain
CFC-114 [b]	-	uncertain
HCFC-22 [b]	-	uncertain
HFC-134a	1,200	positive
HFC-23	10,000	positive
HFC-152a	150	positive
PFCs	5,400	positive
CO	-	positive
NO	-	uncertain
NMVOCs	-	positive

[a] The direct GWP of methane is 11, however, the indirect effects of methane are considered comparable in magnitude to direct effects, therefore a GWP of 22 is recommended for use on this document.

[b] Although CFCs and related compounds have very large direct GWPs, their indirect effects are believed to be negative and could significantly reduce the magnitude of their direct effects (IPCC, 1992). Given the uncertainties surrounding the net effect of these gases, no GWP has been provided at this time.
Source: IPCC, 1992

---

[8] The one exception is methane, which has a direct GWP of 11. The indirect effects of methane are considered comparable in magnitude to the direct effects. A GWP of 22 is used in this document (IPCC, 1992). Using a GWP of 22 for methane is consistent with the GWP used in the *Climate Change Action Plan* (Clinton and Gore, 1993), and follows the suggestion of the International Negotiating Committee's (INC) 9th Session that requests indirect effects of greenhouse gases be included where applicable. The magnitude of the indirect effects of other gases are either zero or uncertain and are not recommended at this time.

Following this convention, the GWP is defined as the time-integrated commitment to climate forcing from the instantaneous release of one kilogram of a trace gas expressed relative to that from one kilogram of carbon dioxide. The magnitude of the GWP is sensitive to the time horizon over which the analysis is conducted (i.e., the time over which the integral is calculated). For example, Table 1 summarizes the GWPs of key greenhouse gases assuming a 100-year time horizon. The assumed integration period defines the time period over which the radiative effects of the gas are measured. These GWPs indicate, for example, that one kilogram of nitrous oxide emissions is estimated to have approximately 270 times the direct impact on radiative forcing as one kilogram of carbon dioxide for a 100-year time horizon. If a 500-year time horizon is assumed, nitrous oxide is estimated to have 170 times the impact on radiative forcing compared to an equivalent amount of carbon dioxide. The difference between the values for 100 years and 500 years incorporate the differences in atmospheric lifetime.

For the discussion included in this document, the GWPs presented in Table 1 for a 100-year time horizon are used to convert all greenhouse gases to a CO_2 equivalent basis so that the relative magnitudes of different quantities of different greenhouse gases can be readily compared. There is nothing unique about this time horizon. It is sufficient that many of the atmospheric processes currently thought to affect concentrations can be considered without weighing long-term impacts on atmospheric processes.

Using the GWPs presented in Table 1, the relative contribution of each greenhouse gas to global warming for any greenhouse gas emission estimates can be calculated. For example, in Table 2, U.S. contributions to global warming by the primary greenhouse gases are represented using U.S. emission estimates for the year 1990 based on conversion to a CO_2-equivalent basis using 100-year GWPs.

Table 2. U.S. Greenhouse Gas Emissions and Sinks: 1990 (10^6 metric tonnes C)

CO_2 Emissions	CO_2 Sinks	CH_4	N_2O	HFC/PFC	Net Emissions
1352	-119	162	30	19	1444

Source: U.S. EPA, 1994

The GWP will be an important concept for states in determining the relative importance of each of the major emission sources and in developing appropriate mitigation strategies.

F. The Inventory Process

Before a state can effectively develop policies to reduce gas emissions and respond to climate change, it needs to identify its anthropogenic emissions and estimate the contribution of these emission sources to overall radiative forcing. The methodologies presented in this workbook have been adopted from the *IPCC Guidelines for National Greenhouse Gas Inventories* (IPCC, 1994)[9] and the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-1993* (U.S. EPA, 1994). In many cases, the methodologies presented are consistent with the *IPCC Guidelines*, however, for emission sources considered to be major sources in the United States, the IPCC default methodologies have been expanded and more comprehensive U.S.- specific methods are provided. These instances include energy consumption, forest sinks, and some methane sources. It is suggested that if a state has access to state- or region-specific emissions factors, or has the ability to take on-site emission measurements at various sources, then the state should pursue these options.

While these methods provide a solid foundation for the development of a more detailed comprehensive emission inventory, they have several strengths and weaknesses. First, there are uncertainties associated with some of the emission coefficients presented. Some of the current emissions coefficients, such as those for CO_2 from energy-related activities and cement processing are considered accurate. For other categories of emissions, a lack of data or an incomplete understanding of how emissions are generated limits the scope or accuracy of the emission coefficients. For certain categories, emission coefficients are given as a specified range to reflect the associated uncertainty. Where applicable, specific factors affecting the accuracy of the estimates are discussed.

Secondly, while the methodologies provided in the *IPCC Guidelines* and the *Inventory of U.S. Greenhouse Gas Emissions and Sinks* represent baseline methodologies for a variety of source categories, many of these methodologies are still being refined. The uncertainties associated with calculating greenhouse gas emissions are both qualitative and quantitative. The methods provided reflect current best scientific understanding. Efforts need to be made to improve existing methodologies and data collection activities, so that the methodologies and data are consistent with one another and so that they allow states to estimate emissions with greater ease, certainty, and consistency.

Regardless of the methodologies or estimation techniques a state may decide to use, the key to a sound emissions inventory is documentation of the activity data and emissions factors being used. This includes information on derivation and clear definitions of activities. Any emissions inventory that is not accompanied by sound documentation is unverifiable. Without clear documentation of the methods employed and data used, it will be impossible to refine and improve the accuracy of greenhouse gas inventories. States may also, at some point, want to

[9] Discussions of inventory methods can be found in *Estimation of Greenhouse Gas Emissions and Sinks: Final Report from the OECD Experts Meeting*, 18-21 February 1991 (August 1991). The report documents baseline inventory methodologies for a variety of source categories, which have subsequently been further refined based on recommendations provided at an IPCC sponsored experts workshop held in Geneva, Switzerland in December 1991 and at an OECD/Netherlands-sponsored workshop in Amersfoort, Netherlands in February 1993. The proceedings from these meetings, the Final Report (OECD, 1991), as well as several other international meetings, form the basis for the current *IPCC Guidelines*.

compare their inventories with other states, or pool statistical data in a regional inventory. This can only be done if emissions are estimated using comparable and consistent methods with data that are understandable and verifiable.

Results

Estimates of Utah greenhouse gas emissions for all gases and anthropogenic emission sources are found in Table 4. In both these broad categories, emissions totaled 64,183,747.43 tons per year. On a ton per year basis, carbon dioxide accounts for nearly all of the emissions, followed by methane (409,553.51) and less than 1,000 tons of nitrous oxides.

Of all categories, fossil fuel consumption is the primary source of Utah's greenhouse emissions. Combustion of fossil fuels in stationary and mobile sources (electric utility, industry, and transportation) represents 97 percent of all greenhouse sources. In the case of electric power generation, Utah's power plants produce over 95 percent from bituminous coal, which accounts for 62 percent of all fossil fuel related carbon.

In addition to the coal burned for consumption in Utah, considerable quantities of power are generated within the state's borders and wheeled to or exchanged with other states. Nearly 4.5 million tons of carbon are produced for power sales and exchange contracts with customers in California and elsewhere.

Carbon dioxide is also associated with other non-energy sectors in the economy including limestone use (834,397.56 tons), cement production (493,788.20 tons), limestone production (368,431.9 tons), and nominal amounts released in soda ash production (415 tons). Juab, Millard, and Morgan counties are responsible for most of the carbon releases related to these activities.

Forest and land use changes may either add or subtract from the carbon dioxide inventory, depending on the relationship between harvest and growth. In 1993, this category accounted for a negative value (35,566.72). Sevier, San Juan, Sanpete and Millard counties are the primary areas in which these fluctuations are found. Of note, Utah does not produce greenhouse gas emissions from rice fields.

The second most important category of greenhouse gas emissions is methane. A distant second from carbon dioxide, this gas accounts for 409,553.51 tons or 4.2 million tons of equivalent of carbon dioxide. Emissions from underground coal mines in Emery, Sevier, and Carbon counties represent over half the total (213,114.23 tons), followed by domestic animals which accounts for 74,000 tons distributed evenly across the state. Oil and gas processing emissions, registering just over 60,000 tons, are found along the Wasatch Front. Albeit rather small in measure, the Wasatch Front is also largely responsible for methane emissions due to landfill leaks and wastewater treatment.

In the category of carbon released from fossil-fuel combustion natural gas, which is mostly methane, is ranked second to bituminous coal. Used in industrial, commercial and residential sectors, natural gas represents 12 percent of total emissions relating to fossil fuel combustion. Petroleum, used primarily for transportation, contributes significant amounts of carbon. Motor gasoline represents 13 percent of total carbon in this category, followed by distillate fuel oils and kerosene (J-type) which together equal eight percent of the total. These emissions are generally associated with economic activity along the Wasatch Front as well.

Nitrous oxide emissions in Utah are estimated at 450.73 tons or 129,000 tons of carbon dioxide equivalent. These emissions are linked to fertilizers used in farming lands in Box Elder, Salt Lake, Utah, and Cache counties.

It is important to note that greenhouse gas emission estimates vary in terms of accuracy. For example, carbon dioxide measurements are most accurate in the case of power plant combustion. Estimates from the transportation sector are less accurate given the variability in engine efficiencies across a wide range of vehicles of different year and make. As a result, estimates are drawn from an average emissions factor based on gasoline tax records. Finally, because of sampling problems, the least accurate measurements involve the calculation of emissions from domestic animals, fertilizer applications, and land use changes.

References

Benioff, R. *Potential State Responses to Climate Change*. U.S. Environmental Protection Agency (U.S. EPA). Prepared for the Office of Policy, Planning, and Evaluation. Washington, D.C.: Government Printing Office, 1990.

Clinton, W. and A. Gore. *The Climate Change Action Plan*. Coordinated by U.S. Department of Energy (U.S. DOE). Office of Policy, Planning, and Program Evaluation (U.S. DOS/PO-0011). Washington, D.C.: Government Printing Office, 1993.

Derwent, R.G. *Trace Gases and Their Relative Contribution to the Greenhouse Effect.* (Report AERE-R13716). Oxon: Atomic Energy Establishment, [1990].

Environmental Information Networks. *Global Warming On-Line*, July 15, 1994.

Environmental Information Networks. *Global Warming On-Line*, September 12, 1994.

Intergovernmental Panel on Climate Change (IPCC). *Guidelines for National Greenhouse Gas Inventories*, 3 volumes: *Vol. 1 Reporting Instructions; Vol. 2 Workbook; Vol. 3 Draft Reference Manual*. Paris: Organization for Economic Co-operation and Development, 1994.

Intergovernmental Panel on Climate Change (IPCC). *Climate Change 1992: The Supplementary Report to the IPCC Scientific Assessment.* Report prepared for IPCC by Working Group I. Paris: Organization for Economic Co-operation and Develpment, 1992

Intergovernmental Panel on Climate Change (IPCC). *Scientific Assessment of Climate Change*. Report prepared for IPCC by Working Group I. Paris: Organization for Economic Co-operation and Development, 1990.

Kerr, R. "Did Pinatubo Send Climate-Warming Gases into a Dither?" *Science* 263 (March 1994): 18.

Lashof, D.A. and D.R. Ahuja. "Relative Contributions of Greenhouse Gas Emissions to Global Warming." *Nature* 344 (1990): 529-531.

Lashof, D.A. and D.A. Tirpak. *Policy Options for Stabilizing Global Climate Change*. U.S. Environmental Protection Agency (U.S. EPA). Office of Policy, Planning and Evaluation. Washington, D.C.: Government Printing Office, 1990.

Lashof, D.A. and E.L. Washburn. *The Statehouse Effect: State Policies to Cool the Greenhouse Effect*. Washington, D.C.: Natural Resources Defense Council, [1990].

Lyman, F., I. Mintzer, K. Courrier, and J. McKenzie. *The Greenhouse Trap*. Washington, D.C.: World Resources Institute, [1990].

Manne, A.S. and R.G. Richels. "CO_2 Emissions Limits - An Economic Cost Analysis for the U.S.A." *The Energy Journal* (November 1989).

National Academy of Sciences. 1991. *Policy Implications of Greenhouse Warming*. National Washington, D.C.: Academy Press.

National Governor's Association (NGA). *A World of Difference: Report of the Task Force on Global Climate Change*. Washington, D.C.: NGA, [1991].

Nordhous, W.D., 1990. *Economic Policy in the Face of Global Warming*. Unpublished paper.

Rodhe, H. "A Comparison of the Contribution of Various Gases to the Greenhouse Effect." *Science* 248 (1990): 1217-1219.

Siegenthaler, V. "Uptake of Excess CO_2 by an Outcrop-Diffusion Model of the Ocean." *Journal of Geophysical Research* 88 (1983):3599-3608.

Silbiger, A. and N. Gonrig. *Selected Summary of Current State Responses to Climate Change*. U.S. Environmental Protection Agency (U.S. EPA). Prepared for the Office of Policy, Planning, and Evaluation. Washington, D.C.: Government Printing Office, 1992.

Smith, J. and D. Tirpak. *The Potential Effects of Global Climate Change on the United States*. U.S. Environmental Protection Agency (U.S. EPA). Prepared for the Office of Policy, Planning, and Evaluation. Washington, D.C.: Government Printing Office, 1989.

State of Oregon. *Fourth Biennial Energy Plan.* Department of Energy (DOE), 1991.

Steele, L.P., E.J. Dlugokencky, P.M. Lang, P.P. Tans, R.C. Martin, and K.A. Masarie. "Slowing Down of the Global Accumulation of Atmospheric Methane During the 1980's." *Nature* 358 (1992):313-316.

Trexler, M. *Minding the Carbon Store*. Washington, D.C.: World Resources Institute, [1991].

U.S. Environmental Protection Agency (U.S. EPA). *U.S. Inventory of Greenhouse Gas Emissions and Sinks: 1990 - 1993*. Office of Policy, Planning, and Evaluation (EPA 230-R-94-014). Washington, D.C.: Government Printing Office, 1994.

U.S. Environmental Protection Agency (U.S. EPA). *Adapting to Climate Change: What Governments Can Do*. Office of Policy, Planning and Evaluation, Climate Change Adaptation Branch. Washington, D.C.: Government Printing Office, 1991.

U.S. Environmental Protection Agency (U.S. EPA). *Policy Options for Stabilizing Global Climate*. Office of Policy, Planning and Evaluation, Climate Change Adaptation Branch. Washington, D.C.: Government Printing Office, 1991.

U.S. Environmental Protection Agency (U.S. EPA). *State Workbook: Methodologies for Estimating Greenhouse Gas Emissions.* Office of Policy, Planning, and Evaluation (EPA-230-B-95-001). Washington, D.C.: Government Printing Office, 1995.

U.S. Government. *U.S. Climate Action Report.* Submission of the U.S. Government Under the Framework Convention on Climate Change (ISBN 0-16-145214-7). Washington, D.C.: Government Printing Office, 1994.

World Resources Institute (WRI). 1990. New York: Oxford University Press.

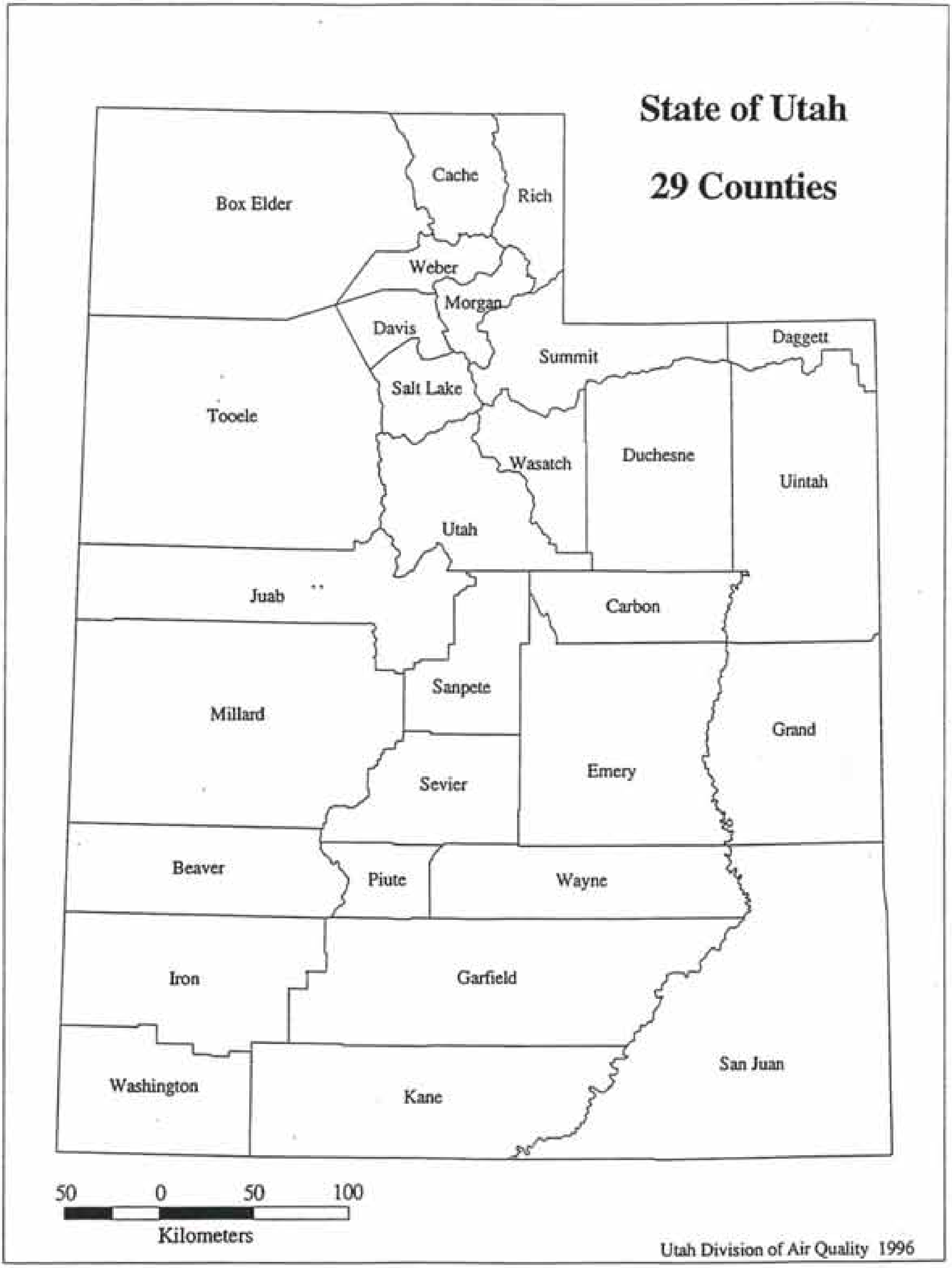

State of Utah
29 Counties
Box Elder
Cache
Rich
Weber
Morgan
Davis
Summit
Daggett
Salt Lake
Tooele
Wasatch
Duchesne
Uintah
Utah
Juab
Carbon
Sanpete
Millard
Grand
Sevier
Emery
Beaver
Piute
Wayne
Iron
Garfield
Washington
Kane
San Juan
50 0 50 100
Kilometers
Utah Division of Air Quality 1996

Figure 1

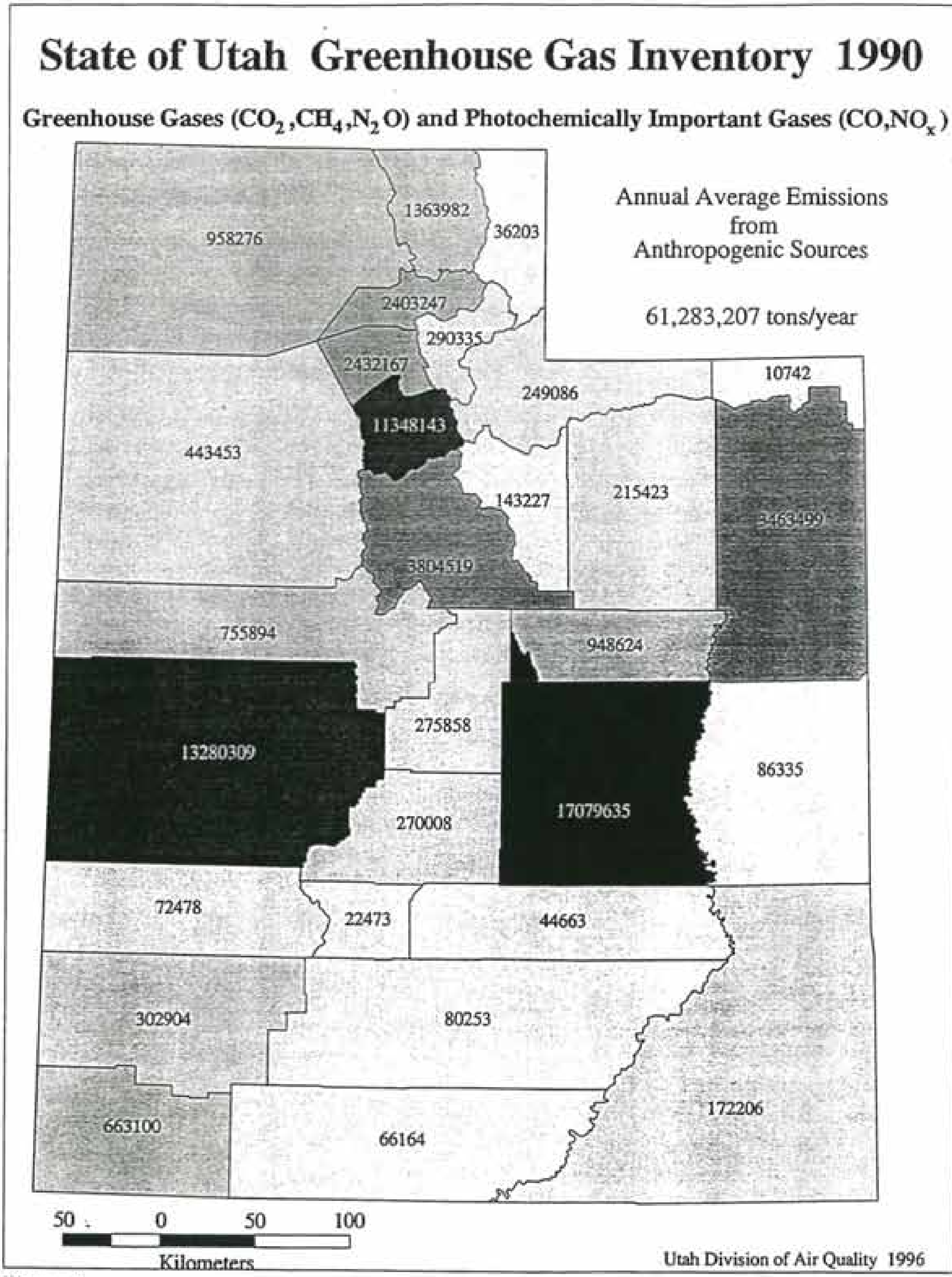

State of Utah Greenhouse Gas Inventory 1990
Greenhouse Gases (CO_2, CH_4, N_2O) and Photochemically Important Gases (CO, NO_x)
Annual Average Emissions
from
Anthropogenic Sources
61,283,207 tons/year
958276
1363982
36203
2403247
290335
2432167
249086
10742
11348143
443453
143227
215423
3463499
3804519
755894
948624
275858
13280309
86335
270008
17079635
72478
22473
44663
302904
80253
172206
663100
66164
50
0
50
100
Kilometers
Utah Division of Air Quality 1996

Figure 2

State of Utah Greenhouse Gas Inventory 1993

Greenhouse Gases (CO_2, CH_4, N_2O) and Photochemically Important Gases (CO, NO_x)

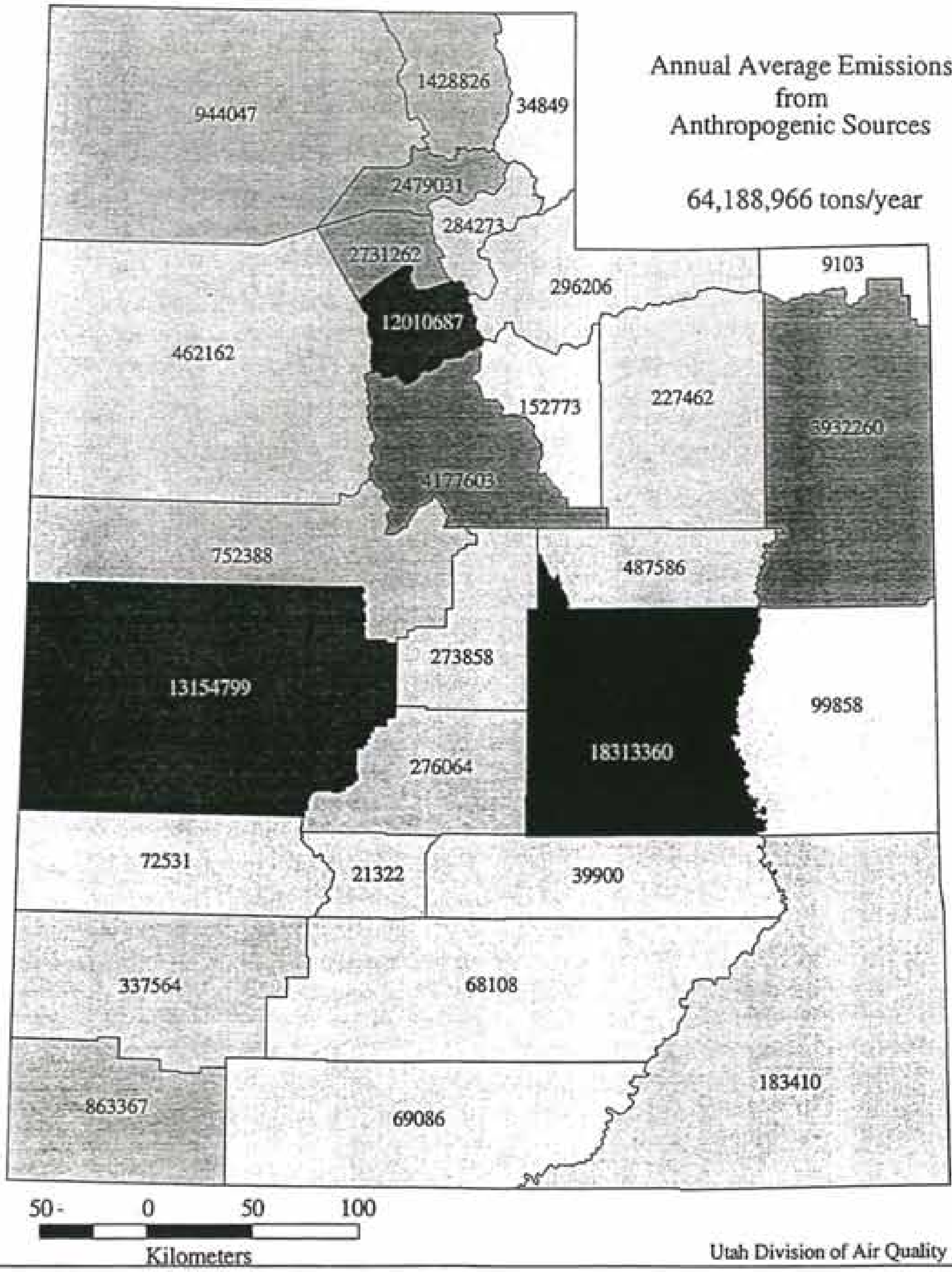


Figure 3

Table 3 Total Greenhouse Gas Emissions 1990

Tons/Year

County	Landfills CH4	Underground Coal Mines CH4	Fertilizer Use N2O	Limestone Use CO2	Cement Production CO2	Lime Production CO2	Soda Ash CO2	Forestry and Land Use Change CO2
Beaver	20.22		2.51				0.58	-940.39
Box Elder	148.33		93.51				4.38	-162.45
Cache	5,824.22		36.39				8.46	-2315.11
Carbon	5,659.38	18,964.10	1.82				2.42	-312.07
Daggett	3.29		0.69				0.08	739.76
Davis	11,734.58		9.94				1.51	-618.05
Duchesne	45.78		13.11				22.56	956.86
Emery	36.52	157,998.18	2.05				1.23	-2336.28
Garfield	16.59		0.00				0.47	10550.96
Grand	30.13		0.00				0.79	-573.99
Iron	75.06		4.42				2.51	2546.43
Juab	23.43		3.18	339,196.00	315,499.72		0.70	-434.96
Kane	18.26		0.02				0.62	1286.05
Millard	44.35		17.11	348,939.80		286,525.00	1.35	-2455.64
Morgan	19.99		6.31		193,897.02		0.66	-171.54
Piute	5.68		0.25				0.15	-1347.76
Rich	7.50		0.00				0.21	-524.69
Salt Lake	13,753.18		84.80				87.37	-689.82
San Juan	49.02		0.65				1.51	-4112.58
Sanpete	62.22		7.31				1.95	-3983.40
Sevier	59.80	36,151.95	2.54				1.85	-4642.94
Summit	48.74		7.44				1.88	-1856.40
Tooele	105.35		21.31	36,530.56		31,400.00	3.20	-1298.56
Uintah	80.42		20.59				2.66	1177.61
Utah	6,428.80		65.81	40,376.71			31.93	-1364.50
Wasatch	35.67		1.29				1.21	-1250.22
Washington	5,687.45		6.49				5.89	4207.87
Wayne	8.80		0.96				0.26	287.40
Weber	6,204.43		11.99				19.08	-642.65
Statewide Total	56,237.22	213,114.23	422.49	765,043.07	509,396.74	317,925.00	207.50	-10281.06

County	Agricultural Burning CH4+CO+N2O+NOx	Wastewater Treatment CH4	Nitric Acid Manufacturing NOx	Oil & Gas CH4	Fossil Fuels CO2	Domestic Animals CH4	Manure Management CH4	County Total
Beaver		3.92		191.27	70,598.11	2,524.20	77.37	72,477.78
Box Elder	139.99	29.81		1,454.43	949,477.11	6,860.16	231.08	958,276.34
Cache		57.57		2,809.24	1,351,319.81	5,826.08	415.50	1,363,982.17
Carbon		16.50		804.92	920,230.87	3,238.25	17.41	948,623.59
Daggett		0.57		27.89	9,604.65	359.50	5.64	10,742.09
Davis		153.53		7,491.30	2,413,309.22	31.99	53.08	2,432,167.09
Duchesne		10.29		502.08	213,342.89	412.80	116.98	215,423.34
Emery		8.41		410.43	16,920,862.95	2,607.25	44.68	17,079,635.44
Garfield		3.23		157.40	69,125.09	370.73	28.88	80,253.35
Grand		5.39		262.99	85,778.74	822.04	8.62	86,334.70
Iron		17.07		832.81	296,721.83	2,650.06	53.96	302,904.15
Juab		4.74		231.11	99,517.37	1,827.92	24.82	755,894.03
Kane		4.21		205.21	63,460.23	1,171.23	17.70	66,163.52
Millard		9.23		450.27	12,643,080.84	3,577.93	118.79	13,280,309.04
Morgan		4.53		221.15	91,682.97	1,286.18	3,387.48	290,334.75
Piute		1.02		49.81	22,308.27	1,422.09	33.13	22,472.64
Rich		1.43		69.73	31,857.91	4,723.64	67.59	36,203.33
Salt Lake		594.52		29,008.85	11,303,997.08	1,210.76	96.13	11,348,142.88
San Juan		10.29		502.08	173,614.34	2,109.18	31.73	172,206.20
Sanpete		13.31		649.51	273,987.31	4,780.79	338.90	275,857.91
Sevier		12.58		613.65	234,370.14	3,322.66	116.09	270,008.32
Summit		12.82		625.60	247,586.11	2,585.72	74.37	249,086.29
Tooele		21.80		1,063.92	372,908.64	2,659.25	37.94	443,453.42
Uintah		18.13		884.61	3,456,673.49	4,557.07	84.51	3,463,499.08
Utah		217.23	514.00	10,599.39	3,742,760.27	4,630.33	259.22	3,804,519.19
Wasatch		8.25		402.46	142,461.62	1,513.05	53.18	143,226.51
Washington		40.10		1,956.50	649,387.41	1,780.69	27.38	663,099.79
Wayne		1.76		85.67	41,839.68	2,395.78	42.21	44,662.53
Weber	139.99	129.85		6,335.72	2,388,803.90	2,112.59	132.09	2,403,246.99
Statewide Total	279.99	1,412.07	514.00	68,900.00	59,280,668.84	73,369.91	5,996.46	61,283,206.46

Table 4 Total Greenhouse Gas Emissions 1993

Tons/Year

County	Landfills CH4	Underground Coal Mines CH4	Fertilizer Use N2O	Limestone Use CO2	Cement Production CO2	Lime Production CO2	Soda Ash CO2	Forestry and Land Use Change CO2
Beaver	20.72		3.55				1.11	-1255.70
Box Elder	156.95		91.42				8.47	-157.34
Cache	6,010.41		43.32				16.92	-2242.23
Carbon	5,825.01	18,964.10	1.95				4.60	-327.52
Daggett	3.09		0.72				0.16	-585.48
Davis	12,142.79		14.00				45.80	-594.75
Duchesne	47.13		9.74				2.93	-757.29
Emery	36.81	157,998.18	2.99				2.31	-2452.02
Garfield	17.21		0.00				0.93	1094.38
Grand	33.52		0.00				1.67	-602.49
Iron	81.17		7.70				5.29	264.17
Juab	24.79		3.57	343,537.92	308,321.36		1.38	-276.80
Kane	19.12		0.02				1.21	133.41
Millard	44.58		22.12	394,318.01		325,186.25	2.60	-3279.07
Morgan	21.57		6.26		185,466.84		1.37	-166.20
Piute	5.90		0.54				0.30	-1799.73
Rich	7.66		0.00				0.40	-508.19
Salt Lake	14,230.66		89.90				172.76	-664.21
San Juan	48.59		1.26				2.91	-4316.31
Sanpete	67.20		8.29				4.02	-4142.70
Sevier	62.03	36,151.95	4.78				3.65	-6199.86
Summit	56.23		9.53				4.38	-1798.00
Tooele	113.22		21.31	35,073.28		43,245.65	6.25	-1257.94
Uintah	85.66		19.63				5.25	-931.13
Utah	6,663.36		67.50	61,468.35			64.70	-1132.60
Wasatch	38.51		1.25				2.49	-795.68
Washington	5,866.24		5.94				13.05	436.49
Wayne	8.96		0.96				0.49	-629.60
Weber	6,403.90		12.50				37.58	-622.35
Statewide Tota	58,143.01	213,114.23	450.73	834,397.56	493,788.20	368,431.90	415.00	-35566.72

County	Agricultural Burning CH4+CO+N2O+NOx	Wastewater Treatment CH4	Nitric Acid Manufacturing NOx	Oil & Gas CH4	Fossil Fuels CO2	Domestic Animals CH4	Manure Management CH4	County Total
Beaver		4.08		162.34	70,811.73	2,692.82	90.64	72,531.29
Box Elder	133.63	31.11		1,237.03	936,391.68	5,920.40	233.67	944,047.03
Cache		62.15		2,470.78	1,416,596.37	5,461.84	406.73	1,428,826.30
Carbon		16.90		672.09	460,987.09	1,423.68	17.84	487,585.75
Daggett		0.57		22.73	9,054.59	601.52	5.10	9,103.00
Davis		168.23		6,688.44	2,711,430.95	1,307.69	58.63	2,731,261.79
Duchesne		10.78		428.58	222,175.97	5,415.18	128.87	227,461.89
Emery		8.49		337.67	18,155,189.62	2,181.13	54.95	18,313,360.13
Garfield		3.43		136.37	64,717.04	2,102.74	35.69	68,107.79
Grand		6.12		243.48	99,603.45	565.61	7.08	99,858.45
Iron		19.44		772.74	334,074.48	2,286.50	52.97	337,564.45
Juab		5.06		201.30	99,319.35	1,224.12	26.06	752,388.10
Kane		4.45		176.95	67,671.55	1,060.20	18.98	69,085.89
Millard		9.56		379.88	12,434,309.63	3,680.49	124.63	13,154,798.67
Morgan		5.02		199.68	97,609.60	1,073.78	55.52	284,273.44
Piute		1.10		43.83	21,808.23	1,229.68	32.57	21,322.43
Rich		1.47		58.44	30,655.33	4,548.09	85.54	34,848.74
Salt Lake		634.54		25,227.68	11,969,371.36	1,500.97	123.21	12,010,686.89
San Juan		10.70		425.33	184,749.40	2,453.85	34.56	183,410.28
Sanpete		14.78		587.67	272,879.01	4,079.50	360.00	273,857.78
Sevier		13.39		532.44	242,370.30	2,996.37	129.44	276,064.50
Summit		16.09		639.62	295,067.19	2,142.98	68.26	296,206.28
Tooele		22.95		912.35	382,203.91	1,784.48	36.54	462,162.00
Uintah		19.27		766.25	3,928,313.43	3,883.27	98.85	3,932,260.48
Utah		237.65	504.00	9,448.23	4,095,430.96	4,552.52	297.97	4,177,602.64
Wasatch		9.15		363.64	151,836.28	1,269.40	48.43	152,773.47
Washington		47.94		1,905.91	853,392.13	1,663.94	35.12	863,366.76
Wayne		1.80		71.43	38,578.80	1,823.23	43.90	39,899.96
Weber	133.63	138.02		5,487.13	2,464,906.68	2,413.07	121.23	2,479,031.38
Statewide Tota	267.26	1,524.24	504.00	60,600.00	62,111,506.13	73,339.06	2,832.97	64,183,747.57

..ole 5 CO2-Equivalents (Global Warming Potential) 1990

Tons/Year

County	Landfills CH4	Underground Coal Mines CH4	Fertilizer Use N2O	Limestone Use CO2	Cement Production CO2	Lime Production CO2	Soda Ash CO2	Forestry and Land Use Change CO2
Beaver	444.93		677.78				0.58	-940.39
Box Elder	3,265.34		25,246.72				4.38	-162.45
Cache	128,132.92		9,826.61				8.46	-2315.11
Carbon	124,506.34	417,210.20	491.20				2.42	-312.07
Daggett	72.38		187.34				0.08	739.76
Davis	258,160.73		2,682.87				1.51	-618.05
Duchesne	1,007.06		3,540.16				22.56	956.86
Emery	803.54	3,475,959.96	554.67				1.23	-2336.28
Garfield	364.94		0.73				0.47	10550.96
Grand	662.75		0.00				0.79	-573.99
Iron	1,651.26		1,194.01				2.51	2546.43
Juab	515.45		859.61	339,196.00	315,499.72		0.70	-434.96
Kane	401.77		4.48				0.62	1286.05
Millard	975.73		4,618.97	348,939.80		286,525.00	1.35	-2455.64
Morgan	439.76		1,704.41		193,897.02		0.66	-171.54
Piute	125.04		68.13				0.15	-1347.76
Rich	165.03		0.11				0.21	-524.69
Salt Lake	302,570.05		22,897.17				87.37	-689.82
San Juan	1,078.35		175.37				1.51	-4112.58
Sanpete	1,368.84		1,974.09				1.95	-3983.40
Sevier	1,315.63	795,342.90	685.56				1.85	-4642.94
Summit	1,072.35		2,007.52				1.88	-1856.40
Tooele	2,317.74		5,752.77	36,530.56		31,400.00	3.20	-1298.56
Uintah	1,769.24		5,558.17				2.66	1177.61
Utah	141,433.69		17,767.36	40,376.71			31.93	-1364.50
Wasatch	784.85		347.41				1.21	-1250.22
Washington	125,123.89		1,751.86				5.89	4207.87
Wayne	193.70		259.45				0.26	287.40
Weber	136,497.53		3,237.61				19.08	-642.65
Statewide Total	1,237,218.83	4,688,513.06	114,072.14	765,043.07	509,396.74	317,925.00	207.50	-10281.06
Percent of CO2-Equivalen	1.76%	6.68%	0.16%	1.09%	0.73%	0.45%	0.00%	-0.01%

County	Agricultural Burning CH4+CO+N2O+NOx	Wastewater Treatment CH4	Nitric Acid Manufacturing NOx	Oil & Gas CH4	Fossil Fuels CO2	Domestic Animals CH4	Manure Management CH4	County Total	Percent of CO2-Equivalen
Beaver		86.24		4,207.88	70,598.11	55,532.30	1,702.21	132,309.64	0.19%
Box Elder		655.78		31,997.40	949,477.11	150,923.52	5,083.78	1,166,489.57	1.66%
Cache		1,266.63		61,803.19	1,351,319.81	128,173.76	9,140.91	1,687,357.19	2.40%
Carbon		362.92		17,708.15	920,230.87	71,241.54	383.04	1,551,824.60	2.21%
Daggett		12.57		613.65	9,604.65	7,908.91	124.14	19,263.49	0.03%
Davis		3,377.67		164,808.51	2,413,309.22	703.79	1,167.76	2,843,594.01	4.05%
Duchesne		226.38		11,045.68	213,342.89	9,081.56	2,573.45	241,796.60	0.34%
Emery		185.05		9,029.40	16,920,862.95	57,359.52	983.01	20,463,403.06	29.15%
Garfield		70.97		3,462.73	69,125.09	8,156.09	635.39	92,367.37	0.13%
Grand		118.58		5,785.83	85,778.74	18,084.87	189.55	110,047.12	0.16%
Iron		375.50		18,321.80	296,721.83	58,301.34	1,187.23	380,301.90	0.54%
Juab		104.20		5,084.52	99,517.37	40,214.26	545.93	801,102.81	1.14%
Kane		92.53		4,514.70	63,460.23	25,767.11	389.29	95,916.78	0.14%
Millard		203.02		9,906.04	12,643,080.84	78,714.51	2,613.38	13,373,123.01	19.05%
Morgan		99.72		4,865.36	91,682.97	28,295.87	74,524.50	395,338.73	0.56%
Piute		22.46		1,095.80	22,308.27	31,285.96	728.77	54,286.83	0.08%
Rich		31.44		1,534.12	31,857.91	103,920.15	1,486.99	138,471.27	0.20%
Salt Lake		13,079.48		638,194.67	11,303,997.08	26,636.63	2,114.83	12,308,887.47	17.54%
San Juan		226.38		11,045.68	173,614.34	46,401.94	698.00	229,128.97	0.33%
Sanpete		292.85		14,289.25	273,987.31	105,177.34	7,455.81	400,564.04	0.57%
Sevier		276.68		13,500.27	234,370.14	73,098.53	2,554.03	1,116,502.64	1.59%
Summit		282.07		13,763.26	247,586.11	56,885.89	1,636.24	321,378.93	0.46%
Tooele		479.70		23,406.32	372,908.64	58,503.45	834.63	530,838.46	0.76%
Uintah		398.85		19,461.43	3,456,673.49	100,255.46	1,859.25	3,587,156.16	5.11%
Utah		4,779.04		233,186.51	3,742,760.27	101,867.28	5,702.92	4,286,541.22	6.11%
Wasatch		181.46		8,854.07	142,461.62	33,287.08	1,169.95	185,837.43	0.26%
Washington		882.15		43,043.07	649,387.41	39,175.16	602.41	864,179.72	1.23%
Wayne		38.63		1,884.78	41,839.68	52,707.27	928.60	98,139.77	0.14%
Weber		2,856.65		139,385.92	2,388,803.90	46,476.91	2,906.06	2,719,541.00	3.87%
Statewide Total		31,065.60		1,515,800.00	59,280,668.84	1,614,137.98	131,922.06	70,195,689.76	100.00%
Percent of CO2-Equivalent		0.04%		2.16%	84.45%	2.30%	0.19%	100.00%	

Table 6 CO2-Equivalents (Global Warming Potential) 1993

Tons/Year

County	Landfills CH4	Underground Coal Mines CH4	Fertilizer Use N2O	Limestone Use CO2	Cement Production CO2	Lime Production CO2	Soda Ash CO2	Forestry and Land Use Change CO2
Beaver	455.83		957.89				1.11	-1255.70
Box Elder	3,453.00		24,684.37				8.47	-157.34
Cache	132,229.06		11,695.62				16.92	-2242.23
Carbon	128,150.24	417,210.20	526.58				4.60	-327.52
Daggett	68.04		194.06				0.16	-585.48
Davis	267,141.32		3,780.12				45.80	-594.75
Duchesne	1,036.84		2,629.56				2.93	-757.29
Emery	809.75	3,475,959.96	807.53				2.31	-2452.02
Garfield	378.72		0.36				0.93	1094.38
Grand	737.55		0.83				1.67	-602.49
Iron	1,785.75		2,079.01				5.29	264.17
Juab	545.31		963.26	343,537.92	308,321.36		1.38	-276.80
Kane	420.59		5.57				1.21	133.41
Millard	980.75		5,971.44	394,318.01		325,186.25	2.60	-3279.07
Morgan	474.61		1,690.19		185,466.84		1.37	-166.20
Piute	129.78		144.93				0.30	-1799.73
Rich	168.50		0.00				0.40	-508.19
Salt Lake	313,074.59		24,273.53				172.76	-664.21
San Juan	1,069.05		340.04				2.91	-4316.31
Sanpete	1,478.48		2,237.71				4.02	-4142.70
Sevier	1,364.61	795,342.90	1,291.08				3.65	-6199.86
Summit	1,237.10		2,572.60				4.38	-1798.00
Tooele	2,490.84		5,754.23	35,073.28		43,245.65	6.25	-1257.94
Uintah	1,884.43		5,300.41				5.25	-931.13
Utah	146,593.94		18,224.84	61,468.35			64.70	-1132.60
Wasatch	847.20		336.69				2.49	-795.68
Washington	129,057.26		1,603.14				13.05	436.49
Wayne	197.20		258.10				0.49	-629.60
Weber	140,885.81		3,374.63				37.58	-622.35
Statewide Tota	1,279,146.15	4,688,513.06	121,698.30	834,397.56	493,788.20	368,431.90	415.00	-35566.72
Percent of CO2-Equivale	1.75%	6.43%	0.17%	1.14%	0.68%	0.51%	0.00%	-0.05%

County	Agricultural Burning CH4+CO+N2O+NOx	Wastewater Treatment CH4	Nitric Acid Manufacturing NOx	Oil & Gas CH4	Fossil Fuels CO2	Domestic Animals CH4	Manure Management CH4	County Total	Percent of CQ2-Equivale
Beaver		89.84		3,571.48	70,811.73	59,242.00	1,994.01	135,868.19	0.19%
Box Elder		684.52		27,214.69	936,391.68	130,248.69	5,140.81	1,127,668.89	1.55%
Cache		1,367.22		54,357.24	1,416,596.37	120,160.42	8,948.12	1,743,128.74	2.39%
Carbon		371.90		14,785.94	460,987.09	31,320.96	392.57	1,053,422.56	1.44%
Daggett		12.57		500.01	9,054.59	13,233.55	112.16	22,589.66	0.03%
Davis		3,701.08		147,145.78	2,711,430.95	28,769.07	1,289.88	3,162,709.26	4.34%
Duchesne		237.16		9,428.71	222,175.97	119,133.87	2,835.23	356,723.00	0.49%
Emery		186.85		7,428.68	18,155,189.62	47,984.95	1,208.87	21,687,126.50	29.75%
Garfield		75.46		3,000.05	64,717.04	46,260.20	785.14	116,313.38	0.16%
Grand		134.73		5,356.51	99,603.45	12,443.45	155.78	117,831.48	0.16%
Iron		427.60		17,000.26	334,074.48	50,303.00	1,165.25	407,104.80	0.56%
Juab		111.39		4,428.64	99,319.33	26,930.67	573.28	784,455.75	1.08%
Kane		97.91		3,892.92	67,671.55	23,324.49	417.50	95,965.14	0.13%
Millard		210.21		8,357.27	12,434,309.63	80,970.81	2,741.76	13,249,769.67	18.17%
Morgan		110.50		4,392.92	97,609.60	23,623.19	1,221.33	314,424.34	0.43%
Piute		24.26		964.30	21,808.23	27,052.99	716.60	49,041.66	0.07%
Rich		32.34		1,285.73	30,655.33	100,057.93	1,881.85	133,573.89	0.18%
Salt Lake		13,959.85		555,009.04	11,969,371.36	33,021.33	2,710.61	12,910,928.87	17.71%
San Juan		235.36		9,357.28	184,749.40	53,984.61	760.22	246,182.56	0.34%
Sanpete		325.19		12,928.77	272,879.01	89,748.98	7,919.96	383,379.42	0.53%
Sevier		294.64		11,713.75	242,370.30	65,920.22	2,847.70	1,114,948.97	1.53%
Summit		353.94		14,071.64	295,067.19	47,145.56	1,501.74	360,156.15	0.49%
Tooele		504.86		20,071.73	382,203.91	39,258.61	803.84	528,155.25	0.72%
Uintah		424.01		16,857.40	3,928,313.43	85,431.98	2,174.72	4,039,460.49	5.54%
Utah		5,228.22		207,860.98	4,095,430.96	100,155.49	6,555.31	4,640,450.19	6.37%
Wasatch		201.22		8,000.12	151,836.28	27,926.82	1,065.55	189,420.69	0.26%
Washington		1,054.64		41,929.91	853,392.13	36,606.77	772.68	1,064,866.07	1.46%
Wayne		39.52		1,571.45	38,578.80	40,110.99	965.85	81,092.79	0.11%
Weber		3,036.33		120,716.81	2,464,906.68	53,087.62	2,666.99	2,788,090.11	3.82%
Statewide Total		33,533.29		1,333,200.00	62,111,506.13	1,613,459.22	62,325.27	72,904,847.37	100.00%
Percent of CO2-Equivalent		0.05%		1.83%	85.20%	2.21%	0.09%	100.00%	

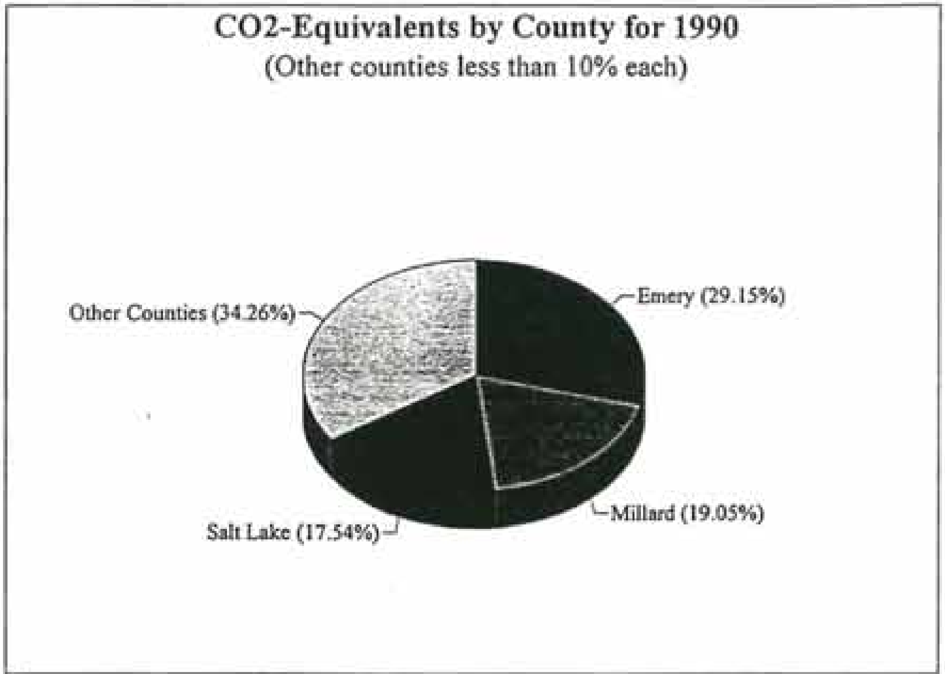


Figure 4

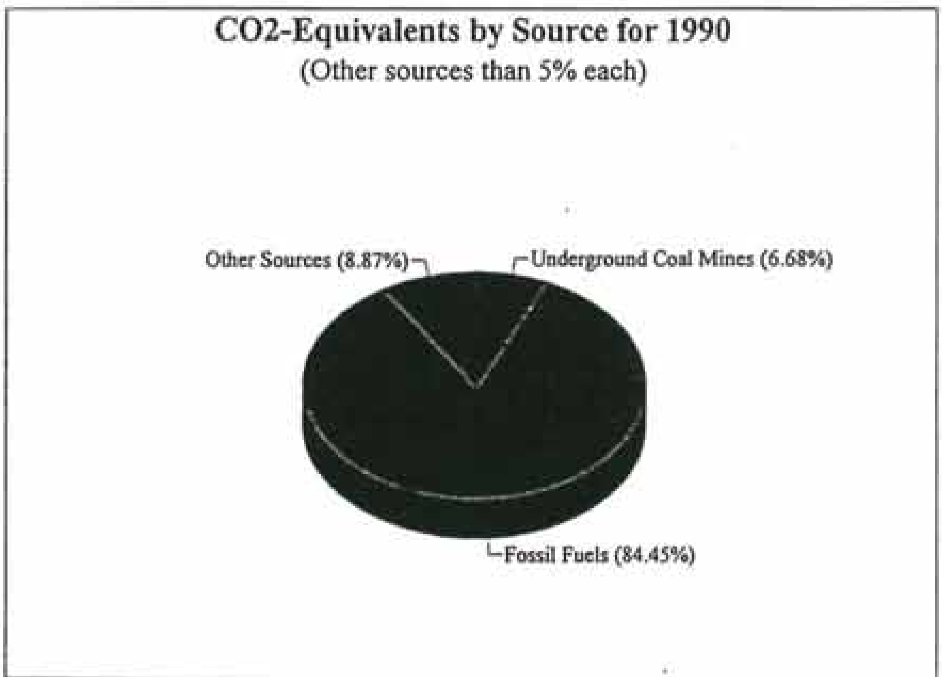


Figure 5

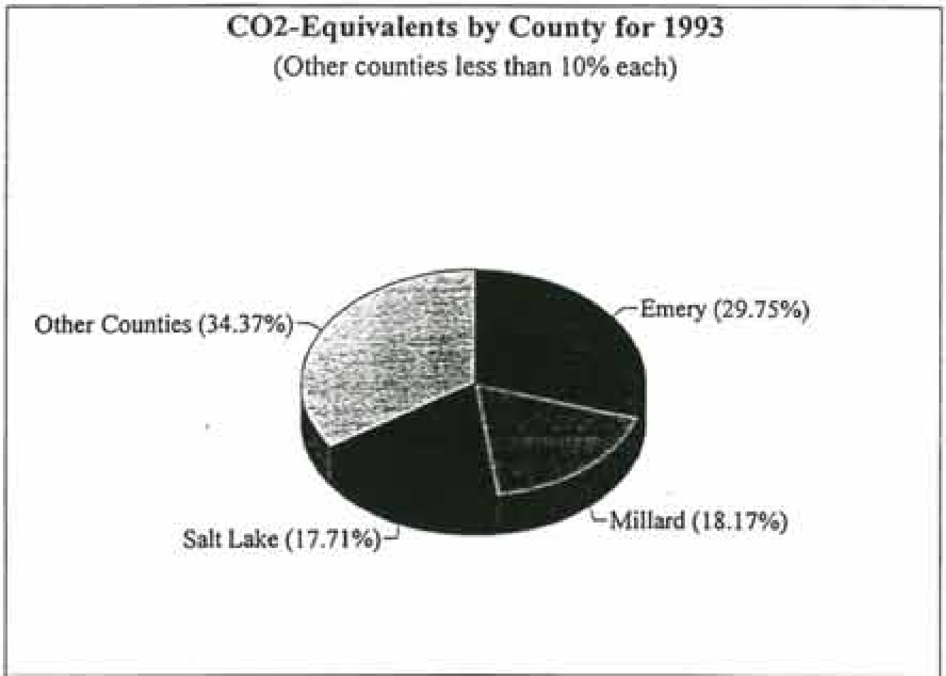


Figure 6

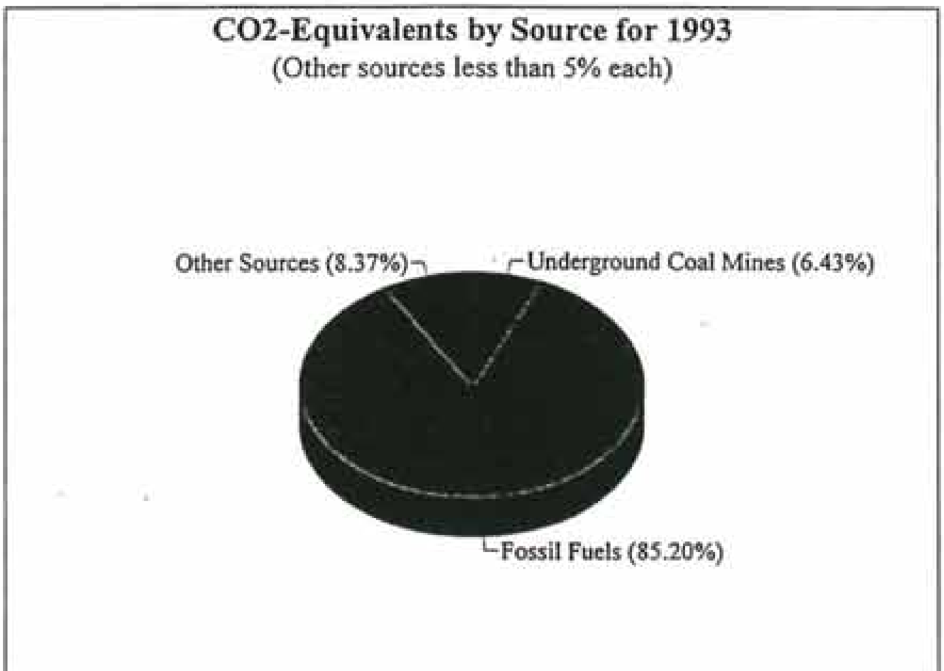


Figure 7

Chapter I

Fossil and Biomass Fuels

This section includes emissions produced from energy-related activities. The sectors using fuel are residential, commercial, industrial, transportation and electric utility. The fuel types defined in reference sources include asphalt, aviation gasoline, distillate fuel oil, jet fuel kerosene, kerosene, liquified petroleum gas, lubricants, motor gasoline, residual fuel oil, bituminous coal, coke, natural gas and wood.

Overview

Energy-related activities are the most significant contributor to U.S. greenhouse gas emissions, accounting for almost 89 percent of total emissions in 1990. Emissions from fossil fuel combustion comprise the vast majority of these energy-related emissions. These emissions were produced from a variety of fossil fuel combustion activities, including heating in residential and commercial buildings, energy combustion to generate electricity, steam production for industrial processes, and gasoline consumption in automobiles and other vehicles, (U.S. EPA, 1995).

As fossil fuels burn, they emit carbon dioxide (CO_2) as a result of oxidation of the carbon in the fuel. In 1990, CO_2 accounted for 96 percent of all greenhouse gas emissions from fossil fuel combustion. The remaining four percent can be attributed to emissions of other gases, such as carbon monoxide (CO), methane (CH_4), or nonmethane volatile organic compounds (NMVOCs), which are emitted as a by-product of incomplete combustion. These gases are then oxidized to CO_2 within anywhere from a few days to 10 or 11 years. For purposes of this analysis, emissions of these other gases are considered to be a subset of CO_2 emissions. This includes all carbon emitted to the atmosphere and reported as CO_2 emissions, while a much smaller portion of the carbon will be reported as these other gases. This "double counting" is intentional. By reporting emissions in this fashion, state estimates of CO_2 will reflect total loadings of carbon. Also, since all of these gases oxidize to CO_2 eventually, they should be viewed as a subset of carbon emitted as CO_2 (U.S. EPA, 1995).

To estimate state emissions of carbon dioxide from fossil and biomass fuels, seven steps should be performed: 1) obtain the required energy data; 2) estimate total carbon content of the fuels; 3) estimate total carbon stored in the products; 4) estimate carbon potentially emitted from bunker fuel consumption; 5) estimate carbon emitted from interstate electricity consumption; 6) calculate net potential carbon emissions; 7) estimate the carbon actually oxidized from energy uses; and 8) convert net carbon emissions from energy consumption to total CO_2 emissions (U.S. EPA, 1995). Separate tables are presented for statewide and county-level fuel consumption. Statewide totals are given in Tables are I-1 and I-2. County-level data are given in the Appendix.

The required energy data were taken from the *State Energy Data Report 1993* of the Energy Information Administration for the years 1990 and 1993. Additional energy data were taken from the *Utah Energy Statistical Abstract*, by the Utah Office of Energy and Resource Planning; and the *Coal Industry Annual 1993*, by the Energy Information Administration. Conversion factors and calculation procedures were taken from the *State Workbook: Methodologies for Estimating Greenhouse Gas Emissions*, by the U.S. Environmental Protection Agency, 1995.

Table I-1 CO_2 Emissions from Fossil and Biomass Fuels - 1990

Fuel	Consumption MMBTU[1]	Carbon Content Coefficient lb C/MMBTU[2]	Total Carbon Tons C	Stored Carbon Tons C[3]	International Bunkers Tons C	Net Carbon Tons C	Total Oxidized Tons C[4]	CO_2 Emissions Tons C
Asphalt and Road Oil	9,144,408	45.5	208,035	208,035	-	0	0	0
Aviation Gasoline	535,088	41.6	11,130	-	-	11,130	11,019	40,401
Distillate Fuel Oil	42,749,675	44.0	940,493	-	-	940,493	931,088	3,413,989
Jet Fuel:Kerosene	29,108,872	43.5	633,118	-	-	633,118	626,787	2,298,218
Jet Fuel:Naptha	-	43.5	-	-	-	-	-	-
Kerosene	79,380	43.5	1,727	-	-	1,727	1,709	6,267
LPG	4,303,803	37.8	81,342	65,074	-	16,268	16,106	59,054
Lubricants	1,855,890	44.6	41,386	20,693	-	20,693	20,486	75,116
Misc. Petroleum Prod.	-	44.7	-	-	-	-	-	-
Motor Gasoline	87,341,631	42.8	1,869,111	-	-	1,869,111	1,850,420	6,784,873
Naptha<104 deg F	-	40.0	-	-	-	-	-	-
Naptha>104 def F	-	44.0	-	-	-	-	-	-
Pentane Plus	-	40.2	-	-	-	-	-	-
Petroleum Coke	-	61.4	-	-	-	-	-	-
Residual Fuel Oil	2,338,764	47.4	55,429	55,429	-	0	0	0
Still Gas	-	38.6	-	-	-	-	-	-
Waxes	-	43.7	-	-	-	-	-	-
Anthracite Coal	-	62.1	-	-	-	-	-	-
Bituminous Coal	375,956,930	56.0	10,526,794	-	-	10,526,794	10,421,526	38,212,262
Sub Bituminous Coal	-	57.9	-	-	-	-	-	-
Lignite Coal	-	58.7	-	-	-	-	-	-
Coke	-	-	-	-	-	-	-	-
Natural Gas	119,480,000	31.9	1,905,706	-	-	1,905,706	1,896,177	6,952,651
Wood (5)	9,000,000	0.5	2,138	-	-	2,138	1,924	7,054
Ethanol	-	41.8	-	-	-	-	-	-
Other	17,586,300	44.6	392,174	-	-	392,174	390,214	1,430,783
Total-Statewide	**699,480,741**	-	**16,668,582**	-	-	**16,319,352**	**16,167,455**	**59,280,669**

Data Source:

1. *Utah Energy Statistical Abstract*, 1995.
2. Energy Information Administration, *State Energy Data Report 1993*, pp 293-298.
3. U.S. Environmental Protection Agency, Policy Planning and Evaluation, *State Workbook: Methodologies for Estimating Greenhouse Gas Emissions*.
4. Ibid, p 1-12.
5. Ibid, p 1-13.
6. Energy Information Administration, *Household Energy Consumption and Expenditures 1993*, p 61, 1995.

Note: C=Carbon

Table I-2 CO_2 Emissions from Fossil and Biomass Fuels - 1993

Fuel	Consumption MMBTU[1]	Carbon Content Coefficient lb C/MMBTU[2]	Total Carbon Tons C	Stored Carbon Tons C[3]	International Bunkers Tons C	Net Carbon Tons C	Total Oxidized Tons C[4]	CO_2 Emissions Tons C
Asphalt and Road Oil	11,480,280	45.5	261,176	261,176	-	0	0	0
Aviation Gasoline	575,472	41.6	11,970	-	-	11,970	11,850	43,450
Distillate Fuel Oil	46,600,000	44.0	1,025,200	-	-	1,025,200	1,014,948	3,721,476
Jet Fuel:Kerosene	30,415,216	43.5	661,531	-	-	661,531	654,916	2,401,357
Jet Fuel:Naptha	-	43.5	-	-	-	-	-	-
Kerosene	45,360	43.5	987	-	-	987	977	3,581
LPG	3,120,558	37.8	58,979	47,183	-	11,796	11,678	42,818
Lubricants	1,728,525	44.6	38,546	19,273	-	19,273	19,080	69,961
Misc. Petroleum Prod.	-	44.7	-	-	-	-	-	-
Motor Gasoline	98,919,243	42.8	2,116,872	-	-	2,116,872	2,095,703	7,684,245
Naptha<104 deg F	-	40.0	-	-	-	-	-	-
Naptha>104 def F	-	44.0	-	-	-	-	-	-
Pentane Plus	-	40.2	-	-	-	-	-	-
Petroleum Coke	-	61.4	-	-	-	-	-	-
Residual Fuel Oil	1,810,656	47.4	42,913	42,913	-	0	0	0
Still Gas	-	38.6	-	-	-	-	-	-
Waxes	-	43.7	-	-	-	-	-	-
Anthracite Coal	-	62.1	-	-	-	-	-	-
Bituminous Coal	378,608,720	56.0	10,601,044	-	-	10,601,044	10,495,034	38,481,790
Sub Bituminous Coal	-	57.9	-	-	-	-	-	-
Lignite Coal	-	58.7	-	-	-	-	-	-
Coke	-	-	-	-	-	-	-	-
Natural Gas	143,170,000	31.9	2,283,562	-	-	2,283,562	2,272,144	8,331,194
Wood (5)	9,000,000	0.5	2,138	-	-	2,138	1,924	7,054
Ethanol	-	41.8	-	-	-	-	-	-
Other	16,280,900	44.6	363,064	-	-	363,064	361,249	1,324,579
Total-Statewide	**741,754,930**	-	**17,467,980**	-	-	**17,097,435**	**16,939,502**	**62,111,506**

Data Source:

1. *Utah Energy Statistical Abstract*, 1995.
2. Energy Information Administration, *State Energy Data Report 1993*, pp 293-298.
3. U.S. Environmental Protection Agency, Policy, Planning and Evaluation, *State Workbook:Methodologies for Estimating Greenhouse Gas Emissions.*
4. Ibid, p 1-12.
5. Ibid, p 1-13.
6. Energy Information Administration, *Household Energy Consumption and Expenditures 1993*, p 61, 1995.

Note: C=Carbon

Methodology

A. Carbon Dioxide

The following is a discussion of how the fuel consumption tables were constructed, including Tables I-1 and I-2 and the county-specific tables in the Appendix, Tables A-1 to A-10.

Statewide Emissions

Units of energy are listed as million British Thermal Units (MMBTU). Conversion factors located in Table 1-2 of the EPA *State Workbook* provide conversion factors for other systems of units.

The column label *carbon content coefficient* represents the fractional molecular weight of carbon in the fuel. This quantity of carbon is the amount that would be emitted if 100 percent of the carbon content in the fuel were released to the atmosphere. Tables 1-3 of the EPA *State Workbook* show carbon content coefficients of several fuels and is partially reproduced in Tables I-1 and I-2 of this report. To estimate the carbon content released from individual fuels, multiply the energy consumption from each fuel type by the appropriate carbon content coefficient. This calculation is repeated for all fuel types in each sector under the column label *total carbon*. The equation is in the following form:

$$Tci = C_i * CCC_i / 2000$$

where Tc_i = Total carbon contained in $fuel_i$ {tons C}

C_i = Fuel consumption for $fuel_i$ {MMBTU}

CCC_i = Carbon content coefficient for $fuel_i$ {lbs C/MMBTU}

Note that special brackets are used for units, e.g., {} and do not signify multiplication. Multiplication is indicated by an asterisk.

Divide the result by 2,000 to convert to tons of carbon and then sum the totals of each fuel type and create a grand total, leaving out biomass consumption (e.g., wood). CO_2 emissions resulting from bioenergy consumption (e.g., wood) should not be included in a state's official emissions inventory in order to avoid double counting CO_2 emissions. The double counting would occur because biofuels tend to be produced on a sustainable basis such that no net increase of CO_2 occurs or CO_2 from biofuels burned on a non-sustainable basis would result in land use changes (U.S. EPA, 1995).

The column labeled *stored carbon* is an estimate of carbon stored in non-fuel products such as asphalt and road oil. Tables 1-4 in the EPA *State Workbook* is used as a source for this information. The fraction stored of individual fuel types are listed. The fraction stored is multiplied by the carbon content as shown in the following equation:

$$Sc_i = TC_i * FSi$$

where Sc_i = Stored carbon {tons C}
TC_i = Total carbon contained in $fuel_i$ {pounds C}
FS_i = Fraction stored

Estimates of carbon from bunker fuel consumption involve international bunker fuels which are calculated in the same manner as fossil fuel combustion.

$Tc_i = C_i * CCC_i$
where TC_i = Total carbon contained in bunker $fuel_i$ {lbs C}
C_i = Consumption of bunker $fuel_i$ {MMBTU}
CCC_i = Carbon content coefficient for bunker $fuel_i$ {lbs C/MMBTU}

The total carbon contained in each bunker fuel should be entered in the table under bunker fuels, and should only be subtracted if the international bunker fuels have been captured in the total carbon data. If the carbon values do not include international bunker fuels, then values under bunker fuels should not be subtracted.

Estimates of carbon emitted from interstate electricity consumption are determined from quantities of energy imported into and exported from the state. Sources of interstate electricity are divided by type of generation (e.g., coal, hydroelectric, etc.). The following equation summarizes the steps outlined above:

$Ei_i = Imp_i * HR_i * CCC_i$
$EE_j = Exp_j * HR_j * CCC_j$
where Ei_i = emissions from imports from $source_i$ {lbs C}
EE_j = emissions from exports from $source_j$ {lbs C}
Imp_i = electricity from $source_i$ {KWH}
Exp_j = electricity from $source_j$ {KWH}
Hr_i = heat rates of generating facilities {BTU/KWH}
CCC_{ij} = carbon content coefficients from source fuels {lb C/BTU}

Emissions from interstate electricity consumption are summed over all fuel types, and exported electricity emissions are subtracted from imported electricity emissions.

$NE = SUM(EI_i - EE_j)$
where NE = Net emissions from interstate consumption {lbs C}
SUM = Summation of ...
EI_i = Emissions of carbon due to imports from $source_i$ {lbs C}
EE_j = Emissions of carbon due to exports from $source_j$ {lbs C}

The resulting values are reported separately from other emissions of fossil fuel consumption. A negative number indicates a net export of carbon from interstate electricity. A positive number indicates a net import.

Calculation of net potential carbon emissions is accomplished by subtracting carbon stored and bunker fuel consumption from the total carbon for each fuel type. This calculation will take the following form:

Net potential carbon emissions {tons} = total carbon {tons} - carbon stored {tons} - bunker fuel {tons}

Multiply the net carbon content for each fuel and sector by the fraction of carbon oxidized to obtain the amount of carbon oxidized to carbon dioxide from the combustion of the fuel. The fraction of carbon oxidized is 0.99 for solid and liquid fuels, 0.995 for natural gas, and 0.90 for wood (U.S. EPA, 1995). This calculation will take the following form:

Net carbon content {tons} * fraction oxidized = total oxidized carbon {tons C}

Sum the results to obtain the total amount of carbon oxidized from all fuel types. Carbon biomass consumption should not be included in total emissions.

To convert carbon oxidized to total CO_2 emissions, multiply by the molecular weight ratio of CO_2 to C (e.g., 44/12) to obtain total CO_2 emissions. Sum across each fuel and sector to find total state emissions of CO_2 from energy consumption. Carbon consumption from biomass should not be included.

Total CO_2 {tons} = carbon oxidized {tons} * 44 {tons CO_2} / 12 {tons C}

Uncertainties

Uncertainties in emission estimates include inaccuracies in the carbon content coefficient for each fuel, since the coefficients are average quantities. Second, the apportionment of emissions from state-wide to county-specific estimates, excluding electric utilities, is made using a population ratio, which is assumed to equal the fuels distribution. This was the most realistic assumption available since county-specific fuel data was unavailable. In the case of electric utilities, emission estimates were based on actual quantities of fuel burned at individual power plants.

B. Methane and Nitrous Oxide

Methane and nitrous oxide emissions are dependent on the combustion process and emission factors vary for different sectors and different combustion technologies in the same sector. Chapter D-12 of the EPA *State Workbook*, published by the U.S. Environmental Protection Agency in 1992, gives emission factors. Insufficient information is available to determine which emission factors to use.

County Emissions

County fuel consumption was determined using ratios of population and employment with the statewide fuel consumption totals. Residential totals were determined using the ratio of county population to statewide multiplied by the residential fuel consumption total for the state. All other categories were determined by using ratios of employment relative to the statewide total. The table showing the ratios is provided in the appendix as Table A-11.

A. Residential Sector

Methodology

The methodology for calculating greenhouse gas emissions is stated in the General Methodology in Section I of this report.

Residential energy use by fuel type is calculated for counties by means of a ratio of county-to-statewide population (*State of Utah Economic and Demographic Projections 1994*, published by the Utah Governor's Office of Planning and Budget, Demographic and Economic Analysis Work Group, 1994). Emissions by county are given in Appendix A.

Results

The residential sector was responsible for about 2.9 million tons of greenhouse gas emissions in 1990 and 3.3 million tons in 1993. The major fuel used by the residential sector is natural gas. Natural gas accounted for 89 percent of residential greenhouse gas emissions in 1990 and 94 percent in 1993.

B. Commercial Sector

Methodology

The Standard Industrial Classifications (SIC) code designates specific manufacturing activities. The commercial sector is defined by SIC codes 50-99.

The methodology for calculating greenhouse gas emissions is stated in the General Methodology in Section I of this report.

Commercial energy use by fuel type is calculated for each county by means of a ratio of county-to-statewide commercial employment (*State of Utah Economic and Demographic Projections 1994*, published by the Utah Governor's Office of Planning and Budget, Demographic and Economic Analysis Work Group, 1994). Emissions by county are given in Appendix A.

Results

Fuel combustion in the commercial sector generated 1.6 million tons of greenhouse gases in 1990 and 1.8 tons in 1993. The major fuel used in the commercial sector is natural gas. Natural gas produced 60 percent of the emissions in 1990 and 79 percent in 1993.

C. Industrial Sector

Methodology

The industrial sector is defined as SIC codes 20-39. The methodology for calculating greenhouse gas emissions is stated in the General Methodology in Section I of this report.

Industrial energy use by fuel type is calculated for counties by means of a ratio of county-to-statewide industrial employment (*State of Utah Economic and Demographic Projections 1994*, published by the Utah Governor's Office of Planning and Budget, Demographic and Economic Analysis Work Group, 1994). Emissions by county are given in Appendix A.

Results

Fuel combustion in the industrial sector generated 10.2 million tons of greenhouse gases in 1990 and 9.8 tons in 1993. The major fuel used in the industrial sector is natural gas . Natural gas produced 45 percent of the emissions in 1990 and 43 percent in 1993.

D. Transportation Sector

Methodology

The transportation sector is defined as SIC codes 46 and 49. The methodology for calculating greenhouse gas emissions is stated in the General Methodology in Section I of this report.

Transportation energy use by fuel type is calculated for counties by means of a ratio of county-to-statewide population. (*State of Utah Economic and Demographic Projections 1994*, published by the Utah Governor's Office of Planning and Budget, Demographic and Economic Analysis Work Group, 1994). Emissions by county are given in Appendix A.

Results

Fuel combustion in the industrial sector generated 11.6 million tons of greenhouse gases in 1990 and 12.9 million tons in 1993. The major fuel used is motor gasoline in the transportation sector. Motor gasoline caused 58 percent of the emissions in 1990 and 59 percent in 1993.

E. Electric Utility Sector

Methodology

The electric utility sector is defined as SIC 4911 through 4931. The methodology for calculating greenhouse gas emissions is stated in the General Methodology in Section I of this report.

Electric utility energy use by fuel type is calculated for counties by means of actual utility combustion in each county and data from the *State Energy Data Report 1993*, from the Energy Information Administration. The data were taken from 1990 and 1993 air emision inventories at the Utah Division of Air Quality. Electric utilities are listed for each county in Appendix A. Emissions by county are given in Appendix A.

Results

Fuel combustion in the electric utility sector generated 33.0 million tons of greenhouse gases in 1990 and 34.4 million tons in 1993. The major fuel used in the electric utility sector is bituminous coal. Bituminous coal produced 99.7 percent of the emissions in 1990 and 98.9 percent in 1993.

Interstate Electricity Imports and Exports

The California Energy Commission, through the Energy Facilities Siting and Environmental Protection Division, supplied data on electricity imports and exports for the year 1990. The source of information is the Energy Information Administration Forms EIA-412 and EIA-860 for purchases and pounds carbon per gigawatthour (California Energy Commission, 1995).

Total exports from Utah to California for 1990 were 126,150 gigawatthours. Total imports from California to Utah for 1990 were 381 gigawatthours. Using emission data from another study of 0.91 tons CO_2 per gigawatthour yields 114,796 tons CO_2 for imports from California and 347 tons for exports from Utah (San Martin, 1989). A summary of the power exchanges is provided in a California Energy Commission document in the appendix. PacifiCorp also has many power exchanges between states other than California, but this information is not currently available.

Summary of Power Transactions from Utah Utilities to Out-of-State Utilities

Greenhouse gases generated from electric power generation generally fall into one of three categories. Power generated as "Sold" refers to all in-state contract power generated for domestic and external consumption. "Exchanged" power includes all energy transactions between utilities where electricity imported is returned at a pre-specified date or accumulated as energy balances until the end of a defined period, after which a cash settlement may occur. Finally, "Wheeled" power refers to contractual shipments of electricity from one system to another over transmission lines of intervening systems. Currently, there is no category of wheeled power in the state of Utah.

As indicated in Table I-3, Utah has a number of power contracts involving two producers, Intermountain and UAMPS, which have out-of-state contracts with California. In servicing regions of southern California, the Intermountain Power Agency generates over 12,000 GWh or roughly 3.3 million tons of carbon. For customers in the Northwest, primarily PacifiCorp, approximately 435 GWh are generated under firm contract, equivalent to about 120,000 tons of carbon.

In terms of exchanged power, Table I-4 presents the Utah-based power which is generated to balance production from PacifiCorp's facilities in the state of Oregon. The DG&T produces two-thirds of this power, followed by UAMPS, and a small fraction from the Provo City Corporation. All told, exchange power is responsible for just over 3,000 GWh and approximately 894,000 tons of carbon.

Table I-3 Power Sales from Utah Utilities to Out-of-State Utilities - 1990

Based on EIA-412,EIA-860, and the California Energy Commission 1992 Electricity Report

Intermountain Power Agency	Power Sold	Carbon Emission Factor	Carbon Emission
California			
Firm Power			
Anaheim City of	1,693,678 MWh	550,731 Lbs C/GWh	466,380 tons C
Burbank City of	533,210 MWh	550,731 Lbs C/GWh	146,827 tons C
Glendale City of	278,484 MWh	550,731 Lbs C/GWh	76,684 tons C
Los Angeles County	8,014,724 MWh	550,731 Lbs C/GWh	2,206,978 tons C
Pasadena City of	771,037 MWh	550,731 Lbs C/GWh	212,316 tons C
Riverside City of	979,253 MWh	550,731 Lbs C/GWh	269,652 tons C
Northwest			
Firm Power			
PacifiCorp	435,542 MWh	550,731 Lbs C/GWh	119,933 tons C
Total Utility Sales	**12,705,928 MWh**		**3,498,774 tons C**
Utah Associated Mun Power Sys			
California			
Economic Power			
Burbank City of	884 MWh	309,590 Lbs C/GWh	136 tons C
Pasadena City of	1,011 MWh	309,590 Lbs C/GWh	156 tons C
Firm Power			
Santa Clara City of	9,866 MWh	309,590 Lbs C/GWh	1,527 tons C
Northwest			
Economic Power			
PacifiCorp	7,313 MWh	309,590 Lbs C/GWh	1,132 tons C
Southwest			
Economic Power			
Western Area Power Admin	163,990 MWh	309,590 Lbs C/GWh	25,384 tons C
Total Utility Sales	**183,064 MWh**		**28,337 tons C**

Table I-4 Exchange Power between Utah Utilities and Out-of-State Utilities - 1990
With Out-of-State Utilities as the reporting party

	Power Produced, Utah	Carbon Emission, Utah
Deseret Generation & Tran Coop		
PacifiCorp	2,156,780 MWh	625,088 tons C
Utility Total	**2,156,780 MWh**	**625,088 tons C**
Provo City Corp		
PacifiCorp	23,838 MWh	4,753 tons C
Utility Total	**23,838 MWh**	**4,753 tons C**
Utah Municipal Power Agency		
PacifiCorp	961,003 MWh	264,627 tons C
Utility Total	**961,003 MWh**	**264,627 tons C**
Oregon		
PacifiCorp	3,141,621 MWh	894,469 tons C
State Total	**3,141,621 MWh**	**894,469 tons C**

Based on EIA-412, EIA-860, and the California Energy Commission 1992

References

California Energy Commission. *California Power Purchases from Utah Based Facilities, 1990.* Energy Facilities Siting and Environmental Protection Division (memo: Joseph Loyer), 1995.

California Energy Commission. Electricity Exports from Utah to California (memo: Joe Loyer), 1996.

California Energy Commission. Transportation and Electric Services Employment, from the Utah Department of Employment Security, Labor Market Information (memo: Jim Hall), 1996.

Energy Information Administration (EIA). *State Energy Data Report 1993.* U.S. Department of Energy (DOE/EIA-0214(93)). Washington, D.C.: Government Printing Office, 1993.

Energy Information Administration (EIA). *Coal Industry Annual 1993.* U.S. Department of Energy (DOE/EIA-0584(93)). Washington, D.C.: Government Printing Office, 1993.

Energy Information Administration (EIA). *Household Energy Consumption and Expenditures 1993.* U.S. Department of Energy, Office of Energy Markets and End Use. Washington, D.C.: Government Printing Office, 1995.

San Martin, Dr. Robert. *Environmental Emissions From Energy Technology Systems: The Total Fuel Cycle.* U.S. Department of Energy (U.S. DOE), Division of Renewable Energy. Washington, D.C.: Government Printing Office, 1989.

State of Utah. *Utah Energy Statistical Abstract.* Department of Natural Resources, Office of Energy and Resource Planning, 5th edition, 1995.

State of Utah. *State of Utah Economic and Demographic Projections 1994.* Utah Governor's Office of Planning and Budget, Demographic and Economic Analysis Work Group, 1994.

U.S. Environmental Protection Agency (U.S. EPA). *State Workbook: Methodologies for Estimating Greenhouse Gas Emissions.* Office of Policy, Planning, and Evaluation (EPA-230-B-95-001). Washington, D.C.: Government Printing Office, 1995.

CO_2 Emissions from Fossil Fuel Combustion - 1990

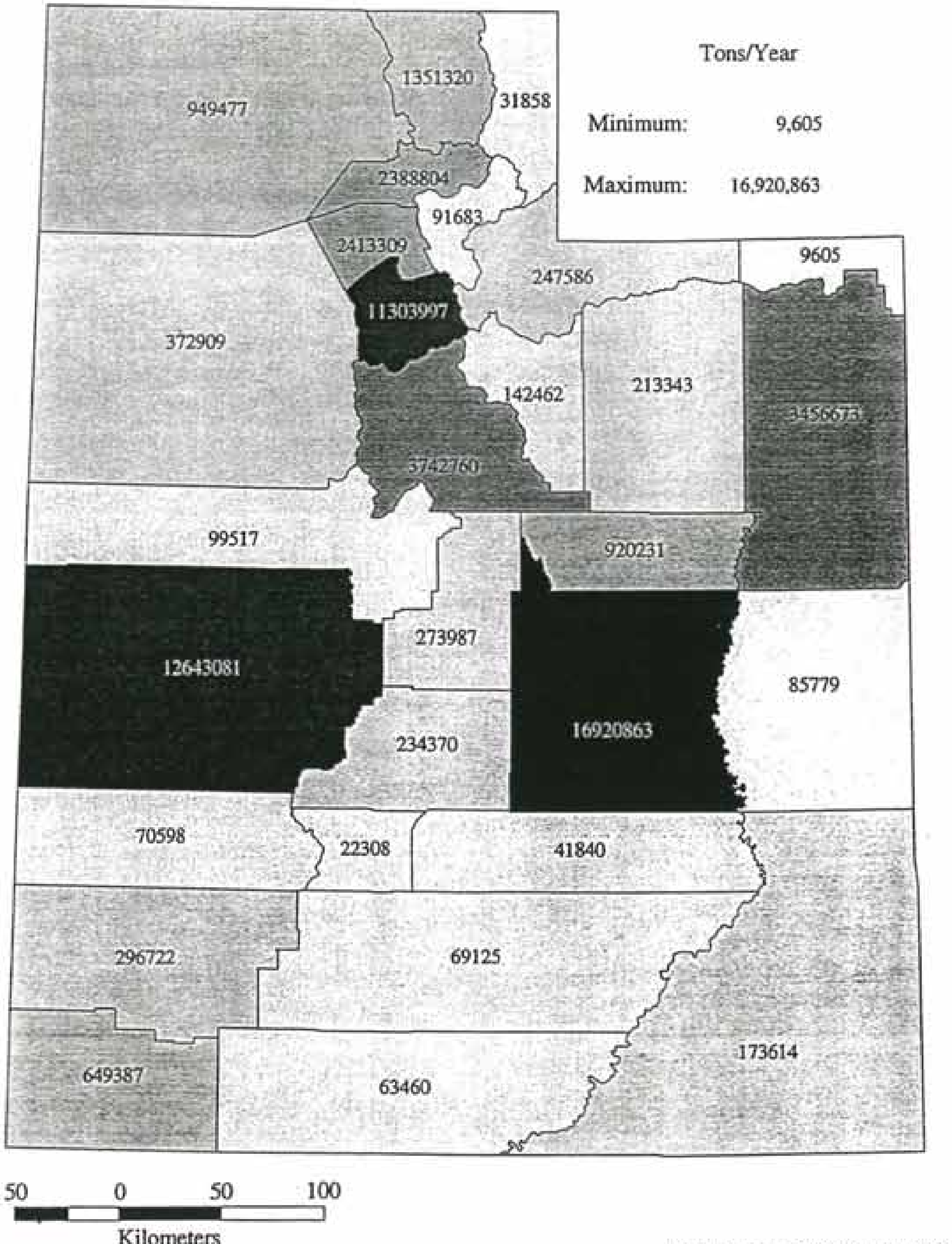
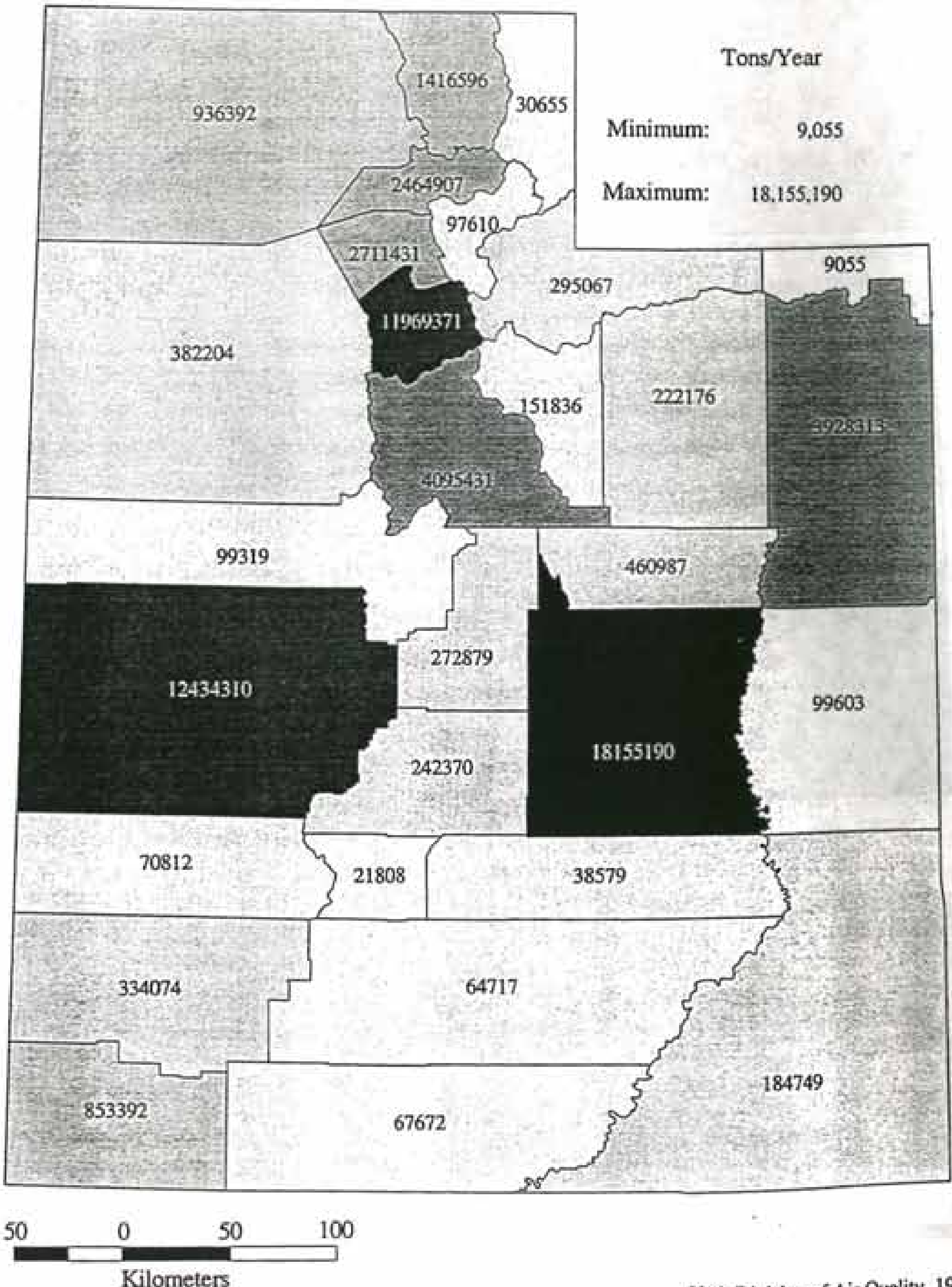


Figure I-1

CO_2 Emissions from Fossil Fuel Combustion - 1993



Utah Division of Air Quality 1996

Figure I-2

Chapter II

Production Processes

This section includes emissions produced from non-energy related activities. The production processes included in this section are: 1) lime and cement production; 2) limestone use; 3) nitric acid production; 4) adipic acid production; 5) soda ash production and use; 6) CO_2 manufacture; 7) aluminum production; and 8) HCFC-22 production.

A. CO_2 from Lime and Cement Production

Overview

The cement production process represents the most significant non-energy source of industrial CO_2 emissions. Carbon dioxide is created when calcium carbonate ($CaCO_3$) is heated in a cement kiln to form lime (calcium oxide -- CaO) and CO_2. This process is known as calcination or calcining:

$$CaCO_3 + Heat \rightarrow CaO + CO_2$$

The lime is then combined with silica-containing materials to form dicalcium or tricalcium silicates (U.S. EPA, 1995). This lime mixture is then combined with more materials to produce clinker. Clinker is an intermediate product from which finished Portland and masonry cement are made.

Methodology

Lime Production

The mass of CO_2 emitted per unit of lime produced can be calculated based on the molecular weights of CO_2 and lime (CaO.) The equation is as follows:

$$EF_{lime} = \frac{44.01(g/moleCO_2)}{56.08(g/moleCaO)} = 0.785(\frac{tonCO_2}{tonLime})$$

In Utah, lime is produced by Continental Lime, Inc. in Millard County, and Chemical Lime Company in Tooele County. The tons of lime produced by each company in 1990 and 1993 were found in the Division of Air Quality (DAQ) database using the Standard Industrial Classification (SIC) codes 3274 and 1422 and source classification code (SCC) 3-05-016 for lime manufacturing. The lime produced in 1990 and 1993 and the CO_2 emitted in Utah are as follows:

Table II-1 Lime Production by County

Company Name			Continental Lime	Chemical Lime	
County			Millard	Tooele	Total Statewide
Lime Production	Throughput (tons)	1990	365,000	40,000	405,000
		1993	414,250	55,090	469,340
	Emission Factor (ton/ton)		0.785	0.785	
	CO_2 Emissions (tons)	1990	286,525	31,400	317,925
		1993	325,186	43,246	368,432

Uncertainties

Uncertainties in emission estimates can be attributed to slight differences in the chemical composition of lime. Lime typically contains trace amounts of impurities, and few plants manufacture lime with exactly the same composition.

A portion of the CO_2 emitted during lime production will be reabsorbed when the lime is used. Typically, the CO_2 reacts with the lime to create calcium carbonate ($CaCO_3$). Due to many unknowns, the amount of CO_2 reabsorbed cannot be presently quantified (U.S. EPA, 1995).

Cement Production

As recommended in the EPA *State Workbook*, the emission factor used for clinker production is the product of the fraction of lime used in the cement clinker and a constant reflecting the mass of CO_2 released per unit of lime. The emission factor was calculated as follows:

$$EF_{clinker} = \%CaO * \frac{44.01(g/moleCO_2)}{56.08(g/moleCaO)} = 0.507\frac{(tonCO_2)}{(tonClinker)}$$

Masonry cement requires additional lime over and above the lime used in the clinker. During the production of masonry cement, additives such as lime, slag and shale are added to the cement, increasing the weight by five percent. Lime accounts for 60 percent of the added substances (U.S. EPA, 1995). The emission factor used to account for the additional lime is as follows:

$$EF_{cement} = (\frac{fw}{1-fw}) * (fl) * \frac{44.02(g/moleCO_2)}{56.08(g/moleCaO)} = (\frac{0.05}{1+0.05}) = 0.0244(\frac{tonCO_2}{tonCement})$$

where

fw = weight fraction of added substances = 0.05
fl = fraction of lime in added substances = 0.6

Holnam Inc., located in Morgan County and Ash Grove Cement Company, located in Juab County, are the only companies in Utah that produce cement. The amount of clinker and cement produced by these companies was found in the DAQ database using SIC code 3241 and SCCs 3-05-006 and 3-05-007 for cement manufacturing.

Using the emission factors found in the EPA *State Workbook*, the amount of clinker and cement produced by county and the corresponding CO_2 emitted are as follows:

Table II-2 Clinker and Cement Production by Company

Company Name			Holnam Inc.	Ash Grove Cement Co.	
County			Morgan	Juab	Total Statewide
Clinker Production	Throughput (tons)	1990	366,327	594,600	960,927
		1993	350,400	581,071	931,471
	Emission Factor (ton/ton)		0.507	0.507	
	CO_2 Emissions (tons)	1990	185,728	301,462	487,190
		1993	177,653	294,603	472,256
Cement Production	Throughput (tons)	1990	364,698	626,675	991,373
		1993	348,841	612,427	961,268
	Emission Factor (ton/ton)		0.022	0.022	
	CO_2 Emissions (tons)	1990	8,169	14,038	22,207
		1993	7,814	13,718	21,532
	Total CO_2 (tons)	1990	139,897	315,500	509,397
		1993	185,467	308,321	493,788

Uncertainties

As in lime consumption, some amount of CO_2 is reabsorbed when the cement is used for construction. As cement reacts with water, alkaline substances are formed. During the curing process, these compounds may react with CO_2 in the atmosphere to create $CaCO_3$. This reaction only occurs in roughly the outer 0.2 inches of surface area. Since the amount of CO_2 reabsorbed is thought to be minimal, an emission estimate is not included here (U.S. EPA, 1995).

B. CO_2 from Limestone Use

Overview

Limestone is a basic raw material used by a wide variety of industries, including construction, agriculture, chemical and metallurgical industries (U.S. EPA, 1995). The two types of limestone, calcite or dolomite, are typically heated during use, generating CO_2 as a by-product.

Methodology

As recommended in the EPA *State Workbook*, the CO_2 emitted per unit of limestone used is the product of the carbon contained in the limestone (calcite or dolomite) and the ratio of the molecular weight of CO_2 to the molecular weight of C.

The emission factors for calcite and dolomite are as follows:

Calcite

$$EF_{Calcite}=0.12\frac{tonC}{tonCalcite}*\frac{44(g/moleCO_2)}{12(g/moleC)}=0.44(\frac{tonCO_2}{tonCalclite})$$

Dolomite

$$EF_{Dolomite}=0.13\frac{tonsC}{tonDolomite}*\frac{44(g/moleCO_2)}{12(g/moleC)}=0.4767(\frac{tonCO_2}{tonDolomite})$$

A query of the DAQ database for limestone use was conducted to determine the applicable sources in the state. The query focused on limestone, calcite or dolomite, throughput. The query found five companies in Utah that use calcite and/or dolomite. The limestone (calcite and dolomite) use and associated CO_2 emissions in the state for 1990 and 1993 are as follows:

Table II-3 Calcite and Dolomite Use by County

Company Name	County	Throughput (tons) 1990	Throughput (tons) 1993	CO_2 Emissions (ton/yr) 1990	CO_2 Emissions (ton/yr) 1993
Calcite Use (EF=0.44 ton CO_2/ton Calcite)					
Ash Grove Cement Company	Juab	770,900	780,768	339,196	343,537
Chemical Lime Company	Tooele	83,024	79,712	36,531	35,073
Continental Lime, Inc.	Millard	730,000	828,500	321,200	364,540
Geneva Steel	Utah	58,289	95,021	25,647	41,809
Intermountain Power Service Co.	Millard	63,045	67,677	27,740	29,778
State Total		**1,705,258**	**1,851,678**	**750,314**	**814,738**
Dolomite Use (EF=0.44 ton CO_2/ton Dolomite)					
Geneva Steel	Utah	30,899	41,240	14,730	19,659
State Total		**30,899**	**41,240**	**14,730**	**19,659**
Total Statewide CO_2 from Limestone				**765,043**	**834,398**

Uncertainties

Emission estimation uncertainties can again be attributed to variations in the chemical composition of limestone. Uncertainties also exist in the activity data. Much of the limestone consumed in the United States is reported as "other unspecified uses." As a result it is difficult to disaggregate by type (U.S. EPA, 1995).

C. Nitric Acid

Overview

The production of nitric acid produces nitrous oxide as a by-product. Ammonia is oxidized to form nitrous oxide in the reaction shown below. Nearly all the nitric acid produced is by the catalytic oxidation of ammonia. La Roche Chemicals in Utah County is the only company in Utah which produces nitric acid.

by-product reaction: $4NH_3 + 2O_2 = 2N_2O + 2H_2O + H_2$

main reaction: $NH_3 + 2O_2 = HNO_3 + H_2O$

Methodology

The mass of N_2O emitted per unit of ammonia is 0.0171 ton per ton at Montercatini and 0.0114 ton per ton at Weatherly divisions of La Roche Chemical, higher than the 1990 U.S. average of 0.0055 ton/ton (U.S. EPA, 1995). These results are based on control equipment and stack gas measurements of NO content. The total NO released is 514 tons in 1990 and 504 tons per year in 1993 at La Roche Chemical.

The tons of nitric acid produced in 1990 and 1993 was found in the Division of Air Quality (DAQ) database using the Standard Industrial Classification code 2873 and source classification code 3-01-013-04 for nitric acid manufacturing.

Table II-4 Nitric Acid Emissions for La Roche Chemicals of Utah County

Company Name		La Roche Chemicals		
Product	**Year**	**Throughput (Tons)**	**Emission Factors (ton / ton)**	**NO Emissions (Tons)**
Nitric Acid Production	1990	93,381	0.0055	514
Nitric Acid Production	1993	91,678	0.0055	504

Uncertainties

The uncertainty in emissions estimates are based on the emission factors which are based on national averages, not on the emissions from this one manufacturing operation.

D. Adipic Acid Production

Overview

Adipic acid is a white crystalline solid used in the manufacture of synthetic fibers, coatings, plastics, urethane foams, elastomers and synthetic lubricants. Ninety percent of all adipic acid produced in the United States is used in the production of nylon 6,6, as well as production of some low-temperature lubricants. It is also used to provide foods with a "tangy" flavor (U.S. EPA, 1995).

Negative Declaration

Adipic acid is not produced in Utah. Therefore, no emissions are generated by this process in the state of Utah.

E. CO_2 from Soda Ash Manufacture and Consumption

Overview

Commercial soda ash (sodium carbonate) is used in many consumer products such as soap, glass, detergents, paper, textiles and food. About 75 percent of world production is synthetic ash made from sodium chloride: the remaining 25 percent is produced from natural sources. The United States produces only natural soda ash. During the production process, trona (the principal ore from which natural soda ash is made) is calcined in a rotary kiln and chemically transformed into a crude soda ash that requires further processing. CO_2 and water are generated as a by-product of the calcination process (U.S. EPA, 1995).

CO_2 is also released when soda ash is consumed. Glass manufacture represents about 49 percent of domestic soda ash consumption, with smaller amounts used for chemical manufacture, soap and detergents, flue gas desulfurization, and other miscellaneous uses (U.S. EPA, 1995).

Methodology

Soda ash is not manufactured in the state of Utah. However, soda ash consumption did occur as reported by Dyce Chemical. Dyce Chemical is a distributor of soda ash which is manufactured outside of Utah. Dyce Chemical reported the tons of soda ash sold to Utah businesses in 1990 and 1993. It is assumed that all soda ash sold to Utah customers was consumed within the state. As stated in the EPA *State Workbook*, a mole of carbon is released for every mole of soda ash consumed, which equates to 0.113 tons of carbon per ton of soda ash consumed, or 0.415 tons of CO_2 per ton of soda ash consumed.

This factor results in the following equation:

$$CO_2 = SAconsumed(tons) * 0.145 \frac{tonCO_2}{tonSA}$$

where SA= Soda Ash

Soda ash consumption is known for the entire state. An assumption was made that the emissions are distributed among each county of the state by population. The resulting emissions for soda ash consumption in 1990 and 1993 are in the following tables.

Table II-5 Soda Ash Consumption and CO_2 Emissions

Soda Ash Consumed Statewide		CO_2 Emissions Statewide	
1990	**1993**	**1990**	**1993**
500	1,000	207.5	415

F. CO_2 Manufacture

Overview

Typically, CO_2 is produced as a by-product from the production of other chemicals, such as ammonia, or obtained by separation from crude oil or natural gas. The by-product CO_2 from these production processes should be accounted for in the emission estimates from fossil fuel consumption (either during combustion or from non-fuel use) (U.S. EPA, 1995).

Negative Declaration

CO_2 is not manufactured in the state of Utah. Handlers of CO_2 in the state, Bagley Ice & Carbonic and Bevco, report that CO_2 used in Utah comes from ammonia wells in Idaho and Wyoming. Therefore, no CO_2 is estimated for this category of the inventory.

G. CF_4 and, C_2F_6 Emissions from Aluminum Smelting

Overview

The aluminum production industry is thought to be the largest source of two PFCs -- CF_4 and C_2F_6. Emissions from aluminum production occur during the reduction of alumina in the primary smelting process. PFCs are formed during disruptions of the production process known as anode effects. The more frequent and long-lasting the anode effects, the greater the emissions (U.S. EPA, 1995).

CO_2 is also emitted during the aluminum production process when alumina is reduced to aluminum. These emissions, however, would fall into the non-fuel use portion of CO_2 emissions from fossil fuel consumption.

Table II-6 CO_2 Emissions from Soda Ash Consumption (tons)

County	1990	1993
Beaver	0.58	1.11
Box Elder	4.38	8.47
Cache	8.46	16.92
Carbon	2.42	4.60
Daggett	0.08	0.16
Davis	22.56	45.80
Duchesne	1.51	2.93
Emery	1.23	2.31
Garfield	0.47	0.93
Grand	0.79	1.67
Iron	2.51	5.29
Juab	0.70	1.38
Kane	0.62	1.21
Millard	1.35	2.60
Morgan	0.66	1.37
Piute	0.15	0.30
Rich	0.21	0.40
Salt Lake	87.37	172.76
San Juan	1.51	2.91
Sanpete	1.95	4.02
Sevier	1.85	3.65
Summit	1.88	4.38
Tooele	3.20	6.25
Uintah	2.66	5.25
Utah	31.93	64.70
Wasatch	1.21	2.49
Washington	5.89	13.05
Wayne	0.26	0.49
Weber	19.08	37.58
Total	**207.50**	**415.00**

Negative Declaration

Aluminum production does not occur in the state of Utah. Therefore, neither CF_4 nor C_2F_6 is emitted from this process in the state of Utah.

H. HCFC-22 Production

Overview

HFCs are chemicals containing hydrogen, carbon and fluorine. The only type of HFC known to be emitted in significant quantities at present is HFC-23, which is emitted as a by-product of HCFC-22 production.

Negative Declaration

No HCFC-22 is produced in the state of Utah. Therefore, no HFC-23 is emitted in the state of Utah.

References

Dyce Chemical Inc. Fax dated August 22, 1995.

U.S. Environmental Protection Agency (U.S. EPA). *State Workbook: Methodologies for Estimating Greenhouse Gas Emissions.* Office of Policy, Planning, and Evaluation (EPA-230-B-95-001). Washington, D.C.: Government Printing Office, 1995.

State of Utah. Utah Division of Air Quality. DAQ Access Database, 1995.

State of Wisconsin. Wisconsin *Greenhouse Gas Emissions Inventory*. Department of Natural Resources, Bureau of Air Management, 1990.

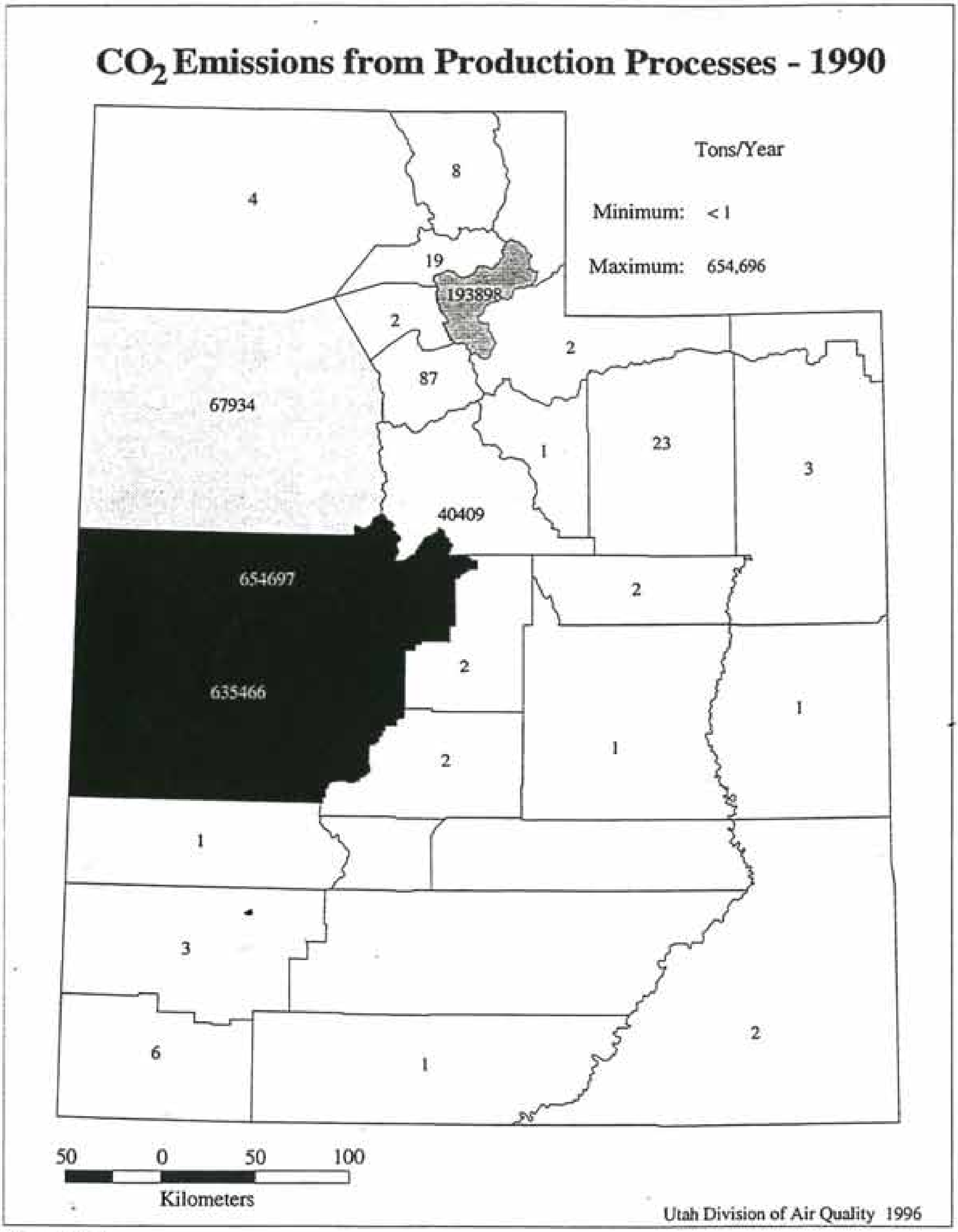
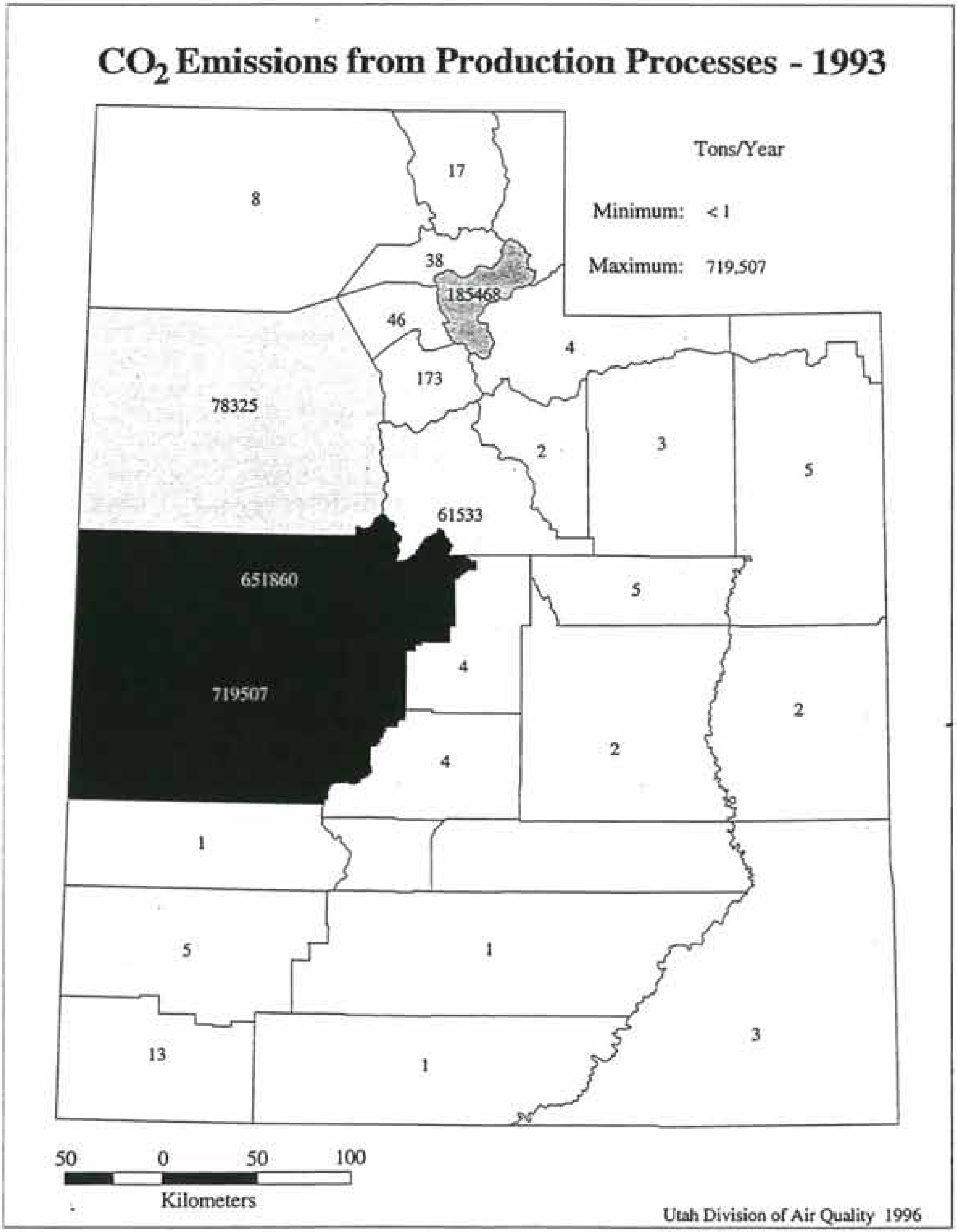

CO2 Emissions from Production Processes - 1990
Tons/Year
Minimum: < 1
Maximum: 654,696
4
8
19
193898
2
87
67934
2
1
23
3
40409
654697
635466
2
2
2
1
1
1
3
6
1
2
50
0
50
100
Kilometers
Utah Division of Air Quality 1996

Figure II-1


CO2 Emissions from Production Processes - 1993
Tons/Year
Minimum: < 1
Maximum: 719,507
8
17
38
185468
46
173
4
78325
2
3
5
61533
651860
5
4
719507
2
2
4
1
5
1
3
13
1
50 0 50 100
Kilometers
Utah Division of Air Quality 1996
Figure II-2

Chapter III

Natural Gas and Oil Systems

Overview

Emissions from natural gas and oil systems are primarily methane, although smaller quantities of non-methane VOCs, carbon dioxide and carbon monoxide can be emitted. Methane emissions occur throughout the total fuel cycles of oil and natural gas. From natural gas, methane emissions occur during field production, processing, refining, storage, injection, transmission and distribution, as well as from engine exhaust. From the production and refining of petroleum liquids, methane emissions occur during field production, storage, refining, and from venting and flaring of natural gas.

To estimate these emissions, the following steps should be taken: 1) obtain the required data on activity levels for different segments of the fuel systems; 2) multiply activity levels by the appropriate emission factor; and 3) sum across activity types to calculate total emissions.

Methodology

Information required to estimate emissions from this source is based on activity by sector whether oil or gas. Information was collected from the Utah Division of Oil, Gas, and Mining. Units are million British Thermal Units or MMBTU. Emissions factors are taken from the EPA *State Workbook*, 1995. Emission factors are expressed in pounds of methane per MMBTU. Three factors are provided (e.g., low, medium, and high). The factors provide estimates in three ranges based on average emissions across the United States. The calculation is shown in the equation below:

Activity Level (MMBTU) x Emissions Factor (high, lbs CH_4/MMBTU) = lbs CH_4, high

Activity Level (MMBTU) x Emissions Factor (low, lbs CH_4/MMBTU) = lbs CH_4, low

Activity Level (MMBTU) x Emissions Factor (medium, lbs CH_4/MMBTU) = lbs CH_4, medium

The total methane emissions are calculated by summing across activity types as shown below:

SUM tons CH_4, high = Total CH_4 Emissions from Oil and Gas Systems (high estimate)

SUM tons CH_4, low = Total CH_4 Emissions from Oil and Gas Systems (low estimate)

SUM tons CH_4, medium = Total CH_4 Emissions from Oil and Gas Systems (medium estimate)

Table III-1 shows the 1990 and 1993 methane emissions for oil and gas activities. Oil and gas is assumed to be produced within the state of Utah and does not include imports or exports. Net oil imports were 33,226,000 barrels in 1990 and 34,596,000 barrels in 1993. Net gas imports were 84,922 MMCF in 1990 and 32,227 MMCF in 1993.

Crude oil transportation, as shown in Table III-1, is assumed to be the same quantity as oil production, since oil in Utah is trucked to the refinery. The quantity of oil reported as refining is the number of crude oil runs, or the amount of oil actually processed by the refinery. The quantity shown as storage tanks is the stock at yearend 1990 and 1993.

Emissions from oil and gas production and distribution for counties are by means of a county-to-statewide population ratio (*State of Utah Economic and Demographic Projections 1994*, published by the Utah Governor's Office of Planning and Budget, Demographic and Economic Analysis Work Group, 1994).

Uncertainties

Uncertainties in the emission estimates include the emission factors associated with the categories of oil and gas production and distribution. Since these values are nationwide averages, the potential exists for large regional variations.

Table III-1 Natural Gas and Oil Emissions Factor and Emissions Sector

Sector	Activity MMBTU	Emissions Factor lb CH4/MMBTU * 10^6 Low	High	Medium	Emissions Sector (tons CH4) Low	High	Medium
1990							
OIL & GAS PRODUCTION							
Oil[1]	2,769,376,686	700	11,600	6,150	969	16,062	8,516
Gas[2]	337,852,000	106,770	194,960	150,870	18,036	32,934	25,486
Venting and Flaring[3]	1,338,000	6,960	32,490	19,730	5	22	13
CRUDE OIL TRANSPORTATION AND REFINING							
Transportation[4]	337,852,000	1,730	1,730	1,730	292	292	292
Refining[5]	285,279,375	210	3,250	1,730	30	464	247
Storage Tanks[6]	4,362,925	50	580	310	0	1	1
NATURAL GAS PROCESSING, TRANSPORTATION, AND DISTIRIBUTION							
Gas processing, transportation, and distribution[7]	337,852,000	132,300	273,880	203,390	22,349	46,265	34,358
				Total	**41,681**	**96,040**	**68,912**
1993							
OIL & GAS PRODUCTION							
Oil[1]	127,098,052	700	11,600	6,150	44	737	391
Gas[2]	337,852,000	106,770	194,960	150,870	18,036	32,934	25,486
Venting and Flaring[3]	2,152,000	6,960	32,490	19,730	7	35	21
CRUDE OIL TRANSPORTATION AND REFINING							
Transportation[4]	127,098,052	1,730	1,730	1,730	110	110	110
Refining[5]	285,279,375	210	3,250	1,730	30	464	247
Storage Tanks[6]	4,025,075	50	580	310	0	1	1
NATURAL GAS PROCESSING, TRANSPORTATION, AND DISTIRIBUTION							
Gas processing, transportation, and distribution[7]	337,852,000	132,300	273,880	203,390	22,349	46,265	34,358
				Total	**40,577**	**80,546**	**60,613**

Notes:
1 gross oil production for state
2 gross gas production for state
3 venting and flaring
4 assumed to be same as 1
5 gross crude oil runs
6 ending refinery stocks
7 assumed to be same as 2
5.825 x bbl = MMBTU
5.825 x bbl = MMBTU
1,000 x MMCF = MMBTU

Source: *Utah Energy Statistical Abstract, 1995*

Table III-2 CH_4 Emissions from Oil and Gas Production and Distribution

County	Low Emissions		Medium Emissions		High Emissions		Population	
	1990 tons/yr	1993 tons/yr	1990 tons/yr	1993 tons/yr	1990 tons/yr	1993 tons/yr	1990	1993
Beaver	1,226	1,201	1,829	1,793	2,898	2,382	4,800	5,000
Box Elder	9,320	9,153	13,911	13,662	22,038	18,148	36,500	38,100
Cache	18,002	18,282	26,870	27,287	42,566	36,248	70,500	76,099
Carbon	5,158	4,973	7,699	7,423	12,196	9,860	20,200	20,700
Daggett	179	168	267	251	423	333	700	700
Davis	48,005	49,489	71,653	73,867	113,509	98,124	188,000	206,001
Duchesne	3,217	3,171	4,802	4,733	7,608	6,288	12,600	13,200
Emery	2,630	2,498	3,926	3,729	6,219	4,954	10,300	10,400
Garfield	1,009	1,009	1,505	1,506	2,385	2,001	3,950	4,200
Grand	1,685	1,802	2,515	2,689	3,985	3,572	6,600	7,499
Iron	5,337	5,718	7,966	8,534	12,619	11,337	20,900	23,800
Juab	1,481	1,489	2,211	2,223	3,502	2,953	5,800	6,200
Kane	1,315	1,309	1,963	1,954	3,109	2,596	5,150	5,450
Millard	2,885	2,811	4,307	4,195	6,823	5,573	11,300	11,700
Morgan	1,417	1,477	2,115	2,205	3,351	2,929	5,550	6,150
Piute	319	324	476	484	755	643	1,250	1,350
Rich	447	432	667	645	1,057	857	1,750	1,800
Salt Lake	185,892	186,663	277,464	278,615	439,547	370,108	728,000	777,001
San Juan	3,217	3,147	4,802	4,697	7,608	6,240	12,600	13,100
Sanpete	4,162	4,348	6,212	6,490	9,842	8,622	16,300	18,100
Sevier	3,932	3,940	5,869	5,880	9,298	7,811	15,400	16,399
Summit	4,009	4,733	5,984	7,064	9,479	9,384	15,700	19,700
Tooele	6,818	6,751	10,176	10,076	16,121	13,385	26,700	28,100
Uintah	5,669	5,670	8,461	8,462	13,404	11,241	22,200	23,600
Utah	67,922	69,909	101,381	104,346	160,604	138,612	266,000	291,001
Wasatch	2,579	2,691	3,849	4,016	6,098	5,335	10,100	11,200
Washington	12,537	14,102	18,714	21,049	29,645	27,961	49,100	58,701
Wayne	549	529	819	789	1,298	1,048	2,150	2,200
Weber	40,600	40,600	60,600	60,600	96,000	80,500	159,000	169,001
State Total	441,519	448,388	659,015	669,268	1,043,985	889,044	1,729,100	1,866,452

References

State of Utah. *State of Utah Economic and Demographic Projections of 1994*, published by the Utah Governor's Office of Planning and Budget, Demographic and Economic Analysis, 1995.

State of Utah. *Utah Energy Statistical Abstract.* Department of Natural Resources, Office of Energy and Resource Planning, 5th edition, 1995.

U.S. Environmental Protection Agency (U.S. EPA). *State Workbook: Methodologies for Estimating Greenhouse Gas Emissions.* Office of Policy, Planning, and Evaluation (EPA-230-B-95-001). Washington, D.C.: Government Printing Office, 1995.

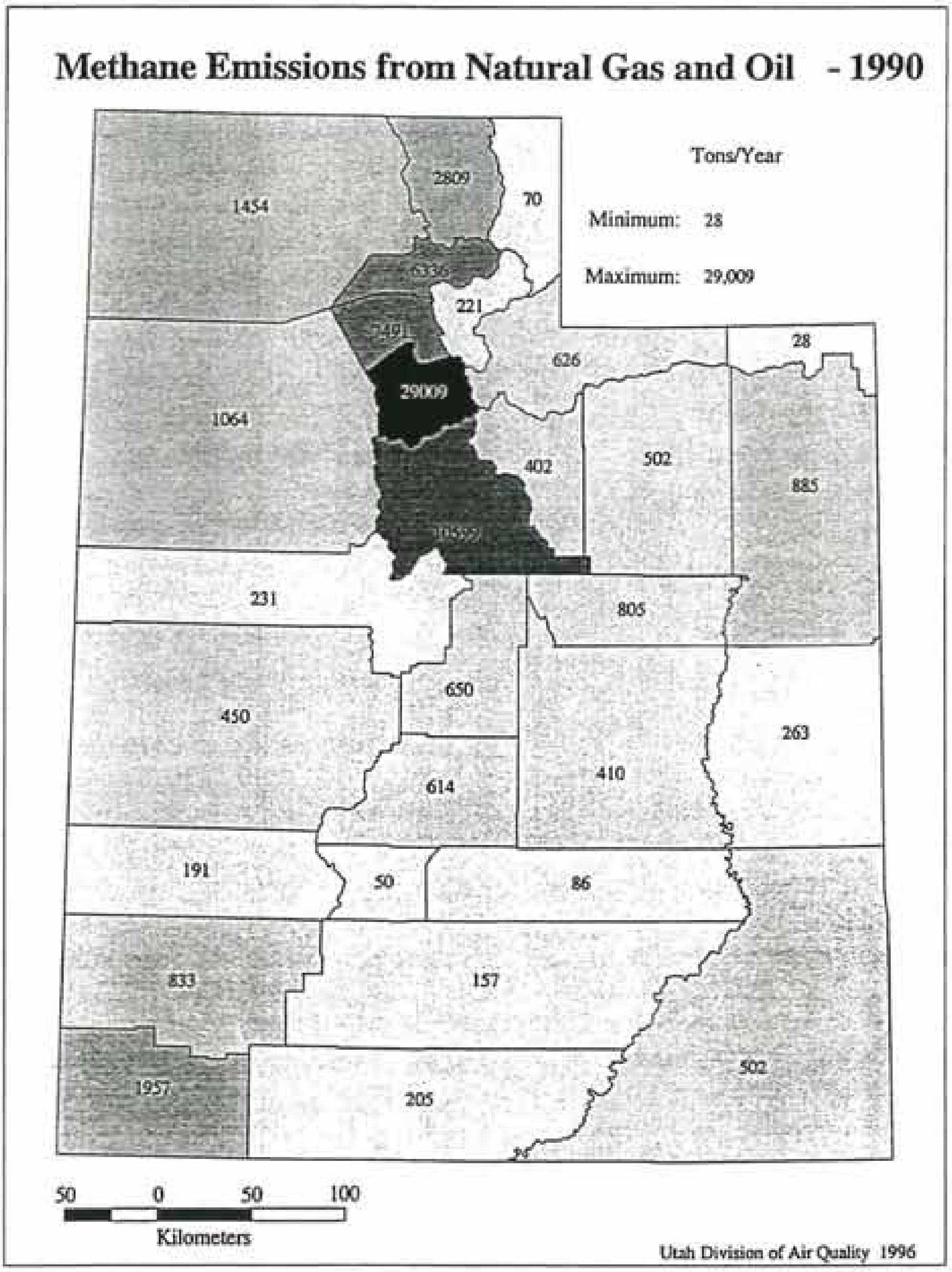

Methane Emissions from Natural Gas and Oil - 1990
Tons/Year
Minimum: 28
Maximum: 29,009
1454
2809
70
221
626
28
29009
1064
402
502
885
231
805
450
650
263
614
410
191
50
86
833
157
502
1957
205
50 0 50 100
Kilometers
Utah Division of Air Quality 1996

Figure III-1

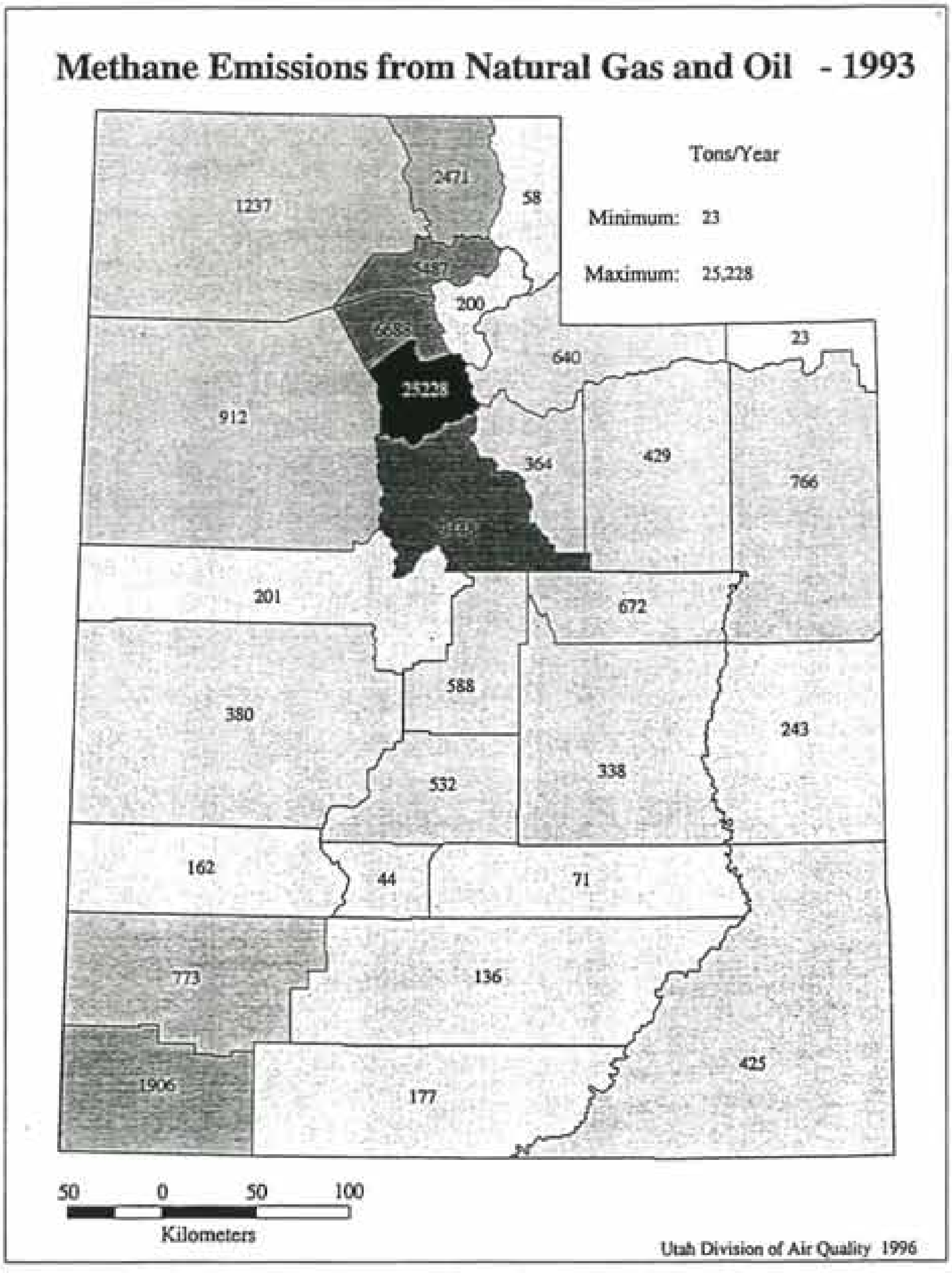

Methane Emissions from Natural Gas and Oil - 1993
Tons/Year
Minimum: 23
Maximum: 25,228
2471
58
1237
200
640
23
25228
912
364
429
766
201
672
588
380
243
338
532
162
44
71
773
136
425
1906
177
50
0
50
100
Kilometers
Utah Division of Air Quality 1996

Figure III-2

Chapter IV

Coal Mining

Overview

Methane and coal are formed during coalification, a process in which vegetation is converted by geological and biological forces into coal. Methane is released when pressure within a coalbed is reduced, either through mining or through natural erosion or faulting (U.S. EPA, 1995).

Methodology

The EPA *State Workbook* specifies that methane emissions from coal mining should be based on 1) the annual coal production; 2) mining activity; 3) post-mining activity; and 4) the amount of gas recovered for pipeline sales. Some methane remains in the coal after it has been mined and can be emitted during transportation and handling of the coal; these emissions are called post-mining emissions. The *State Workbook* also recommends using a more detailed, alternate methodology for estimating methane emissions from underground mines within the state of Utah. The data furnished in the workbook for this more detailed method appear erroneous. Consequently, the original method, as described in Chapter 4 of the workbook is used.

All coal mining in Utah is underground. These mines are located in Carbon, Emery, and Sevier Counties. The underground coal mining data as well as methane gas recovery data were obtained from the *1990 Annual Review and Forecast of Utah Coal Production and Distribution* and the *Utah Energy Statistical Abstract*. The data was supplied for both 1990 and 1993. One company in Utah recovers methane gas produced by coal mining activities, and then sells the gas. Through an operations contractual agreement with the Soldier Creek Coal Company, Western Natural Gas Inc. collects and markets recovered methane and provides the volumetric data for gas production.

The appropriate emissions coefficients were taken from the EPA *State Workbook* for both underground mining and post-mining. Both a low and high emissions coefficient were used so that the potential range of emissions could be calculated. The average of the low and high emissions was calculated to represent a single approximation of state coal mining methane emissions. Note that a degree of uncertainty is associated with this single estimate, and the range developed from the low and high values represents the best approximation of state emissions (U.S. EPA, 1995).

Total million cubic feet of methane emissions from mining in Utah is the product of underground coal production and the emission coefficients for mining and post-mining, less the amount recovered. The total cubic feet are then converted to tons by multiplying by 20.66 tons per million cubic feet. Total methane emissions are calculated as follows:

$$CH_{4(total)}(tons)=(\frac{CH_{4(low)}+CH_{4(high)}}{2}-CH_{4(captured)})*20.66(\frac{tons}{10^6 cf})$$

where

$$CH_{4(low)}(10^6 cf) = coalproduction(ton) * (370(\frac{cf_{act}}{ton}) + 55(\frac{cf_{post}}{ton}))$$

$CH_{4(captured)}$ = CH_4 captured for pipeline sales
cf_{act} = cubic feet of emissions from mining activity
cf_{post} = cubic feet of emissions from post-mining activity

Following the table format given in the workbook, coal production, methane gas emissions, and methane gas recovery data were entered in the appropriate formulas. It should be noted again that *there are no active surface coal mines in the state of Utah. All coal mining activities take place underground.* The attached table shows the calculations performed.

Definitions, Formulas, Coefficients, and Calculations

Coal Production:	Actual tons of coal mined.
Emissions Coefficient:	Given by the handbook in cubic feet of methane per ton of coal mined. Due to the variability of coal quality, a range of low to high is given for both underground mines and post-mining activity.
Methane Emissions:	Obtained by multiplying the low and high emissions coefficients by the coal production tonnage amounts and dividing that product by 1,000,000. Units are million cubic feet of methane gas.
Total Emissions:	Obtained by adding the methane emissions from mining and post-mining activities and dividing the sum by 1,000,000. Units are million cubic feet of methane.
Average Emissions:	Obtained by adding the high and low total emissions and dividing by two. Units are million cubic feet of methane.
Methane Recovered:	Provided by the company making the recovery, in million cubic feet of methane per year.
Total Emissions:	Obtained by subtracting the amount of methane recovered from the average emissions calculated. Units are million cubic feet of methane gas.
Total Emissions:	Obtained by multiplying the total emissions in million cubic feet by a conversion factor of 20.66 to get tons of methane gas.

Table IV-1 Greenhouse Gas Emissions from Coal Mining

Statewide	Year		Underground Mines	Post Mining (underground)	Carbon County Mines	Carbon County Post-Mining	Emery County Mines	Emery County Post-Mining	Sevier County Mines	Sevier County Post Mining
Coal Production (tons)	1990		22,012,000	22,012,000	8,810,000	8,810,000	10,315,000	10,315,000	2,887,000	2,887,000
	1993		21,723,000	21,723,000	2,642,000	2,642,000	15,528,000	15,528,000	3,553,000	3,553,000
Emissions Coefficient (cf/ton)	1990	Low	370	55	370	55	370	55	370	55
		High	470	90	470	90	470	90	470	90
	1993	Low	370	55	370	55	370	55	370	55
		High	470	90	470	90	470	90	470	90
Methane Emissions (10^6 cf)	1990	Low	8,144	1,211	3,260	485	3,817	567	1,068	159
		High	10,346	1,981	4,141	793	4,848	928	1,357	260
	1993	Low	8,038	1,195	978	145	5,745	854	1,315	195
		High	10,210	1,955	1,242	238	7,298	1,398	1,670	320
Total Emissions (10^6 cf)	1990	Low	9,355		3,744		4,384		1,227	
		High	12,327		4,934		5,776		1,617	
	1993	Low	9,232		1,123		6,599		1,510	
		High	12,165		1,480		8,696		1,990	
Average Emissions (10^6 cf)	1990		10,841		4,339		5,080		1,422	
	1993		10,699		1,301		7,648		1,750	
Methane Recovered (10^6 cf)	1990		127		127		0		0	
	1993		383		383		0		0	
Total Emissions (10^6 cf of CH_4)	1990		10,714		4,212		5,080		1,422	
	1993		10,315		918		7,648		1,750	
Total Emissions (tons of CH_4)	1990		221,360		87,029		104,956		29,375	
	1993		213,114		18,964		157,998		36,152	

Table showing statewide and county by county coal production, methane gas recovery, and methane gas emissions.

References

Jahanbani, F.R. *1990 Annual Review and Forecast of Utah Coal Production and Distribution.*. Department of Natural Resources, Office of Energy and Resource Planning, *1991.*

State of Utah. *Utah Energy Statistical Abstract.* Department of Natural Resources, Office of Energy and Resource Planning, 5th edition, 1995.

U.S. Environmental Protection Agency (U.S. EPA). *State Workbook: Methodologies for Estimating Greenhouse Gas Emissions.* Office of Policy, Planning, and Evaluation (EPA-230-B-95-001). Washington, D.C.: Government Printing Office, 1995.

Western Natural Gas Inc. Fax Dated October 4, 1995.

Western Natural Gas Inc. Fax Dated October 5, 1995.

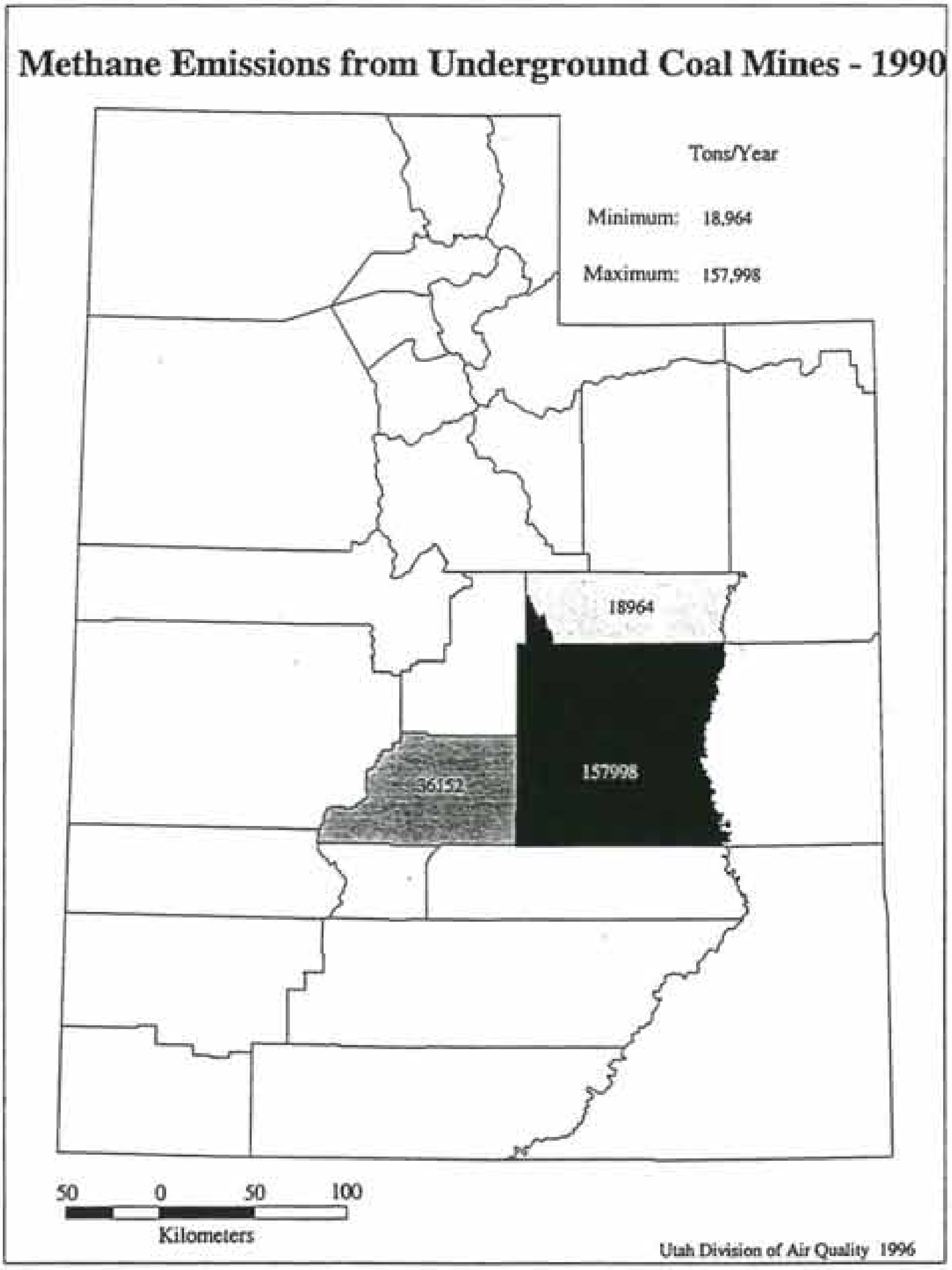

Methane Emissions from Underground Coal Mines - 1990
Tons/Year
Minimum: 18,964
Maximum: 157,998
18964
157998
36152
50 0 50 100
Kilometers
Utah Division of Air Quality 1996

Figure IV-1

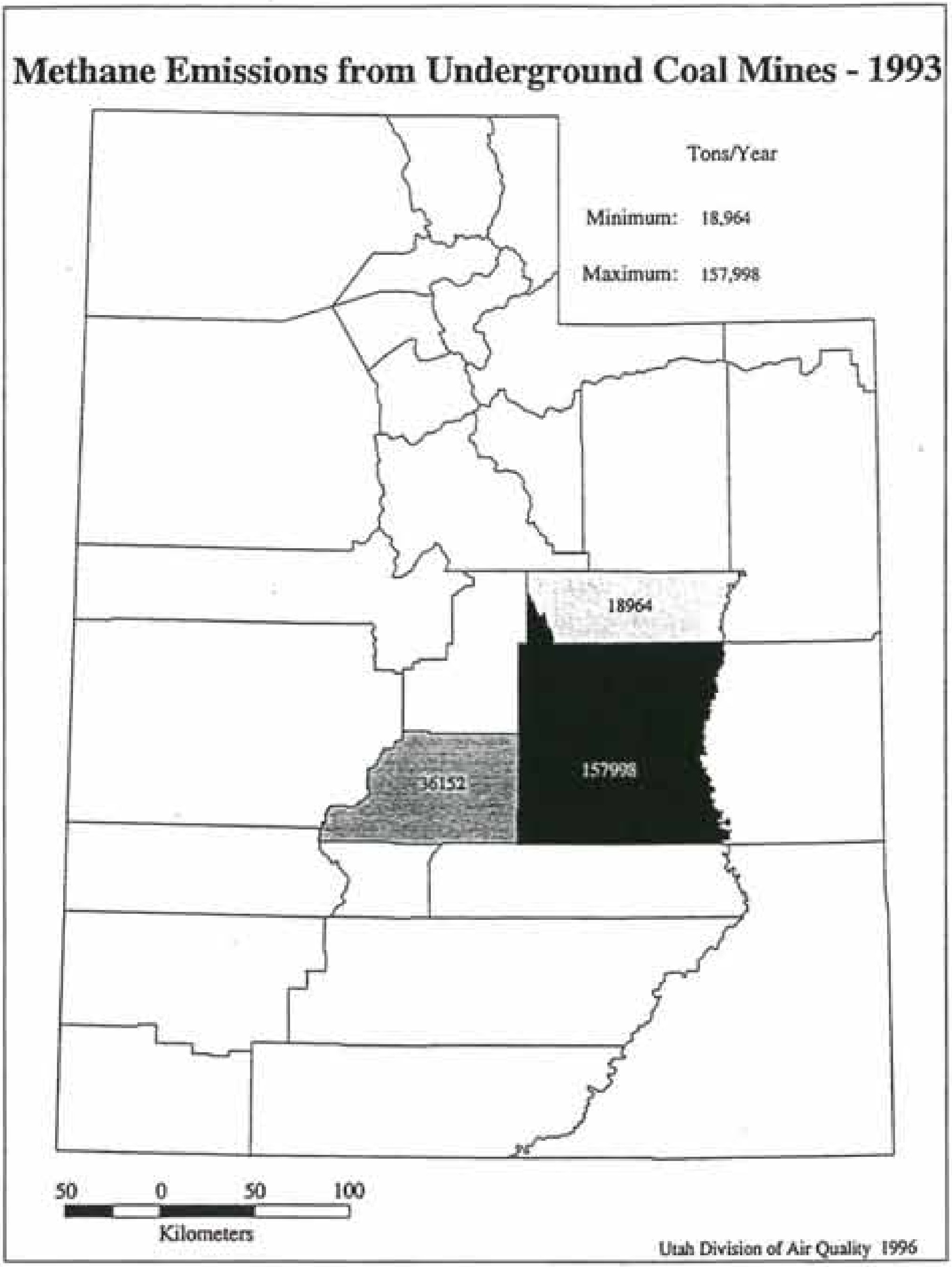

Methane Emissions from Underground Coal Mines - 1993
Tons/Year
Minimum: 18,964
Maximum: 157,998
18964
157998
36152
50 0 50 100
Kilometers
Utah Division of Air Quality 1996

Figure IV-2

Chapter V

Methane Emissions from Landfills

Overview

Landfill gas, consisting primarily of methane (CH_4) and carbon dioxide (CO_2), is produced as a result of the decomposition of organic waste in an anaerobic environment. Most landfill gas is emitted directly to the atmosphere. However, at a few landfills, the gas is recovered and either flared or used as an energy source. Landfill gas production typically begins one to two years after waste placement in a landfill, and may last from ten to sixty years (U.S. EPA, 1993). Municipal solid waste (MSW) landfills are estimated to account for more than 90 percent of all methane emissions from landfills in the United States (U.S. EPA, 1993). Industrial landfills, which receive nonhazardous waste from factories, processing plants, and other manufacturing activities, account for the remainder of landfill methane emissions.

Methodology

Methane emissions from landfills are estimated using the method provided in the EPA *State Workbook* (U.S. EPA, 1995). The methodology used to estimate methane emissions from Utah landfills can be summarized as follows:

A. Estimate Waste in Place at MSW Landfills

Waste in place is estimated based on: 1) the current population of the state; 2) the average annual population growth rate over the past thirty years; 3) the per capita waste generation rate; and 4) the portion of waste that is land filled.

Waste in Place (tons)

= 30 years * Current State Population * Per Capita Waste Generation Rate

* Percent Landfilled * Population Growth Correction Factor ÷ 2,000

where:

- The default range of per capita waste generation rate provided by EPA is from 1,460 to 1,825 lbs/person/year. A mean value of 1,642.5 lbs/person/year is used for estimating waste in place at Utah landfills.
- A default value of 70 percent, given by EPA, is used for the portion of landfilled waste.
- Average annual population growth rates over the past thirty years are calculated based on the population information listed in the *State of Utah Economic and Demographic Projections 1994*.
- Population growth correction factors are calculated by curve-fitting default values provided in the EPA *State Workbook*, Table 5-1. A linear relationship has been

established between average annual growth rates and growth correction factors as follows:

Growth Correction Factor = (−0.0719) * Average Annual Growth Rate + 0.9011

B. Estimate Waste Fraction Generated in Large Versus Small MSW Landfills

EPA defines a large landfill as having more than 1.1 million tons of waste in place. EPA gives a default value for Utah of 86 percent for the waste fraction in large versus small MSW landfills.

Waste in Place at Large Landfills (tons) = Waste in Place (tons) * 0.86

Waste in Place at Small Landfills (tons) = Waste in Place (tons) * (1 − 0.86)

C. Classify State as Arid or Non-arid

Moisture is an important factor in the production of methane in landfills. EPA has developed different methane emission estimates for arid and non-arid states. EPA defines arid states as states that have average rainfall of less than 25 inches per year. Utah is considered to be an arid state (EPA *State Workbook*, Table 5-3).

D. Estimate Methane Generated from Waste in Place at Small MSW Landfills

The following equation is used to estimate the methane emissions from small MSW landfills:

Methane Generated at Small MSW Landfills (tons/year)

= 0.27* Waste in Place at Small MSW Landfills (tons) * 0.0077

= 0.27 * Waste in Place (tons) * (1 - 0.86) * 0.0077

where 0.0077 is a conversion factor from ft^3/day to tons/year.

E. Estimate Methane Generated from Waste in Place at Large MSW Landfills

According to information provided by Utah Department of Environmental Quality, Division of Solid and Hazardous Waste, the nine landfills that have or will soon have more than 1.1 million tons of waste in place in Utah are Salt Lake County, Davis County, Cache County, Utah County, Weber County, Washington County and Carbon County.

The following equation is used to estimate the methane generated at large MSW landfills:

Methane Generated at Large MSW Landfills (tons/year)
= N * (419,000 + 0.16 W_{avg} (tons)) * 0.0077

where

N = Number of large landfills in each county and

W_{avg} = Average waste in place at large landfills (tons) = Waste in place (tons) * 0.86 ÷ 9

F. Estimate Total Methane Generated from MSW Landfills

Total methane generated from MSW landfills is the sum of methane generated at small landfills and methane generated at large landfills.

Total MSW Landfill Methane Generation

= Methane Generated at Small Landfills + Methane Generated at Large Landfills

G. Estimate Methane Generated from Industrial Landfills

Precise estimates of the quantity of waste in industrial landfills and its methane generation rates are not available. EPA estimated that methane generation from industrial landfills in the United States is approximately seven percent of methane generation from MSW landfills in the United States (1993). This seven percent default value is used to estimate methane generation from industrial landfills in Utah.

Industrial Landfill Methane Generation = MSW Landfill Methane Generation * seven percent

Total methane generation then equals MSW landfill methane generation plus industrial landfill methane generation.

Total Methane Generation

= MSW Landfill Methane Generation + Industrial Landfill Methane Generation

H. Adjust for Flaring and Recovery

Methane that is flared or recovered should be subtracted from total methane generated. No landfill gas is flared or recovered in Utah, according to information provided by Utah Department of Environmental Quality, Division of Solid and Hazardous Waste.

I. Adjust for Oxidation

Some methane may be oxidized in the top layer of soil over the landfill, and thus not emitted to the atmosphere. The amount of oxidation that occurs is uncertain and depends on the characteristics of the soil and the environment. It is assumed that 10 percent of methane generated that is not recovered is oxidized in the soil. Methane generated (after the adjustment for flaring and recovery) is multiplied by 90 percent to account for oxidation. Once the adjustment for oxidation has been made, the result is total methane emissions from landfills.

Total Methane Emissions
= (Total Methane Generation – Methane Flared or Recovered) * 90 percent

Results

The 1990 and 1993 methane emissions from landfills in Utah are shown in Tables V-1 and V-2, respectively. The total 1990 methane emitted from landfills in Utah is 56,237 tons. The total 1993 methane emitted from landfills in Utah is 58,143 tons. The difference is likely due to the recent rapid population growth in Utah.

Nationally, it is estimated that landfills emitted 37 percent of total U.S. 1990 methane emissions, (U.S. DOE, 1993). Many factors may cause Utah's results to differ from the national average.

Uncertainties

Many uncertainties are associated with using this method for estimating methane emissions from landfills in Utah. First, many default values were used in the calculations due to limited availability of information. For example, default values are used for: 1) the waste fractions in large MSW landfills; 2) small MSW and industrial landfills; 3) the per capita waste generation rate; 4) the portion of landfilled waste; and 5) the oxidized portion of methane generation. These assumptions may skew estimated results from actual methane emissions in Utah. Other sources of uncertainties in estimating methane emissions from landfills are the 30-year time period assumed, the effects of climate on methane emission rates, and the impact of landfill design characteristics and maintenance procedures.

Table V-1 Estimates of Methane Emissions from Landfills in Utah - 1990

County	Total Methane (Tons/Year)
Beaver	20.22
Box Elder	148.33
Cache	5,824.22
Carbon	5,659.38
Daggett	3.29
Davis	11,734.58
Duchesne	45.78
Emery	36.52
Garfield	16.59
Grand	30.13
Iron	75.06
Juab	23.43
Kane	18.26
Millard	44.35
Morgan	19.99
Piute	5.68
Rich	7.50
Salt Lake	13,753.18
San Juan	49.02
Sanpete	62.22
Sevier	59.80
Summit	48.74
Tooele	105.35
Uintah	80.42
Utah	6,428.80
Wasatch	35.67
Washington	5,687.45
Wayne	8.80
Weber	6,204.43
Statewide Total	56,237.22

Table V-2 Estimates of Methane Emissions from Landfills in Utah - 1993

County	Total Methane from Landfills (Tons/Year)
Beaver	20.72
Box Elder	156.95
Cache	6,010.41
Carbon	5,825.01
Daggett	3.09
Davis	12,142.79
Duchesne	47.13
Emery	36.81
Garfield	17.21
Grand	33.52
Iron	81.17
Juab	24.79
Kane	19.12
Millard	44.58
Morgan	21.57
Piute	5.90
Rich	7.66
Salt Lake	14,230.66
San Juan	48.59
Sanpete	67.20
Sevier	62.03
Summit	56.23
Tooele	113.22
Uintah	85.66
Utah	6,663.36
Wasatch	38.51
Washington	5,866.24
Wayne	8.96
Weber	6,403.90
Statewide Total	58,143.01

References

State of Wisconsin. *Wisconsin Greenhouse Gas Emission Inventory, Estimates for 1990.* Department of Natural Resources, Bureau of Air Management, 1993.

State of Utah. *State of Utah Economic and Demographic Projections 1994.* Demographic and Economic Analysis, Governor's Office of Planning and Budget, 1994.

U.S. Environmental Protection Agency (U.S. EPA). *State Workbook: Methodologies for Estimating Greenhouse Gas Emissions.* Office of Policy, Planning, and Evaluation (EPA-230-B-95-001). Washington, D.C.: Government Printing Office, 1995.

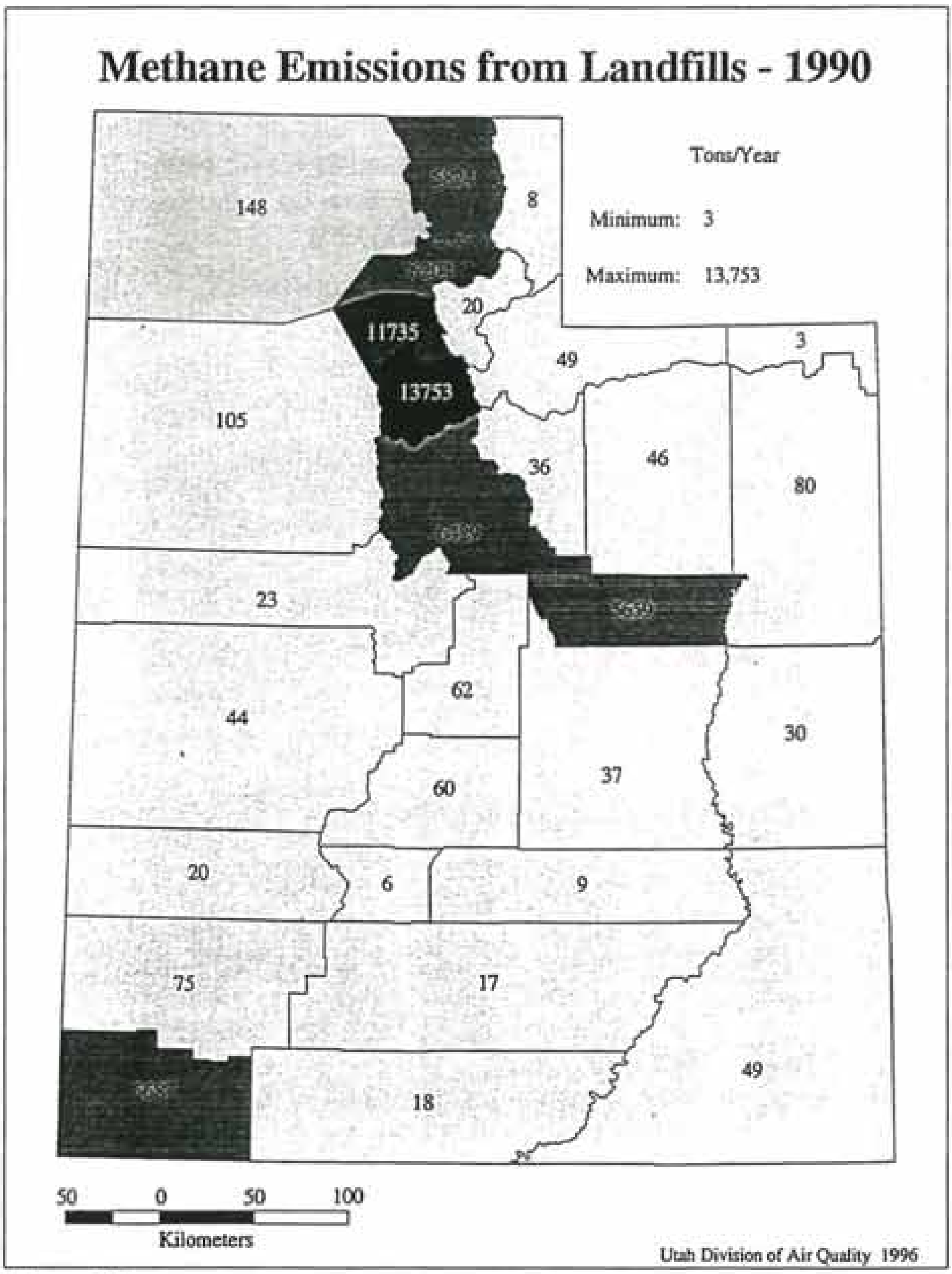

Methane Emissions from Landfills - 1990
Tons/Year
Minimum: 3
Maximum: 13,753
148
8
20
11735
13753
49
3
105
46
36
80
23
62
44
30
37
60
20
6
9
75
17
49
18
50 0 50 100
Kilometers
Utah Division of Air Quality 1996

Figure V-1

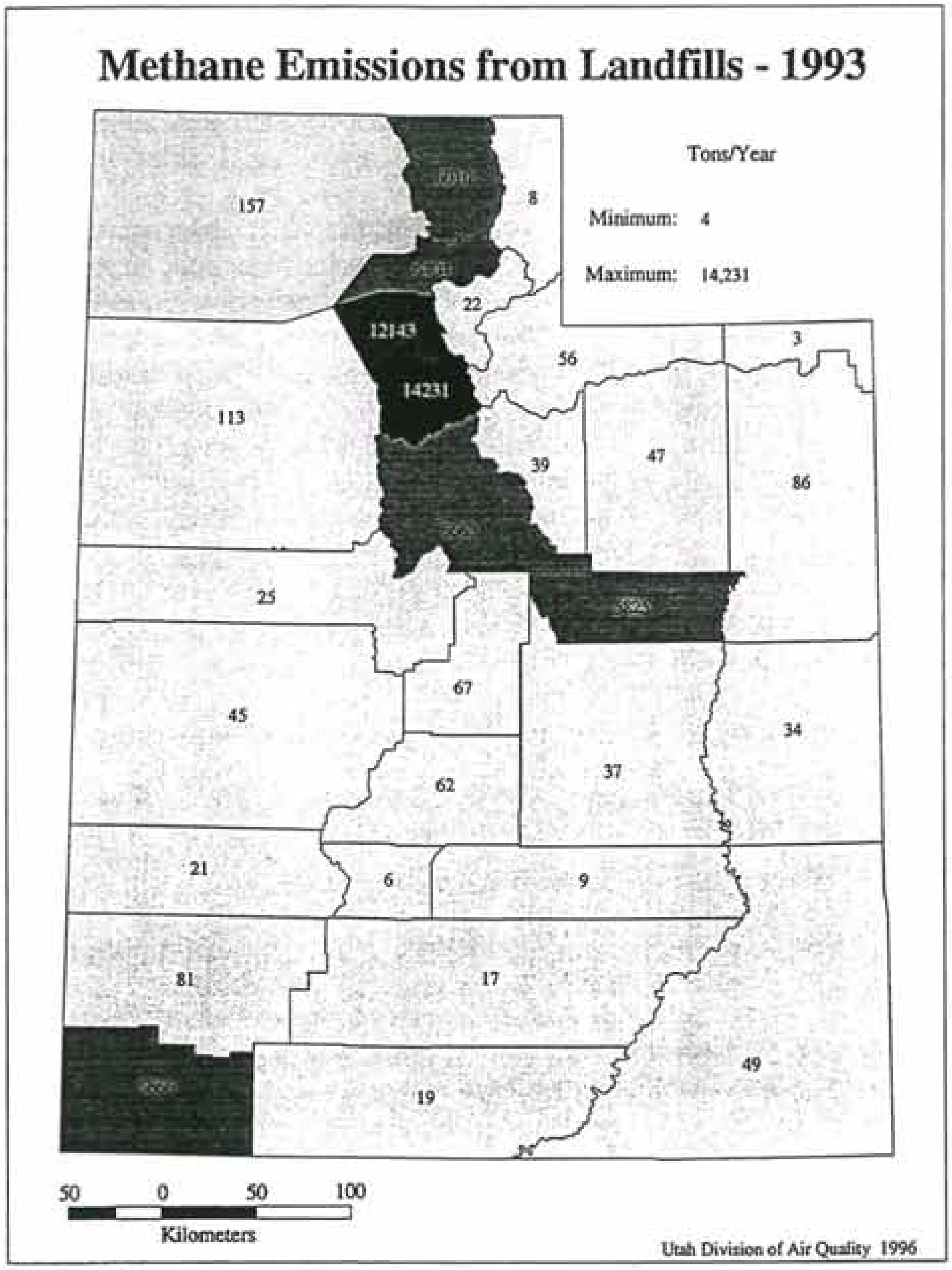

Methane Emissions from Landfills - 1993
Tons/Year
Minimum: 4
Maximum: 14,231
157
8
22
12143
14231
56
3
113
39
47
86
25
67
45
34
37
62
21
6
9
81
17
49
19
50
0
50
100
Kilometers
Utah Division of Air Quality 1996

Figure V-2

Chapter VI

Methane from Domesticated Animals

Overview

Livestock production contributes to greenhouse gas emissions as methane is produced in the normal digestive process of animals. Methane is produced through a process referred to as *enteric fermentation*, in which microbes that reside in animal digestive systems break down feed consumed by the animal.

Ruminants, which include cattle, buffalo, sheep, and goats, have the highest methane emissions among all animal types because of their unique digestive system. Ruminants possess a rumen, or large "fore-stomach" in which a significant amount of methane-producing fermentation occurs. Non-ruminant domestic animals, such as pigs and horses, have much lower methane emissions than ruminants because much less methane-producing fermentation takes place in their digestive systems. The amount of methane produced and excreted by an individual animal depends upon its digestive system (whether or not it possesses a rumen), and the amount and type of feed it consumes.

Methodology

The methane emissions from domestic animals are estimated using the method provided in the EPA *State Workbook*, (U.S. EPA, 1995). This method applies a regional emission factor to each animal population to obtain pounds of methane for each animal type. Emissions are then summed for all animal types to obtain total methane emissions from domesticated animals.

$$Animal_i * (CH_4EF)_i * 1ton/2{,}000lbs.$$

Where: $Animal_i$ = population of animal category i
$(CH_4\ EF)_i$ = methane emission factor for animal category i
(lbs CH4/animal/year)

Domestic Animal populations for 1990 and 1993 were obtained from the annual Utah Department of Agriculture publication, *Utah Agricultural Statistics*, for 1991 and 1994. However, the suggested EPA animal types for cattle did not correspond directly to the types provided in the *Agricultural Statistics*. Classification estimates for cattle were changed in Utah in 1971 from sex and age to sex and weight. Steers, Heifers, and Bulls under 500 lbs were assumed to be less than 12 months old. Their total is estimated by calculating a ratio tied to the Beef and Dairy zero to 12 month replacements category based on the total beef and dairy cows for 1991 and 1994. Steers and bulls over 500 lbs are included in the Beef Cattle category only. Goats, horses and mules/asses populations were obtained from a 1992 Utah Department of Agriculture census, as they are not categories in the *Agricultural Statistics* publication. Buffalo populations, along with other big game populations, were obtained from regional Division of Wildlife Resources staff, as no statewide census of big game is maintained.

The Regional Emission Factors were obtained from the EPA *State Workbook* tables for the Western region.

The contribution of individual counties to the statewide methane emissions was more difficult to calculate. The *Agricultural Statistics* publication provided only selected information at the county level, so several assumptions were made:

1) For all counties dairy and beef cow populations were provided, so the populations for the two subcategories (zero to 12 month replacements and 12 to 24 month replacements) were generated by dividing the county's dairy or beef cow population by the statewide population to get the county fraction of the statewide population. Each replacements subcategory statewide population was then multiplied by the county fraction to get each estimated dairy and beef cattle replacement population.

2) For other animal categories where county populations were not provided, an estimate was made using the fraction of each county's total livestock cash receipts as compared with the total state livestock cash receipts. That fraction was then multiplied against the statewide animal category population to obtain an estimated county population.

3) In cases where the only 1993 population estimate provided was "< 500" head, several estimation methods were used. The previously discussed fraction of a county livestock cash receipts value was used only once successfully to estimate a cattle population, as the resulting value was less than 500. In all other cases, if the 1990 value was zero or 100, the 1993 value would be set to match. If the 1990 value was 1,000 or greater, the 1993 value would be set to 499 as an assumption that the population would be unlikely to drop by over 50 percent in three years.

Results

Domesticated Animal Populations, methane emission factors, and total emissions for 1990 and 1993 are summarized in the following table. Dairy and Beef cattle combined accounted for 92 percent of the methane emissions in 1990 with 59,922 tons of a total 65,273 tons. In 1993, the same categories accounted for 93 percent with 62,477 tons of a total 67,234 tons. Beef cattle alone accounted for 70 percent of the methane emissions in 1990 and 72 percent in 1993.

Table VI-1 Methane Emissions from Domesticated Animals

	State Wide Population		Western US Emission Factor (Lbs Methane/Head/yr)	Emissions	(Tons)
Average Animal Population (head)	**1990**	**1993**		**1990**	**1993**
Cattle					
Dairy					
0-12 month replacements	27,000	26,000	45.5	614.25	591.50
12-24 month replacements**	52,000	45,000	134.6	3,499.60	3,028.50
Mature Cows	**80,000**	**80,000**	262.5	10,500.00	10,500.00
Total Dairy	159,000	151,000		**14,613.85**	**14,120.00**
Beef					
0-12 month replacements	108,000	110,000	49.9	2,694.60	2,744.50
12-24 month replacements**	58,000	69,000	142.7	4,138.30	4,923.15
Mature Cows	**321,000**	**340,000**	152	24,396.00	25,840.00
Bulls #	19,000	20,000	220	2,090.00	2,200.00
Steers ##	109,000	115,000	220	11,990.00	12,650.00
Total Beef	**615,000**	**654,000**		**45,308.90**	**48,357.65**
Buffalo	950	950	220	104.50	104.50
Sheep	**509,000**	**440,000**	17.6	4,479.20	3,872.00
Goats^	2,120	**2,129**	11	11.66	11.71
Swine	**33,000**	**40,000**	3.3	54.45	66.00
Horses^^	34,700	**34,778**	39.6	687.06	688.60
Mules/Asses^^^	560	**565**	48.5	13.58	13.70
Total	**1,354,330**	**1,323,422**		**65,273.20**	**67,234.17**
Big Game	428,505	232,260		8,223.02	6,012.00
Total Including Big Game	**1,782,835**	**1,616,682**		**73,496.22**	**73,246.16**

* Beginning 1/1/71, classification estimates for Cattle were changed from sex and age to sex and weight.

** Heifers 500 lbs and over are assumed to be at least 12 months old, and will be categorized as 12-24 month replacements.

Bulls 500 lbs and over are categorized only as Beef Cattle.

Steers 500 lbs and over are added to the Bulls category for Beef Cattle, Steers, Heifers, and Bulls under 500 lbs are assumed to be less than 12 months old, and are ratioed to the Beef and Dairy 0-12 month replacements category based on the total beef cows and dairy cows for 1/1/91.

^ Goat populations are based on a 1992 Department of Agriculture census.

^^ Horse populations are based on a 1992 Department of Agriculture census. Category includes ponies.

^^^ Mules/Asses populations are based on a 1992 Department of Agriculture census. Category includes Mules, Burros, Donkeys.

Methane from Big Game Animals

Overview

Emissions from big game animals are estimated because the state of Utah manages its game populations for the sake of hunting. Although game animals are not categorized as domesticated animals, as an "animal crop" their populations and emissions could be controlled.

Emission factors for big game animals were obtained from Crutzen et al for moose, elk, mule deer, antelope, bighorn sheep, and mountain goats. The formula used to calculate methane emissions is the same as for domesticated animals, substituting game populations and factors for domesticated animal populations and factors.

Results

The combined methane emissions for big game animals, less the buffalo category already accounted for in the previous section, totals 8,170.66 tons in 1990, and 5,959.63 tons in 1993.

Table VI-2 Methane Emissions from Big Game Animals

Emission Factors (from Crutzen et al.) (Kg/head/year)		Populations 1990	1993	Total kg/year 1990	1993
Buffalo	50	950	950	47,500	47,500
Moose	31	1,775	1,660	55,025	57,460
Elk	31	61,750	63,350	1,914,250	1,963,850
Mule Deer	15	350,500	214,000	5,257,500	3,210,000
Antelope	15	11,000	10,700	165,000	160,500
Bighorn Sheep	8	2,200	2,250	17,600	18,000
Mountain Goats	5	330	350	1,650	1,750
		428,505	293,260	7,458,525	5,453,060
			Total lbs/yr	16,446,048	12,023,997
			Total tons/yr	8,223	6,012
		Total tons (with buffalo emissions removed)		**8,171**	**5960**

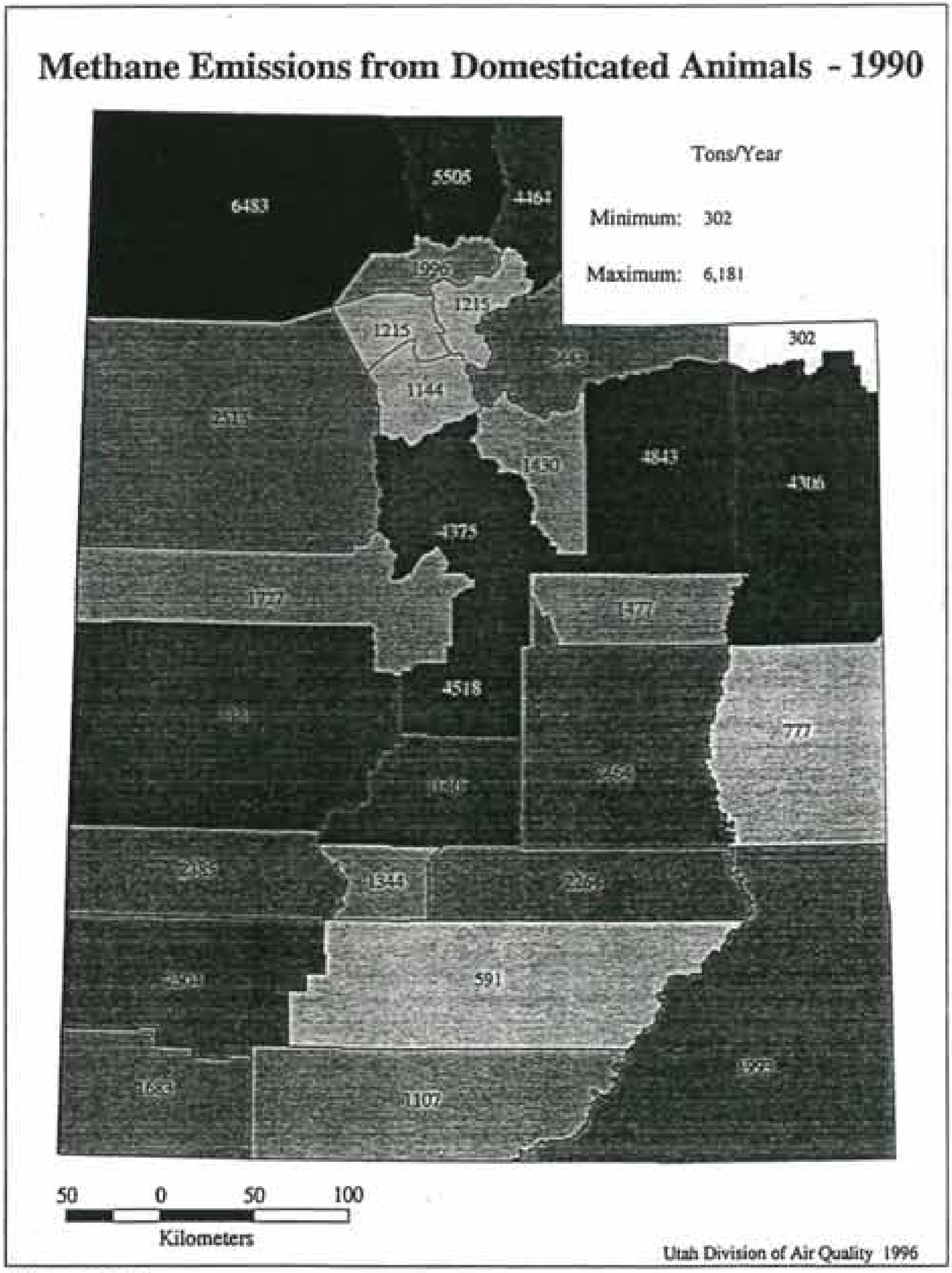

Methane Emissions from Domesticated Animals - 1990
Tons/Year
Minimum: 302
Maximum: 6,181
6483
5505
4464
1996
1215
1215
1144
1450
4843
4306
4375
4518
302
777
1344
591
50 0 50 100
Kilometers
Utah Division of Air Quality 1996

Figure VI-1

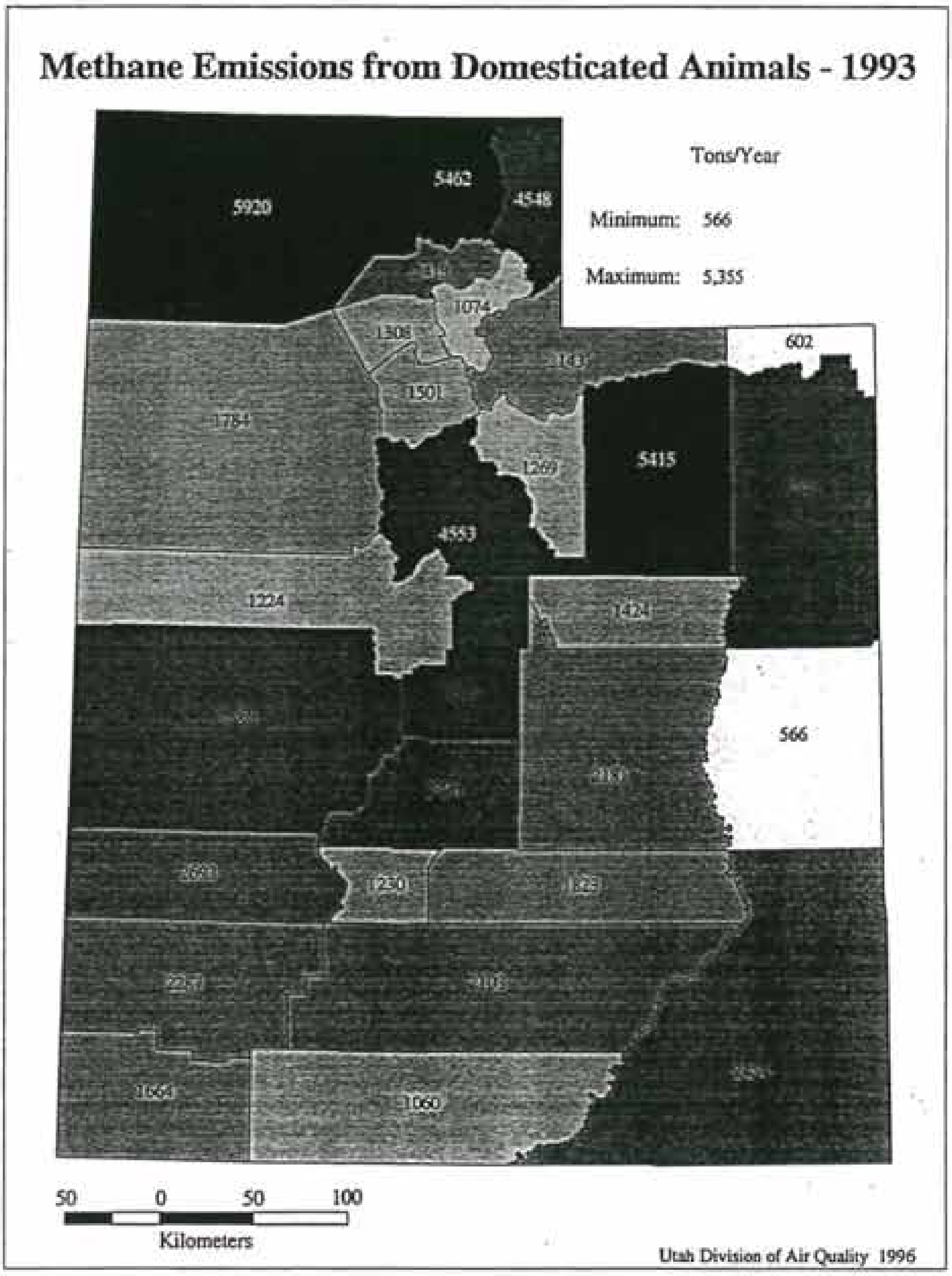

Methane Emissions from Domesticated Animals - 1993
Tons/Year
Minimum: 566
Maximum: 5,355
5920
5462
4548
1074
1308
1501
1784
1269
5415
602
4553
1224
566
1060
50
0
50
100
Kilometers
Utah Division of Air Quality 1996

Figure VI-2

Chapter VII

Methane from Manure Management

Overview

When animal manure decomposes in an anaerobic environment, decomposition of the organic material in the manure produces methane. The way in which manure is managed is the most important factor affecting the amount of methane produced, since certain types of storage and treatment systems promote an oxygen-free environment. When manure is handled as a solid or when it is deposited on pastures and rangelands, it tends to decompose aerobically and produce little or no methane. Liquid systems, *e.g.*, lagoons, ponds, tanks, or pits, tend to produce a significant quantity of methane. Higher temperatures and moist climatic conditions also promote methane production. Only manure from animals managed by humans for production of animal products is included in the calculations.

Methodology

The methane emissions from animal manure are estimated using the method provided in the EPA *State Workbook* (U.S. EPA, 1995). Several calculation steps are involved to estimate manure methane emissions for each animal type. All factors required in these calculations were taken from the tables provided in the EPA *State Workbook*. A summary table for each animal type follows in the Results section. An Appendix provides calculation results for each animal type by county.

Animal populations for the Recommended Representative Animal Types (U.S. EPA, 1995) were taken in part from the previous section, Methane Emissions from Domesticated Animals, and in part from the Utah Department of Agriculture 1991 and 1994 *Utah Agricultural Statistics*.

Step 1: Calculate Volatile Solids (VS) for all animal categories.

$$Animal_i * TAM_i * vs_i = VS_i$$

where:

$Animal_i$	= population of animal category i
TAM_i	= typical animal mass for animal category i
VS_i	= average annual volatile solids production/unit of animal mass

Step 2: Estimate the Maximum Potential Methane Emissions for all animal categories.

$$Max.Potential(CH_4)_i(ft^3 CH_4) = VS_i * B_i$$

where: VS_i = amount of volatile solids produced by animal category i; calculated in Step 1 above

B_i = max. methane producing potential of manure; depends on animal type (ft^3 CH_4/lb VS)

Step 3: Estimate CH_4 emissions for each manure management system for each animal category.

$$MethaneEmissions_i(ft^3 CH_4) = Max.Potential(CH_4)_i * MCF_j * WS\%_{ij}$$

where: Max. Potential $(CH_4)_i$ was calculated for animal category *i*
MCF_j = methane conversion factor for manure management system *j*
WS% = percent of animal manure type *i* managed in management system type *j*

Step 4: Convert to tons of methane.

For each animal category *i* and management system *j*, multiply by the density of methane (0.0413 lbs CH_4/ft^3) to convert to pounds, then divide by 2,000 to convert to tons. Sum the emissions across all manure management systems for each animal category *i* to obtain total manure emissions for that animal category.

Results

The following tables present 1990 and 1993 methane emissions from animal manure management.

Table VII-1 Methane Emissions from Manure Management

Animal Category	CH_4 (lbs/yr)	CH_4 (tons/yr)	
1990			
Dairy Cattle	1,212,917.29	606.46	23.10%
Beef Cattle	221,375.72	110.69	4.22%
Swine	2,845,602.23	1,422.80	54.18%
Poultry	918,474.62	459.24	17.49%
Sheep	28,272.72	14.14	0.54%
Goats	105.17	0.05	0.00%
Mules/Asses	265.66	0.13	0.01%
Horses	24,704.85	12.35	0.47%
	5,251,718.27	**2,625.86**	100.00%
1993			
Dairy Cattle	1,163,949.70	581.97	20.55%
Beef Cattle	235,946.41	117.97	4.17%
Swine	3,307,382.57	1,653.69	58.38%
Poultry	907,948.19	453.97	16.03%
Sheep	24,440.07	12.22	0.43%
Goats	105.62	0.05	0.00%
Mules/Asses	268.03	0.13	0.00%
Horses	24,760.38	12.38	0.44%
	5,664,800.97	**2,832.40**	100.00%

The largest portion of methane emissions comes from swine, with 54 percent of the total 2,625 tons in 1990, and 58 percent of the total 2,832 tons in 1993. This apparently is due to the anaerobic lagoon management method attributed to the category. The next highest emissions come from the dairy cattle category with 23 percent of the total in 1990 and 20 percent in 1993.

Methane emissions for Domestic Animals and Animal Manure Management sources, summarized by county, can be found in the table "Methane Summaries." County-specific estimates were made using two methods:

1) for counties where an animal population was known from the *Utah Agricultural Statistics* publications, the county animal population, as a percentage of the total state animal population, was multiplied by the estimated statewide emissions for that animal category.

$$(CP_i/SP_i)\times SE_i=CE_i$$

where: CP_i = reported county population of animal category *I*
SP_i = reported state population of animal category *I*
SE_i = statewide emissions (tons) for animal category *I*
CE_i = county emissions (tons) for animal category *I*

2) for counties where the animal category population was not known, a percentage based on that county's portion of the total state livestock cash receipts as reported by the *Utah Agricultural Statistics* was multiplied by the estimated statewide emissions for the animal category.

$$(CR_c/SR)\times SE_i=CE_i$$

where: CR_c = cash receipts for livestock in county *c*
SR = total state cash receipts for livestock
SE_i = statewide emissions (tons) for animal category *I*
CE_i = emissions (tons) for animal category *I* in county *c*

References

Domestic Animals:

Utah Department of Agriculture, 1991 and 1994 *Utah Agricultural Statistics, Enterprise Budgets.*

U.S. Environmental Protection Agency (U.S. EPA), 1995. *States Workbook; Methodologies for Estimating Greenhouse Gas Emissions,* EPA-230-B-95-001 Office of Policy, Planning, and Evaluation.

Big Game Animals:

Crutzen, Paul J., Ingo Aselmann, and Wolfgang Seiler, 1986. "Methane Production by domestic animals, Wild Ruminants, Other Herbivorous Fauna, and Humans," *Tellus*, Vol 38B:271-284.

Utah Division of Wildlife regional staff:

Ogden	Mike Welch, Big Game Coordinator	(801) 479-5143
Springville	Bruce Giunth, Game Biologist	(801) 489-5678
Price	Jim Karpowitz, Game Biologist	(801) 637-3310
Antelope Island	Timothy Smith, Park Director	(801) 580-1043
Cedar City	Floyd Coles, Game Biologist	(801) 586-2455
Vernal	Steve Cranny, Game Biologist	(801) 789-3103

Manure Management:

State of Utah. *Utah Agricultural Statistics, Enterprise Budgets, 1991 and 1994.* Utah Department of Agriculture, 1991.

U.S. Environmental Protection Agency (U.S. EPA). *State Workbook: Methodologies for Estimating Greenhouse Gas Emissions.* Office of Policy, Planning, and Evaluation (EPA-230-B-95-001). Washington, D.C.: Government Printing Office, 1995.

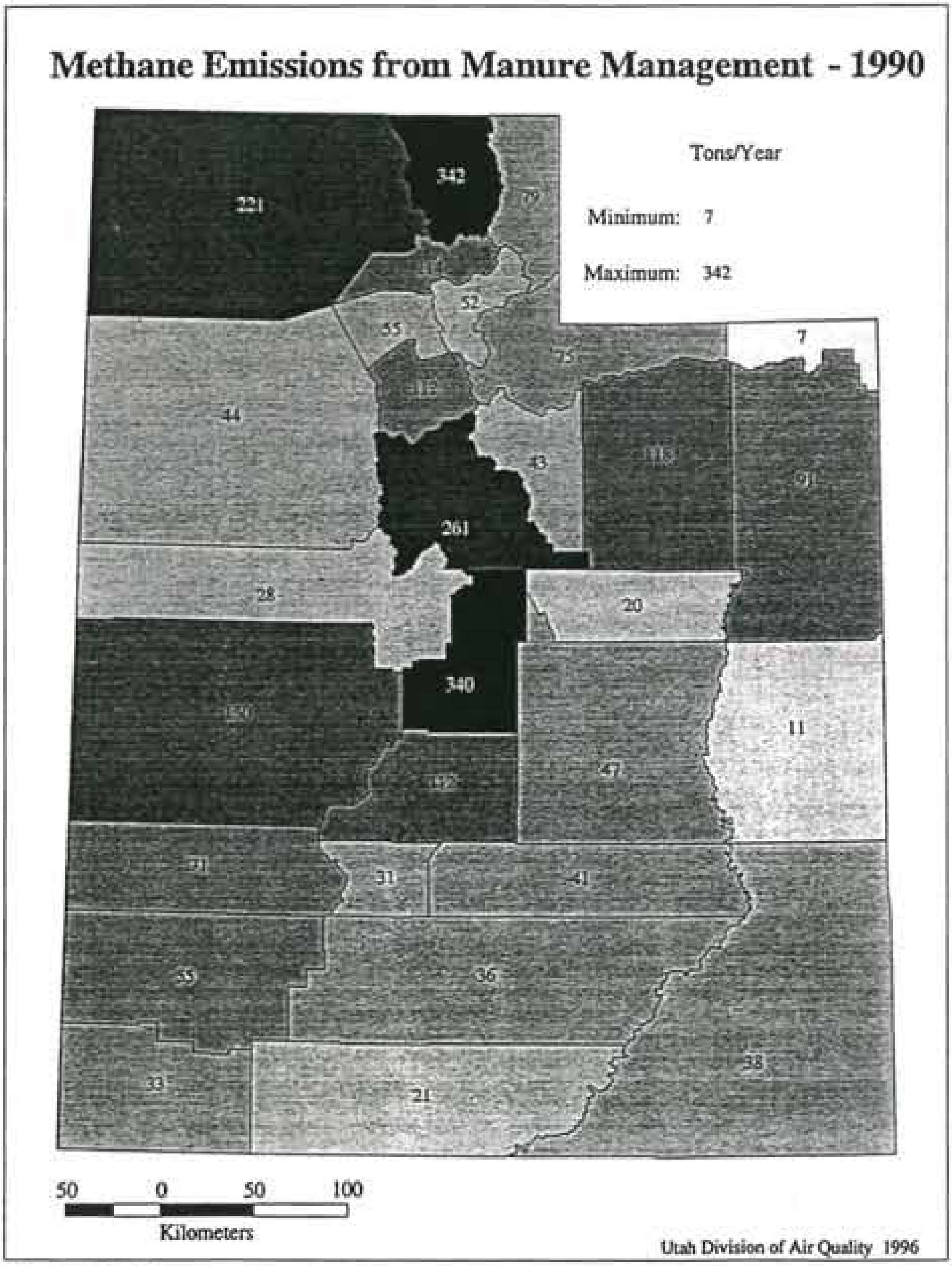

Methane Emissions from Manure Management - 1990
Tons/Year
Minimum: 7
Maximum: 342
221
342
52
55
7
75
44
43
261
28
20
340
11
47
31
41
36
21
38
50
0
50
100
Kilometers
Utah Division of Air Quality 1996

Figure VII-1

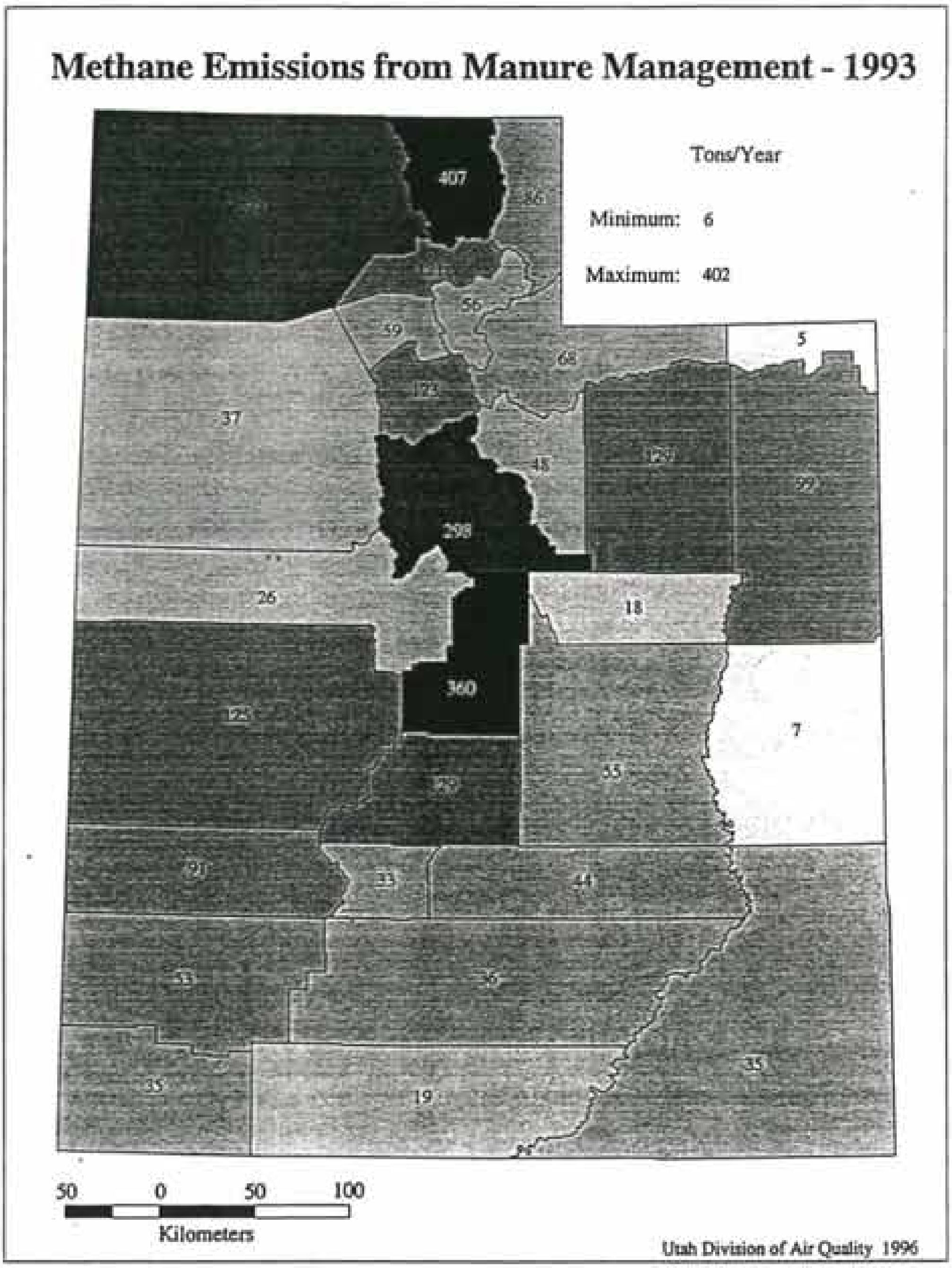

Methane Emissions from Manure Management - 1993
Tons/Year
Minimum: 6
Maximum: 402
407
360
298
18
7
5
50 0 50 100
Kilometers
Utah Division of Air Quality 1996

Figure VII-2

Chapter VIII

Agricultural Soil Management

Overview

Various agricultural soil management practices contribute to greenhouse gas emissions. The use of synthetic and organic fertilizers adds nitrogen to soils, thereby increasing natural emissions of nitrous oxide. Fertilizer use is the most significant source of N_2O in the United States (U.S. EPA, 1995). Other agricultural soil management practices such as irrigation and tilling are sinks and/or sources of carbon dioxide (CO_2), carbon monoxide (CO), methane (CH_4), and a source of nitrous oxide (N_2O). There is much uncertainty about the direction and magnitude of the effects of these other practices. Therefore, only the emissions from fertilizer use is included in this section of the inventory.

Methodology

The nitrous oxide emissions from fertilizer application are estimated using the method provided in the EPA *State Workbook*, (U.S. EPA, 1995). This method applies an N_2O emission coefficient (0.0117) per unit mass of nitrogen for each fertilizer type to yield N_2O-N emissions. A molecular weight conversion factor (44/28) is then applied to give emissions in terms of mass N_2O. Emissions are then summed for all fertilizer types.

$$N_2O(Tons)=\sum(F_f*E_f)*44N_2O/28N$$

where:
F = fertilizer nitrogen applied (tons- N applied)
= fertilizer consumption (tons) * %(nitrogen content)
E = emission coefficient (tons N_2O-N released/ton -N applied)
f = fertilizer type

Normally, using the EPA methodology, a 3-year average of consumption centered on the target year (1991 and 1993) is used to calculate emissions. However, fertilizer usage for 1990 was not available with information for county usage. Therefore, a 3-year average was taken using data from 1991, 1992 and 1993, and this average is assumed to represent 1990 fertilizer consumption. The 1993 average is taken from a 3-year average of 1992, 1993 and 1994. Averaging is used to minimize annual fluctuations in consumption due to economic and weather factors that affect agricultural activity. The fertilizer consumption data was obtained from the *Utah Fertilizer Tonnage Annual Reports* published by the Utah Department of Agriculture, Division of Plant Industry (UDADPI).

To calculate mass consumption of nitrogen, fertilizer use is multiplied by the percent content of nitrogen. The EPA *State Workbook* provides nitrogen content for many of the individual fertilizers reported by the UDADPI. However, where possible, nitrogen contents specific to Utah were used as given in *Commercial Fertilizers*. Where this information was not available, the

3-year average nitrogen content as determined by the UDADPI was used for Utah fertilizers. In several cases, where neither the *State Workbook*, nor the *Commercial Fertilizers*, nor the UDADPI stated a nitrogen content for a specific fertilizer, a nitrogen content was used as given in the *Wisconsin Greenhouse Gas Emissions* report. For each fertilizer, the nitrogen content reference is specified in Table F-1 through F-4 under the heading "Content Ref." Fertilizer type, nitrogen content, and corresponding N_2O-N and N_2O emissions by county are shown in Table VIII-2. Supporting data are found in appendix F.

Table VIII-1 Fertilizer Emissions by County
Tons of N_2O from Fertilizer Use

County	1990	1993
Beaver	2.51	3.55
Box Elder	93.51	91.42
Cache	36.39	43.32
Carbon	1.82	1.95
Daggett	0.69	0.72
Duchesne	13.11	14.00
Davis	9.94	9.74
Emery	2.05	2.99
Garfield	0.00	0.00
Grand	0.00	0.00
Iron	4.42	7.70
Juab	3.18	3.57
Kane	0.02	0.02
Millard	17.11	22.12
Morgan	6.31	6.26
Piute	0.25	0.54
Rich	0.00	0.00
Salt Lake	84.80	89.90
San Juan	0.65	1.26
Sanpete	7.31	8.29
Sevier	2.54	4.78
Summit	7.44	9.53
Tooele	21.31	21.31
Uintah	20.59	19.63
Utah	65.81	67.50
Wasatch	1.29	1.25
Washington	6.49	5.94
Wayne	0.96	0.96
Weber	11.99	12.50
Statewide Tons of N_2O	422.49	450.73

Table VIII-2 Fertilizer Emissions by Type for 1990 and 1993

Fertilizer Types	Average Fertilizer Consumption (Tons) 1990	Total Nitrogen (Tons) 1990	Tons N_2O-N 1990	Tons N_2O 1990	Average Fertilizer Consumption (Tons) 1993	Total Nitrogen (Tons) 1993	Tons N_2O-N 1993	Tons N_2O 1993
Nitrogen								
Ammonium Nitrate	29169.21	9805.19	114.33	179.66	33303.57	11190.19	130.53	205.12
Ammonium Sulfate	15981.14	3377.04	39.27	61.70	14837.83	3136.94	36.46	57.29
Anhydrous Ammonia	2122.03	1822.06	20.36	31.99	2297.61	1966.04	22.04	34.64
Calcium Nitrate	0.00	15.00	0.00	0.00	0.00	15.00	0.00	0.00
Nitrogen Solution 28%	35.05	37.81	0.11	0.18	43.49	40.18	0.14	0.22
Nitrogen Solution 30%	0.00	30.00	0.00	0.00	9.67	32.90	0.03	0.05
Nitrogen Solution 32%	8362.01	2707.84	31.31	49.20	8168.05	2645.78	30.58	48.06
Sodium Nitrate	15.97	18.55	0.03	0.05	317.71	66.83	0.59	0.93
Sulfur coated Urea	0.00	38.00	0.00	0.00	0.00	38.00	0.00	0.00
Urea	6748.20	3150.17	36.32	57.07	6482.31	3027.86	34.89	54.82
Phosphate								
Superphosphate, Triple	8728.90	0.00	0.00	0.00	8141.14	0.00	0.00	0.00
Potash								
Murite of Potash 60%	2792.04	0.00	0.00	0.00	3759.07	0.00	0.00	0.00
Potassium Sulfate	97.95	0.00	0.00	0.00	2.64	0.00	0.00	0.00
Multiple Nutrient								
Ammonium Phosphate Sulfate	227.53	47.49	0.39	0.61	127.46	32.98	0.22	0.34
Diammonium Phosphate	1895.34	369.14	4.10	6.45	2774.64	531.81	6.01	9.44
Epson Salt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gypsum (Calcium Sulfate)	8096.43	0.00	0.00	0.00	11331.71	0.00	0.00	0.00
Lime Product-Code Unk.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Monoammonium Phosphate	7751.95	863.71	9.98	15.68	9171.42	1019.86	11.80	18.55
Potash-Not Identified	0.00	15.00	0.00	0.00	0.00	15.00	0.00	0.00
Potassium Nitrate	0.00	13.00	0.00	0.00	0.00	13.00	0.00	0.00
Sulfur	1343.48	0.00	0.00	0.00	1247.76	0.00	0.00	0.00
Unknown								
Ammonium Thiosulfate	697.45	0.00	0.00	0.00	524.63	0.00	0.00	0.00
Borax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calcium Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manure	336.28	21.81	0.20	0.31	258.89	17.94	0.15	0.24
Copper Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferric Sulfate	165.47	0.00	0.00	0.00	82.73	0.00	0.00	0.00
Ferrous Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron Chelate	4.22	0.00	0.00	0.00	7.69	0.00	0.00	0.00
Iron Compound	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Liquid Amm Polyphosphate	1607.75	187.85	2.07	3.25	1731.16	201.43	2.23	3.50
Magnesium Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed Grades	4844.21	850.40	9.75	15.32	4901.85	860.32	9.86	15.50
Mult. Nutrient-Code/Grade Unk	385.88	68.99	0.64	1.01	771.71	123.78	1.28	2.01
Nitric Acid	3.15	34.04	0.01	0.02	1.57	33.52	0.01	0.01
Phosphate Prod. Code Unk.	2220.06	0.00	0.00	0.00	2919.90	0.00	0.00	0.00
Zinc Chelate	5.64	0.00	0.00	0.00	0.86	0.00	0.00	0.00
Zinc Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	103637.32	22979.22	268.86	422.49	113217.08	24515.47	286.83	450.73

Uncertainties

For some fertilizer sold in Utah, the fertilizer type is unknown. The UDADPI knows how much fertilizer was sold in the State. However, for some fertilizers, the UDADPI does not know what type of fertilizer was sold. In cases where a known amount of an unknown fertilizer type was sold in a county, the unknown amount of fertilizer was distributed proportionately among the known fertilizer types sold in that county.

Similarly, for some fertilizers sold in Utah, the county in which the fertilizer was sold is not known. Again, the UDADPI knows how much fertilizer was sold in the State. However, the UDADPI does not know where some of the fertilizer was sold. Each fertilizer type of an unknown sales point was distributed among the same fertilizer type of known counties. Percentages of fertilizers were taken from each county, and the unknown county's fertilizers were distributed in proportion to the amounts of the same fertilizer sold in each county.

Due to the above uncertainties, the calculated values were checked against values found in *Summary Data 1992* and *Commercial Fertilizers 1993* by the Tennessee Valley Authority. The nitrogen content for select fertilizers calculated in *Commercial Fertilizers 1993* is 24,248 tons. Using the method described in the EPA *State Workbook*, the calculated nitrogen content is 24,515 for 1993. This result shows a difference of 1.1 percent. Other values were checked, where possible, and are in accordance with those reported by the Tennessee Valley Authority.

References

Allen, Clair A., Utah Department of Agriculture, Division of Plant Industry, 1995. Personal communication.

Berry, Janice T., and Melanie H. Montgomery. *Commercial Fertilizers* 1993, Tennessee Valley Authority, National Fertilizer and Environmental Research Center, Muscle Shoals, Alabama, 1993.

Berry, Janice T. *Summary Data*, Tennessee Valley Authority, National Fertilizer and Environmental Research Center, Muscle Shoals, Alabama, 1992.

State of Utah. *Division of Plant Industry, Utah Fertilizer Tonnage Annual Reports, 1990 thru 1994.* Utah Department of Agriculture, 1995.

State of Wisconsin. *Wisconsin Greenhouse Gas Emissions Inventory*. Department of Natural Resources, Bureau of Air Management, 1990.

U.S. Environmental Protection Agency (U.S. EPA). *State Workbook: Methodologies for Estimating Greenhouse Gas Emissions.* Office of Policy, Planning, and Evaluation (EPA-230-B-95-001). Washington, D.C.: Government Printing Office, 1995.

N_2O Emissions from Agricultural Soil Management - 1990

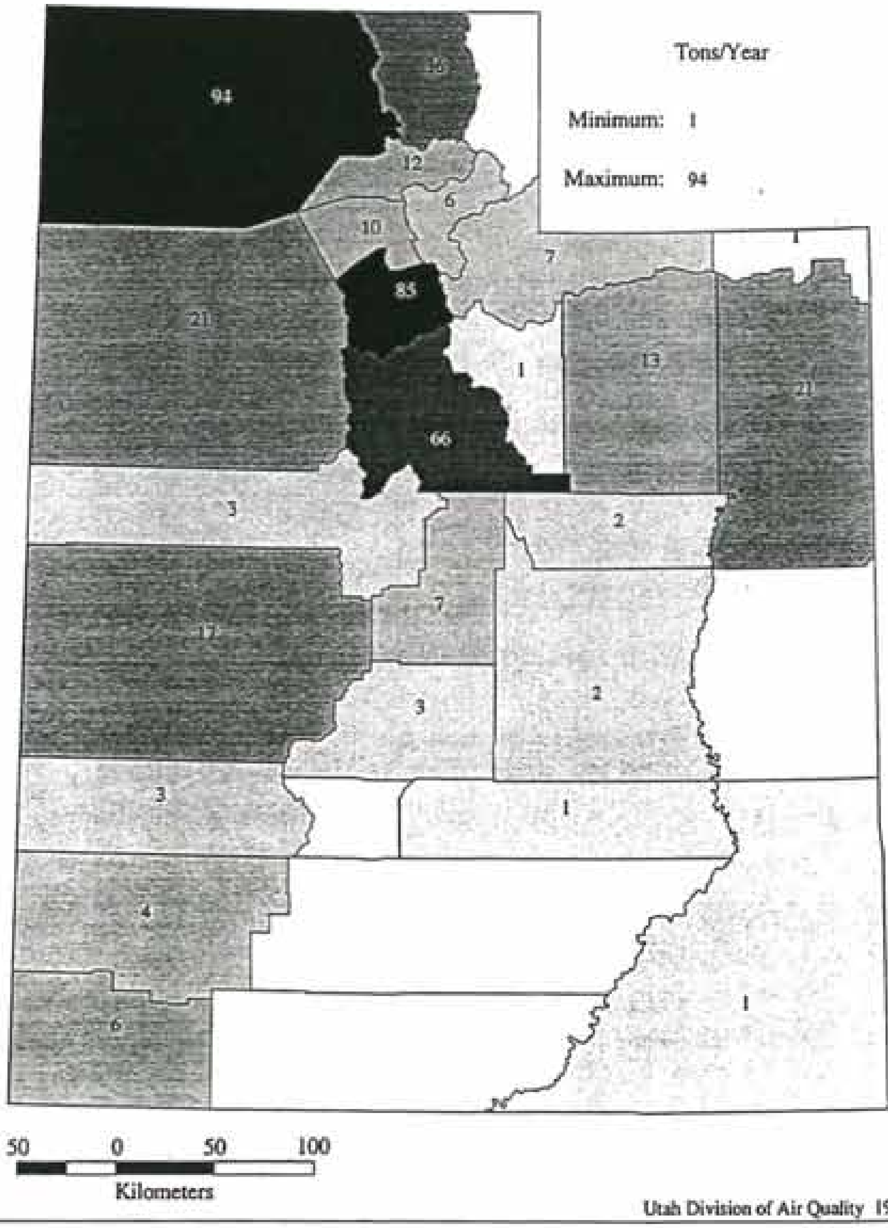


Figure VIII-1

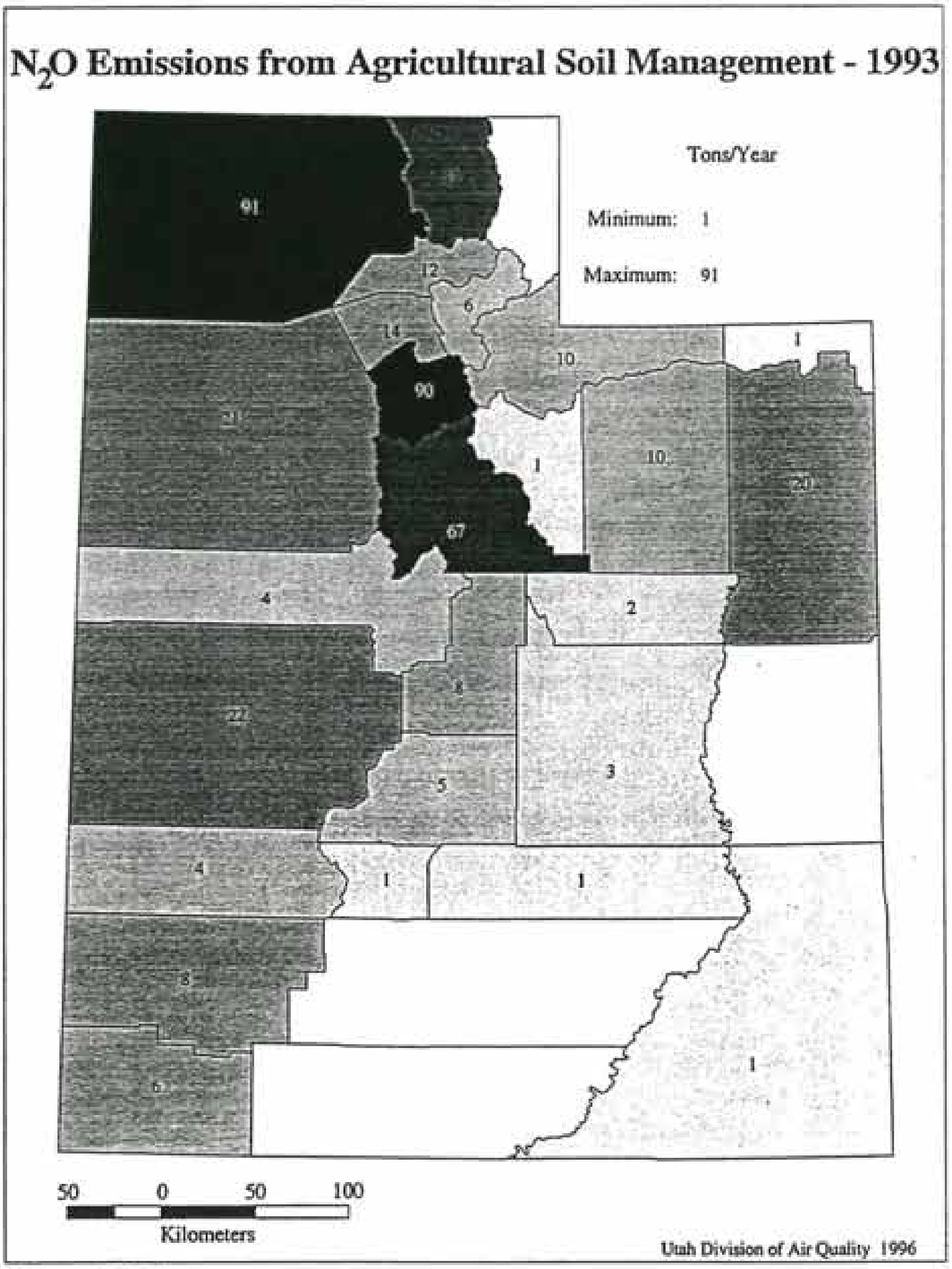


Figure VIII-2

Chapter IX

Forest Management and Land Use Change

Land use change and forestry activities covered in the EPA *State Workbook* method are divided into three categories; 1) changes in forests and other woody biomass stocks; 2) forest and grassland conversion; and 3) abandonment of managed lands. For this inventory only changes in the first category were considered.

Category 2, forest and grassland conversion, is not included in this inventory because of the lack of data and high level of uncertainty about the data which do exist. Category 3, abandonment of managed lands, was not considered because Utah, unlike perhaps some states in the eastern United States, does not have areas of the state which have reverted from farmland to pre-settlement forest land.

A. Changes in Forests and Other Woody Biomass Stocks

Overview

The main gas of concern in this category is CO_2, and the method used for this reporting category is specific to CO_2. According to the workbook the most important effects of human interactions with existing forests are considered in this category. For the purposes of this inventory this includes the commercial management and logging for forest products, replanting after logging, the harvest of fuel wood, and planting trees in urban and suburban locations.

Essentially, this method estimates the annual growth increment of biomass on managed forest lands, including fuel wood cutting and urban forests, within the state. The net carbon emitted is equal to the total harvest of carbon minus the total growth increment. Emissions from soil carbon are not accounted for in this method because of the uncertainty of these effects on soil carbon.

The EPA *State Workbook* contains a discussion about the assumption that carbon emitted is equal to the net biomass harvest. This is a simplifying assumption, but one that is based on the following reasoning [pages D10-1 and D10-8].

> The net change in forest carbon...is not likely to be equivalent to the net flux between forests and the atmosphere. Because most of the timber that is harvested and removed from U.S. forests is used in wood products, harvests may not always result in an immediate flux of carbon to the atmosphere. Harvesting in effect transfers carbon from one of the "forest pools" to a "product pool." Once in a product pool, the carbon is emitted over time as CO_2 through either combustion or decay, although the exact rate of emission varies considerably between different product pools and may in fact result in effective long-term carbon storage.
> For the purposes of the basic calculation, however, the recommended default assumption is that all carbon removed in wood and other biomass from forests is

oxidized in the year of removal. This is because new products from current harvests frequently replace existing product stocks, which are in turn discarded and oxidized. This clearly would not be accurate if the relative size of forest product pools change significantly over time, but is considered a legitimate, conservative assumption for initial calculations.

Table IX-1 CO_2 Sources and Sinks from Commercial Forestry and Fuelwood Cutting
Normalized values 10^3 tons/year

County	FIPS	1990 Inventory	1993 Inventory
Box Elder	3	-162.5	-157.3
Cache	5	-2,315.1	-2,242.2
Rich	33	-524.7	-508.2
Weber	57	-642.7	-622.3
Morgan	29	-171.5	-166.2
Summit	43	-1,856.4	-1,798.0
Davis	11	-618.1	-594.7
Tooele	45	-1,298.6	-1,257.9
Daggett	9	739.8	-585.5
Salt Lake	35	-689.8	-664.2
Uintah	47	1,177.6	-931.1
Duchesne	13	956.9	-757.3
Wasatch	51	-1,250.2	-795.7
Utah	49	-1,052.4	-805.1
(Manti-La Sal)		-312.1	-327.5
Juab	23	-435.0	-276.8
Sanpete	39	-3,891.1	-4,083.9
(Uintah)		-92.3	-58.8
Carbon	7	-312.1	-327.5
Emery	15	-2,336.3	-2,452.0
Millard	27	-2,455.6	-3,279.1
Grand	19	-574.0	-602.5
Sevier	41	-4,642.9	-6,199.9
Beaver	1	-940.4	-1,255.7
Piute	31	-1,347.8	-1,799.7
San Juan	37	-4,112.6	-4,316.3
Wayne	55	-535.4	-714.9
(Dixie)		822.8	85.3
Iron	21	2,546.4	264.2
Garfield	17	10,551.0	1,094.4
Washington	53	4,207.9	436.5
Kane	25	1,286.1	133.4

Note: Negative values represent CO_2 uptake and positive values represent CO_2 emissions.

Methodology

Procedure for Worksheet 10 (Sheet 1)

Forest Worksheet 10-1 changes in forests and woody biomass stock from directions on page 10-4.

Total Forest Acres. This is the USFS number for the size of the national forest

Column A This number is calculated on the worksheet "forest stocks." Assuming that the values for 'forest land acres' given by Rollie Saylor of USFS were a 1994 estimation, the values for the years of interest were calculated on this spreadsheet by taking the difference between what was planted and harvested in a given year and subtracting that value from forest land acres to obtain an estimation of the net change in forest stock for that year. These values are linked to column A of sheet number one.

Example: For the Ashley Forest in FY 1994 the forest land acres were 836,800. To obtain the 1993 value the following formula was applied in the spreadsheet:

(1994 forest acres) - (1993 acres planted- 1993 acres harvested) = 1993 forest acres

(836,800) - (1,350 - 0) = 835,450 acres

Column B This is the annual growth rate assumed from Table 10-1 of page 10-5. The value assumed (13.5) was chosen since it is for Douglas Fir, the most appropriate tree species for this area from among those defaults given in the workbook.

Column D The carbon fraction of dry matter is taken from Table 1.2 of Birdsey, 1992 (page 10-27 of U.S. EPA). The value (0.512) was chosen as the percent carbon for softwood. This value covers the predominant types of timber cut in Utah (spruce, fir, ponderosa pine and lodgepole).

Column E Columns C and D are multiplied and the annual totals are at the bottom of the page.

Lower Column A Number of other trees. Includes dispersed trees such as those in tree farms and urban forestry. Urban forestry is the only category used for this inventory. See description of urban forest calculations.

Lower Column B Annual growth rate. Used the default of 9 t dm/acre/yr for the annual growth rate of urban forest trees. This value is from Table 10-1 of page 10-5, as above, this is the default for Loblolly Pine.

Procedure for Worksheet 10 (Sheet 2)

Forest 2 Worksheet 10-1: Changes in Forests and Woody Biomass Stock (continued)

Volume of Convertible Timber For the years 1990, 1991, and 1992 these values were found in the 1993 *Statistical Abstract of Utah.* The 1993 values were faxed to us by Diane Gillam of the BEBR.

Column F Amount of commercial timber harvested in thousand cubic feet. This column converts the board foot value of the previous column into cubic foot by multiplying by 0.083333 and then dividing by 1,000 to acquire thousand cubic feet. (Note: one board foot is a piece of wood one square foot by one inch in thickness).

Column G Biomass conversion/expansion ratio. The default value found on page 10-5 is 16 t dm/ft^3. Sixteen **tons** per cubic foot of wood is obviously a mistake in the workbook. After conversation with EPA contractor, ICF Inc., it was decided that 16 lb dm/ft^3 is the appropriate conversion factor.

Fuelwood cut (in million board feet) Information provided by Rollie Saylor of USFS.

Fuelwood cut converted to thousand cubic feet Cell formula multiplies by 0.083333 and divides by 1,000. Same as previous column.

Column I Fuelwood consumed times the biomass conversion factor.

Column M Column K minus Column L. The totals for all four years is in the shaded area at the bottom of the column. These totals are carried to **Column O** where they are multiplied by the default carbon fraction listed in **Column N**.

Column N This default, 0.5 tons carbon/tons of dry mass, is the general default found on page 10-6 of EPA *State Workbook*.

Column P Subtract Column E from Sheet 1 (the total carbon uptake increment) from Column O.

Column Q Multiply Column P by 44/12 to give the annual CO_2 emissions or uptake. Positive values reflect emissions while negative values indicate uptake.

Methodology for Estimating Area of Urban Forests

Spreadsheet calculations are on page 4 of "Greenhouse Gas from Forest Changes (Urban Forest)."

Since there are no real tree farms outside of urban areas in Utah, for the sake of this inventory this category represents only urban forests. There is no database in existence which counts all of the trees within a city area. Salt Lake City has the best data on its urban forest but these numbers are estimated to represent only 12 percent to 20 percent of all of the trees in an urban area. The other trees were found on private property.[1]

A method for estimating the number of trees in the urban forests of the state was developed using urban tree-cover data provided by Greg McPherson.[2] Because of the paucity of data, it was decided to account for urban tree-cover by selecting only those municipalities within the state with a population greater than some arbitrary number. A baseline of 20,000 population was chosen because there are so few cities outside the Wasatch Front urban area with populations of 50,000 or greater.

There are fourteen municipalities in Utah with populations greater than 20,000. The number of acres contained within each city boundary was obtained and then the number of urban-forest-acres was estimated based on the average percent tree cover of Logan and Salt Lake City. These two cities are the only ones with percent of tree cover data for Utah. Because there is a large variance between these values the average of the two was used to calculate the amount of urban forest for the entire state.

Uncertainties

The estimates in urban forest area, while very rough, make up only about five percent of the forest category and so even if overestimated still would account for a small proportion of this section. As noted above, there is considerably more uncertainty surrounding the effect of conversion from grassland to urban and suburban development.

The EPA *State Workbook* is based on methods developed by the Intergovernmental Panel on Climate Change (IPCC) for an international inventory of greenhouse gas emissions.[3] In the IPCC inventory process the categories of forest and land use change the emphasis was on tropical deforestation and land use development. Consequently, the effect of similar activities in temperate climates are not well understood. Another complicating factor in Utah, and this would be true throughout much of the Intermountain West, would be the proper characterization of the effect of land use changes relative to data developed for regions with higher humidity and, therefore, more dense vegetation.

In Utah, urban and suburban development may take place either on converted farm fields or scrub-type range land. In either case, the above-ground biomass will not be great and so suburban development, with the planting of lawns and shade trees may actually serve to deter CO_2. As stated in the workbook, the release of CO_2 from the soil once it is disturbed varies with the type of agricultural crop that is growing. If these potential changes are thought to be significant, more research will need to be done to differentiate between widely differing land types and regional climate conditions.

1. Based on a personal conversation with Bill Rutherford, SLC urban forester.

2. Data provided on percent tree cover for approximately 50 cities, including Salt Lake and Logan. Also number of trees per acre for Chicago and surrounding counties. From the Western Center for Urban Forest Research.

3. Personal conversation with Barbara Brantz of ICF Incorporated, EPA consultant for U.S. greenhouse gas emissions inventory.

References

U.S. Department of Agriculture (U.S. DOA). *Summary Report 1992 National Resources Inventory.* Natural Resources Conservation Service. Washington, D.C.: Government Printing Office, 1994.

U.S. Environmental Protection Agency (U.S. EPA). *State Workbook: Methodologies for Estimating Greenhouse Gas Emissions.* Office of Policy, Planning, and Evaluation (EPA-230-B-95-001). Washington, D.C.: Government Printing Office, 1995.

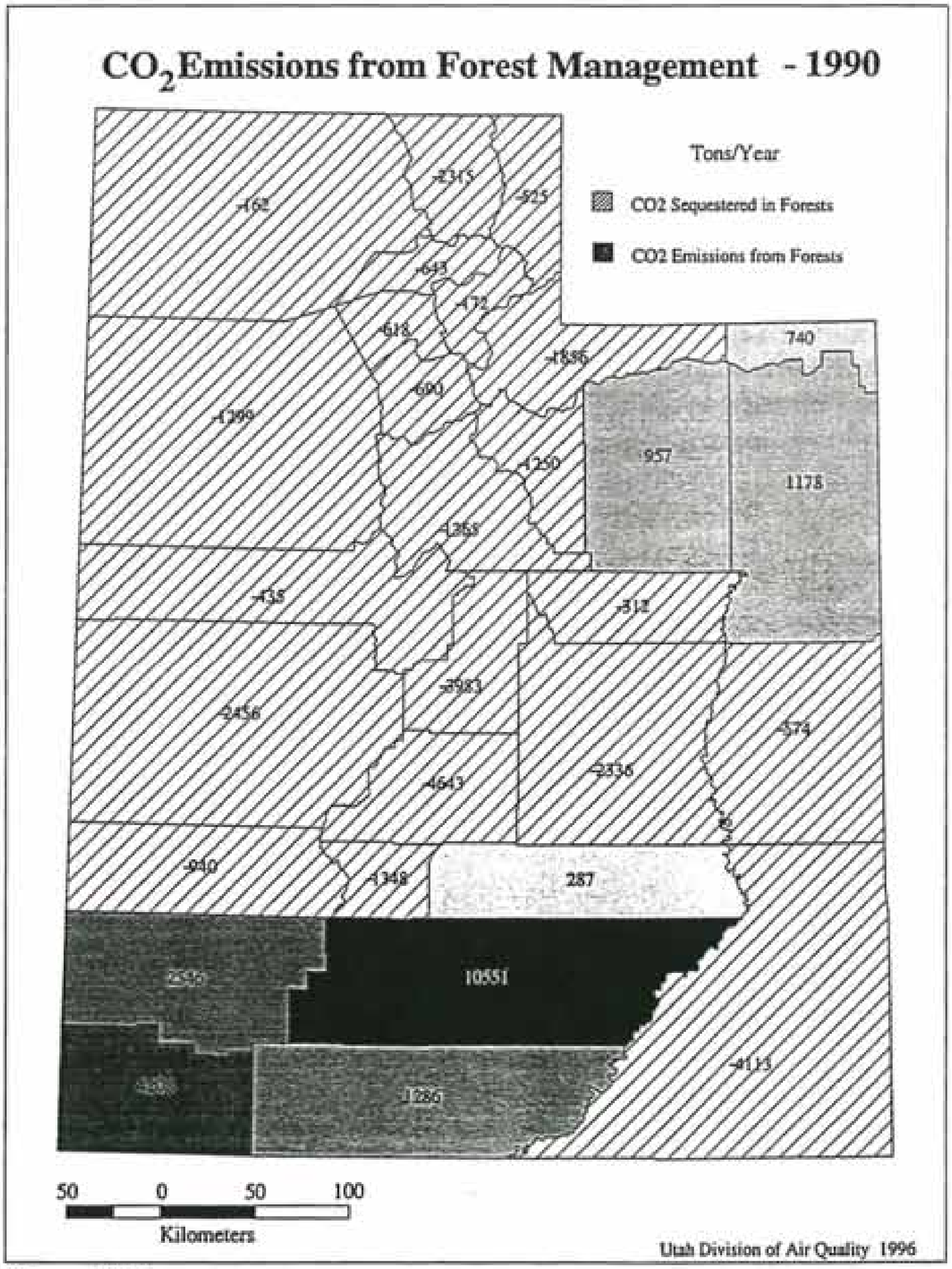

CO2 Emissions from Forest Management - 1990
Tons/Year
CO2 Sequestered in Forests
CO2 Emissions from Forests
740
957
1178
287
10551
50 0 50 100
Kilometers
Utah Division of Air Quality 1996

Figure IX-1

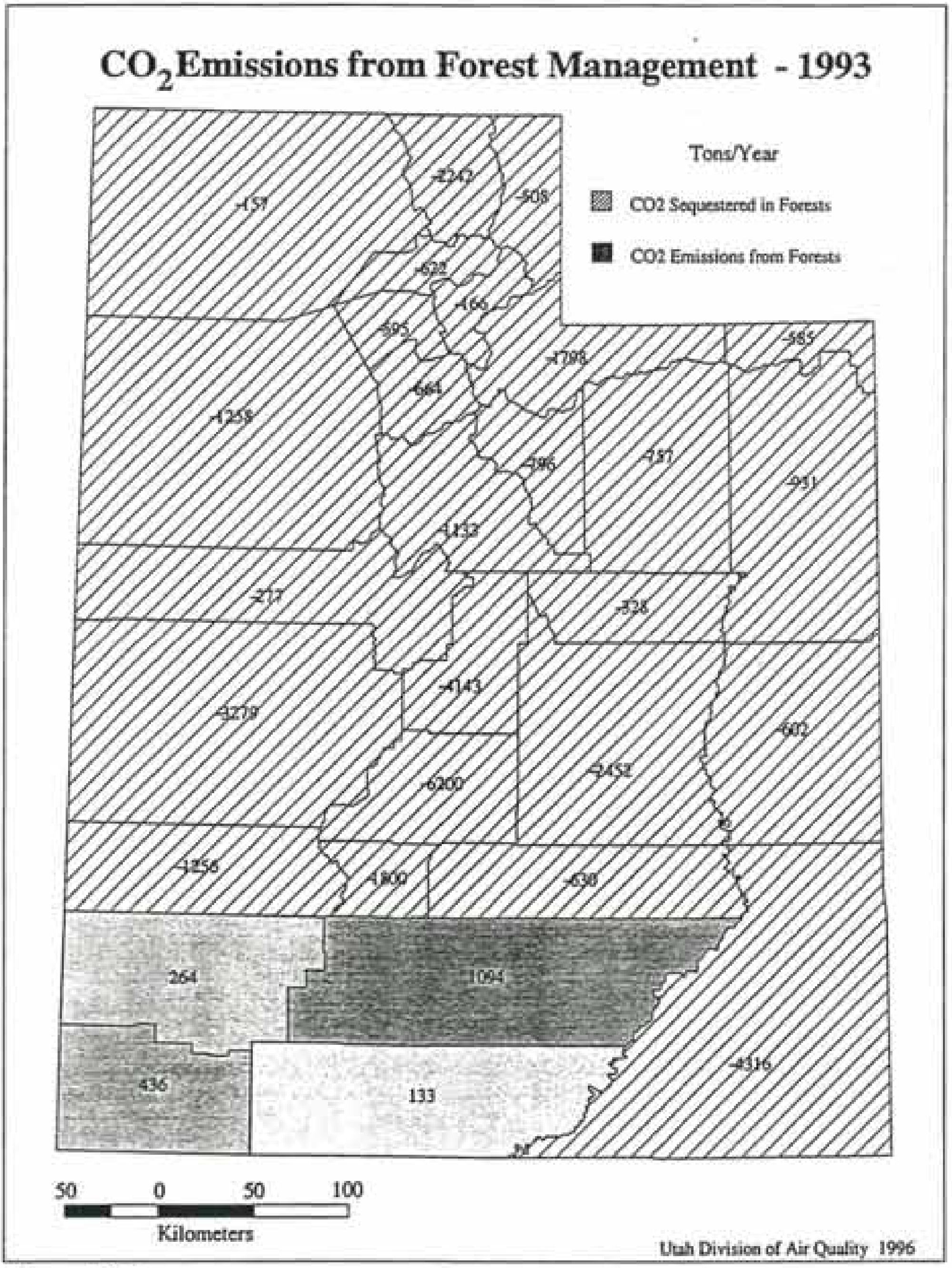

CO2 Emissions from Forest Management - 1993
Tons/Year
CO2 Sequestered in Forests
CO2 Emissions from Forests
264
1094
436
133
50 0 50 100
Kilometers
Utah Division of Air Quality 1996

Figure IX-2

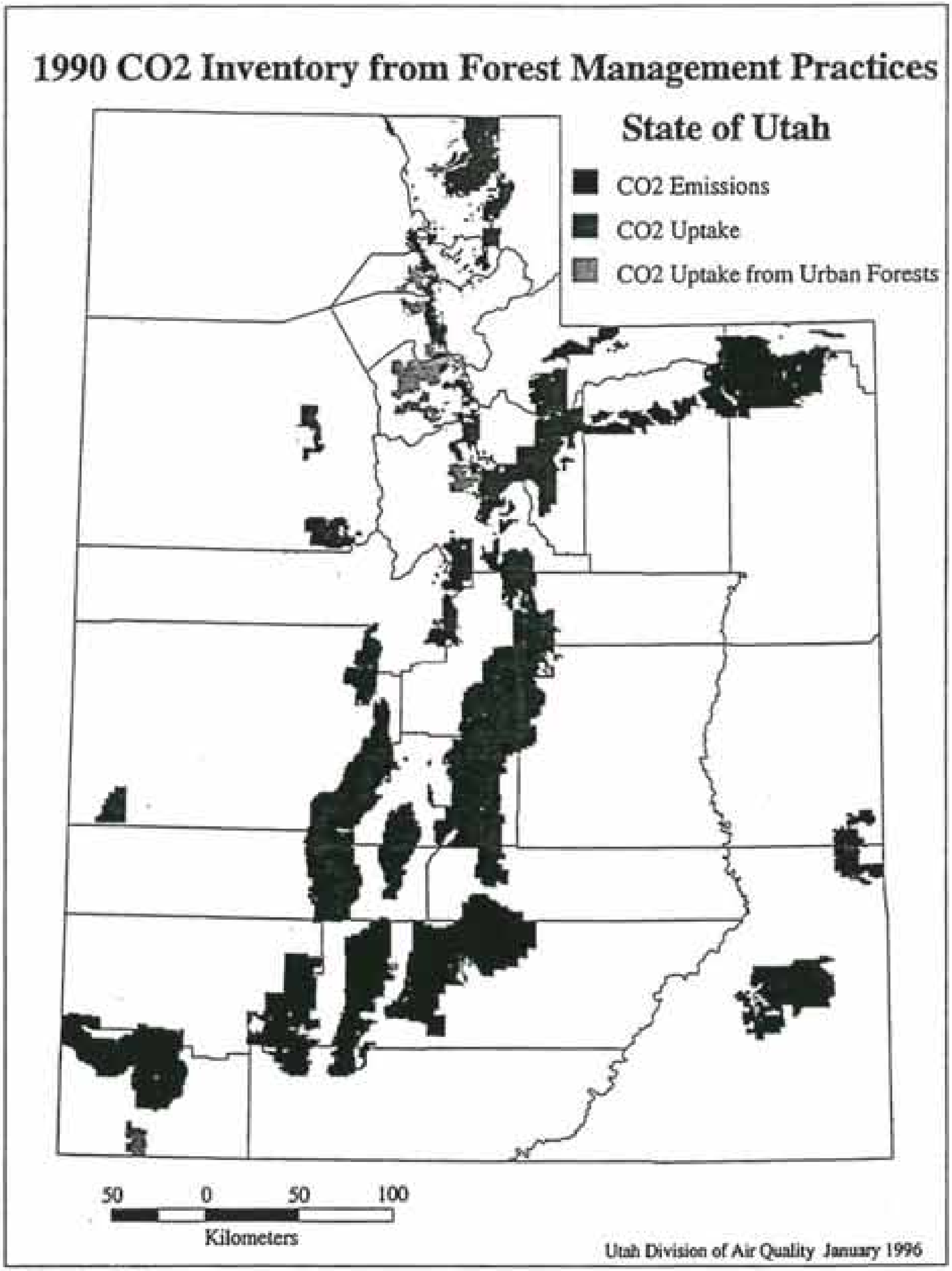

1990 CO2 Inventory from Forest Management Practices
State of Utah
CO2 Emissions
CO2 Uptake
CO2 Uptake from Urban Forests
50 0 50 100
Kilometers
Utah Division of Air Quality January 1996

Figure IX-3

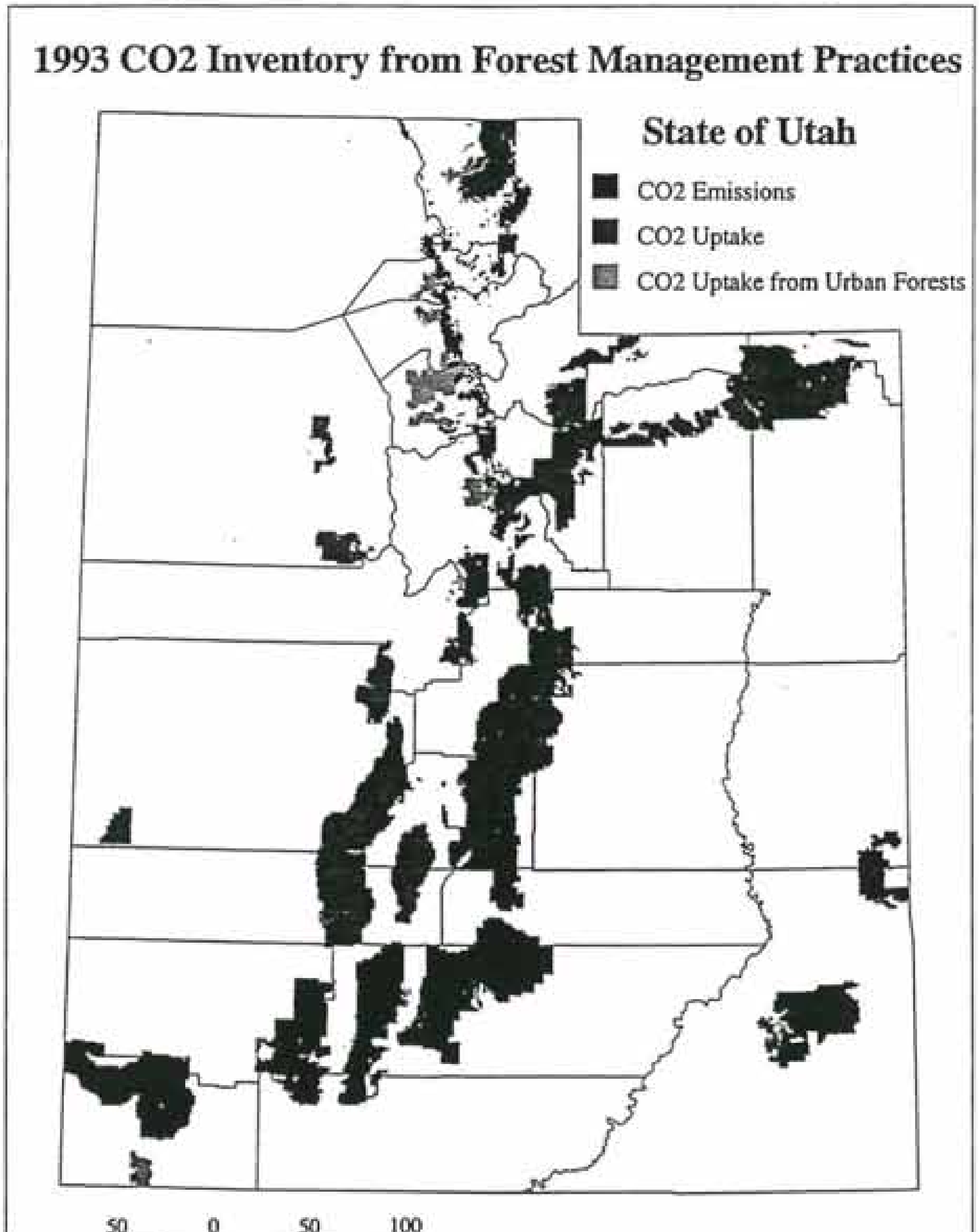

1993 CO2 Inventory from Forest Management Practices
State of Utah
CO2 Emissions
CO2 Uptake
CO2 Uptake from Urban Forests
50
0
50
100
Kilometers
Utah Division of Air Quality January 1996

Figure IX-4

Chapter X

Burning Agricultural Crop Wastes

Overview

Crop residue burning is not thought to be a net source of carbon dioxide because the carbon dioxide released during burning is reabsorbed by crop regrowth during the next growing season. It is, however, thought to be a net source of several other greenhouse gases including methane, carbon monoxide, nitrous oxide, and oxides of nitrogen.

Agricultural crop wastes are not burned as a matter of common practice by agricultural producers in the state of Utah. According to Larry Lewis, at the Utah Department of Agriculture, there are no statistics kept on such farming practices within the state. However, the best assessment is that in two northern Utah counties, Box Elder and Weber, some proportion of the barley farmers burn their crop stubble in the field.

Crop production statistics for 1995 from the Utah Department of Agriculture were used to determine barley production in the state. Since it is not known what percentage of barley producers burn their crop stubble, the total crop production for each inventory year was cut in half so that total greenhouse gas emissions from this category are based on fifty percent of the total barley production. The workbook methodology was followed to determine the emissions inventory for this category.

Methodology

The gases above are inventoried in a six-step process, detailed in the attached table, "Greenhouse Gas from Agricultural Burning." First, the amount of dry matter burned is calculated. From this estimate the total amount of carbon burned is calculated and from this value emissions of methane and carbon monoxide are calculated.

The nitrogen content of dry matter is estimated and from that emissions of nitrous oxide, and oxides of nitrogen are estimated. Finally, after emissions for all four trace gases are estimated, they are converted to their full molecular weights.

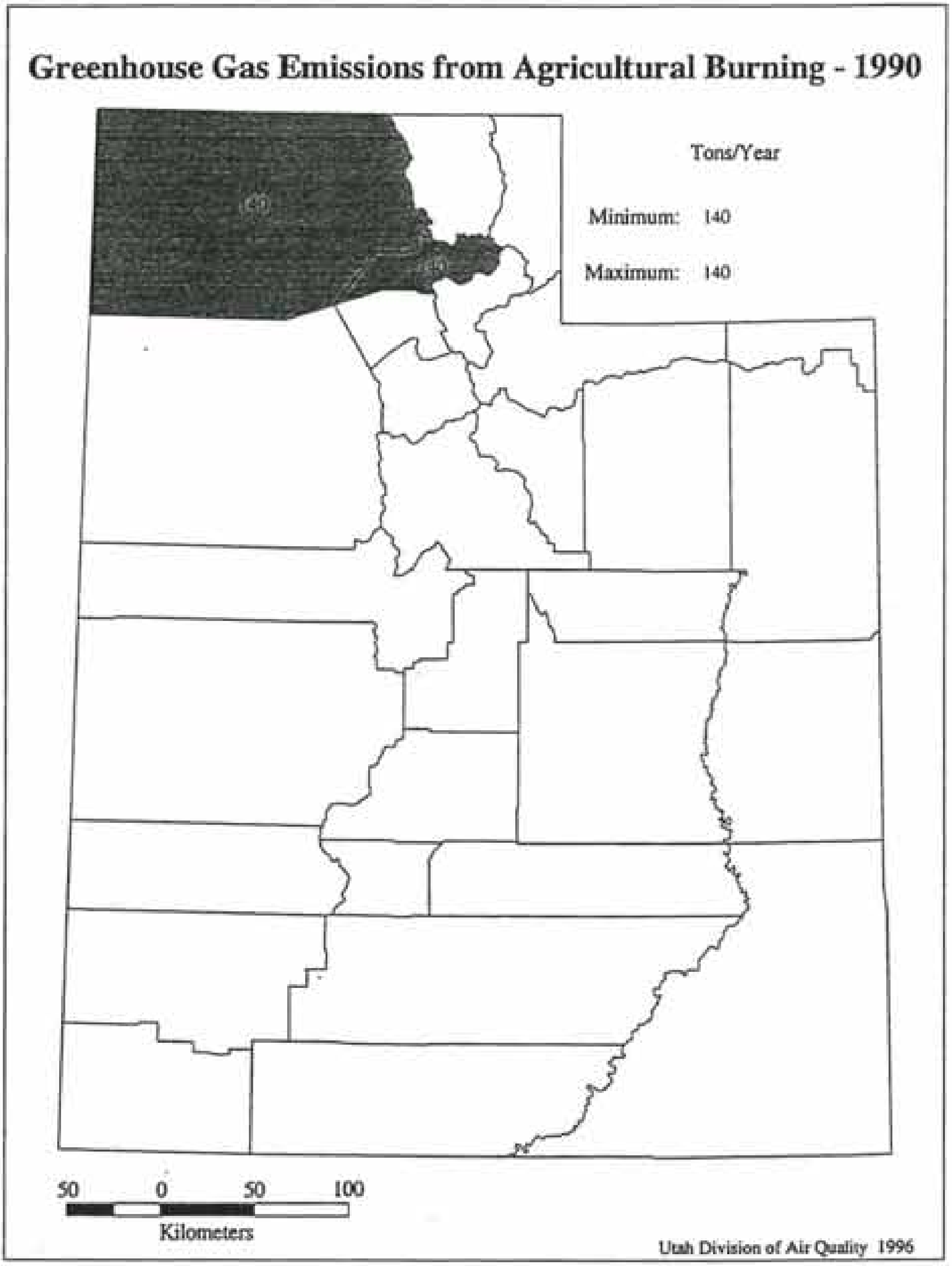
Table X-1 Final Estimates for Emissions from Agricultural Burning
Full Molecular Weights

		CH_4	CO	N_2O	NO_x
1990	Tons	18	619	0.13	5
1993	Tons	17	591	0.12	4

References

U.S. Department of Agriculture (U.S. DOA). *Utah Agricultural Statistics.* Washington, D.C.: Government Printing Office, 1995.

U.S. Environmental Protection Agency (U.S. EPA). *State Workbook: Methodologies for Estimating Greenhouse Gas Emission.* Office of Policy, Planning, and Evaluation (EPA-230-B-95-001). Washington, D.C.: Government Printing Office, 1995.


Greenhouse Gas Emissions from Agricultural Burning - 1990
Tons/Year
Minimum: 140
Maximum: 140
50 0 50 100
Kilometers
Utah Division of Air Quality 1996
Figure X-1

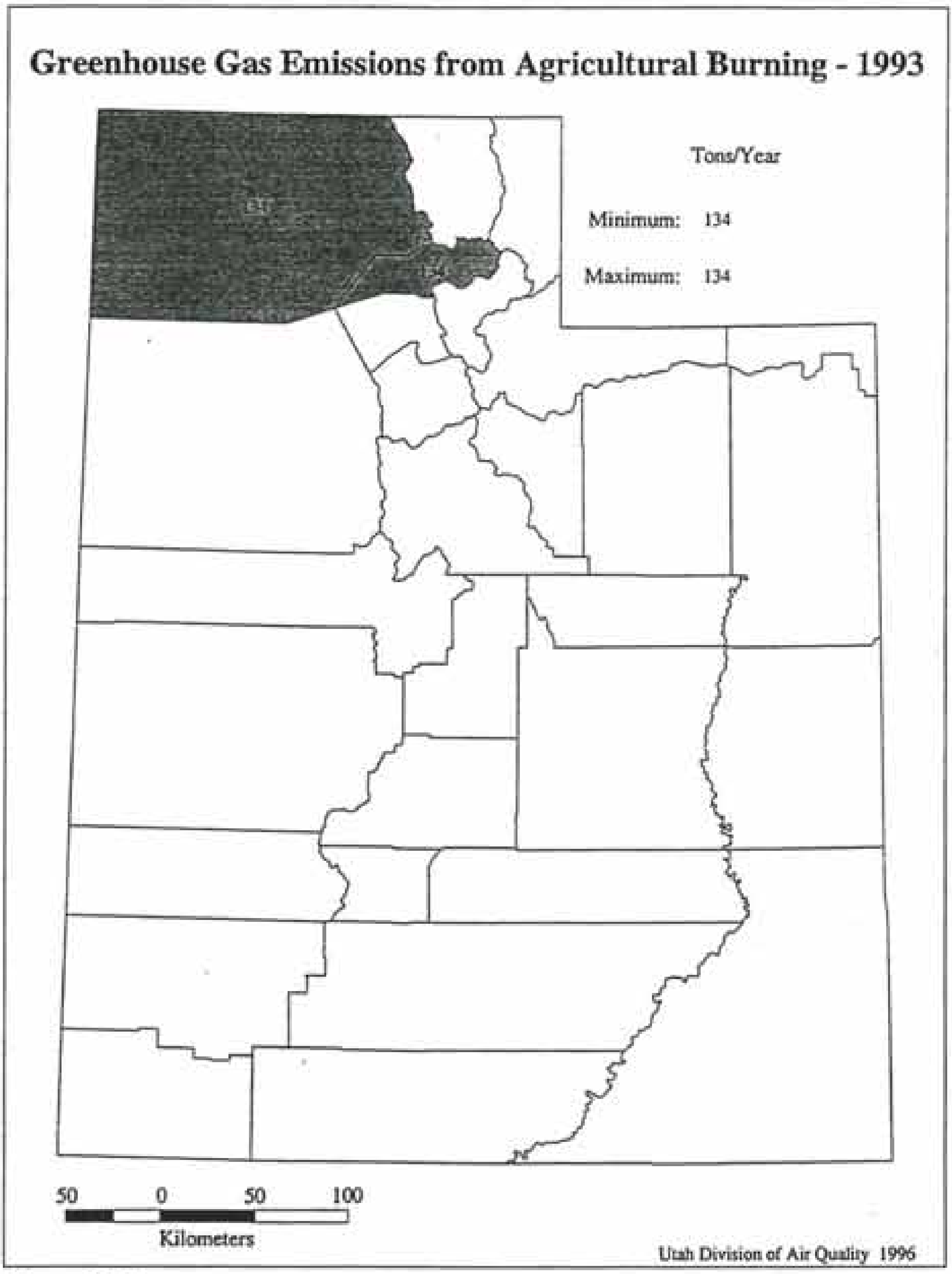

Greenhouse Gas Emissions from Agricultural Burning - 1993
Tons/Year
Minimum: 134
Maximum: 134
50 0 50 100
Kilometers
Utah Division of Air Quality 1996

Figure X-2

Chapter XI

Municipal Wastewater

Overview

Wastewater can be treated using aerobic and/or anaerobic technologies, or if untreated, can degrade under either aerobic or anaerobic conditions. Methane is produced when organic material in both treated and untreated wastewater degrades anaerobically, i.e., without the presence of oxygen. Highly organic wastewater streams such as from food processing or pulp and paper plants readily deplete available oxygen in the water stream as their organic matter decomposes. The organic content, otherwise known as "loading" of these wastewater streams, is expressed in terms of biochemical oxygen demand, or "BOD." BOD represents the amounts of oxygen taken up by the organic matter in the wastewater during decomposition. Under the same conditions, wastewater with higher BOD concentrations will produce more methane than wastewater with relatively lower BOD concentrations. BOD_5 represents the amount of oxygen taken up by organic matter in wastewater during a 5-day period.

Methodology

To estimate methane emissions from municipal wastewater, the following steps are required: 1) obtain the required data on state population; 2) estimate biochemical oxygen demand (BOD_5); 3) estimate gross annual methane emissions; and 4) estimate net annual methane emissions. The following equation summarizes the methane emissions calculation from municipal wastewater:

CH_4 lbs/year = (Population (thousands) * 0.1356 BOD_5 lbs/capita/day * 365 days/year * 0.1356 lbs CH_4/lbs BOD_5 * 0.15 fraction anaerobically digested) - 0.00 methane recovered

where

CH4 is the pounds per year of methane released to atmosphere
Population is the number of thousands of residents for each county
0.1356 BOD_5 is the biochemical oxygen demand in pounds per capita per day
0.1356 lbs CH4/lb BOD_5 is the emission factor
0.15 is the fraction anaerobically digested of all wastewater
0.00 is the quantity of methane recovered for power generation

For the years 1990 and 1993, the data on state population was taken from *State of Utah Economic and Demographic Projections 1994* by the Governor's Office of Planning and Budget, Division of Demographic and Economic Analysis, 1994. The BOD_5 per capita per day, the pounds methane per pound BOD, the fraction of BOD anaerobically digested, and the methane recovered were taken from default values listed in the EPA *State Workbook*. The table below shows methane emissions for each county for the years 1990 and 1993.

Table XI-1 Methane Emissions from Anaerobic Treatment of Wastewater

County	Population 1990	Population 1993	Methane Emissions (lbs/yr) 1990	Methane Emissions (lbs/yr) 1993
Beaver	4,800	5,000	7,840	8,167
Box Elder	36,500	38,100	59,616	62,229
Cache	70,500	76,099	115,148	124,293
Carbon	20,200	20,700	32,993	33,809
Daggett	700	700	1,143	1,143
Davis	18,8000	20,6001	307,061	336,462
Duchesne	12,600	13,200	20,580	21,560
Emery	10,300	10,400	16,823	16,986
Garfield	3,950	4,200	6,452	6,860
Grand	6,600	7,499	10,780	12,248
Iron	20,900	23,800	34,136	38,873
Juab	5,800	6,200	9,473	10,126
Kane	5,150	5,450	8,412	8,901
Millard	11,300	11,700	18,456	19,110
Morgan	5,550	6,150	9,065	10,045
Piute	1,250	1,350	2,042	2,205
Rich	1,750	1,800	2,858	2,940
Salt Lake	728,000	777,001	1,189,044	1,269,077
San Juan	12,600	13,100	20,580	21,396
Sanpete	16,300	18,100	26,623	29,563
Sevier	15,400	16,399	25,153	26,785
Summit	15,700	19,700	25,643	32,176
Tooele	26,700	28,100	43,609	45,896
Uintah	22,200	23,600	36,259	38,546
Utah	266,000	291,001	434,458	475,293
Wasatch	10,100	11,200	16,496	18,293
Washington	49,100	58,701	80,195	95,876
Wayne	2,150	2,200	3,512	3,593
Weber	159,000	169,001	259,695	276,030
State Total	1,729,100	1,866,452	2,824,142	3,048,480

Assumptions: BOD/capita = 0.1356 lbs/capita/day
Emission Factor = 0.22 lbs Methane/lb BOD
f = 15%
Methane, recovered = 0%

Uncertainties

Uncertainties in the emissions calculations include estimates of emissions factors for methane generated from BOD because of mixture of aerobic and anaerobic treatment facilities, the fraction of anaerobically digested wastewater, since an accurate summation was unavailable from the state, and the quantity of methane recovered. The default factors used are national averages.

Reference

U.S. Environmental Protection Agency (U.S. EPA). *State Workbook: Methodologies for Estimating Greenhouse Gas Emissions.* Office of Policy, Planning, and Evaluation (EPA-230-B-95-001). Washington, D.C.: Government Printing Office, 1995.

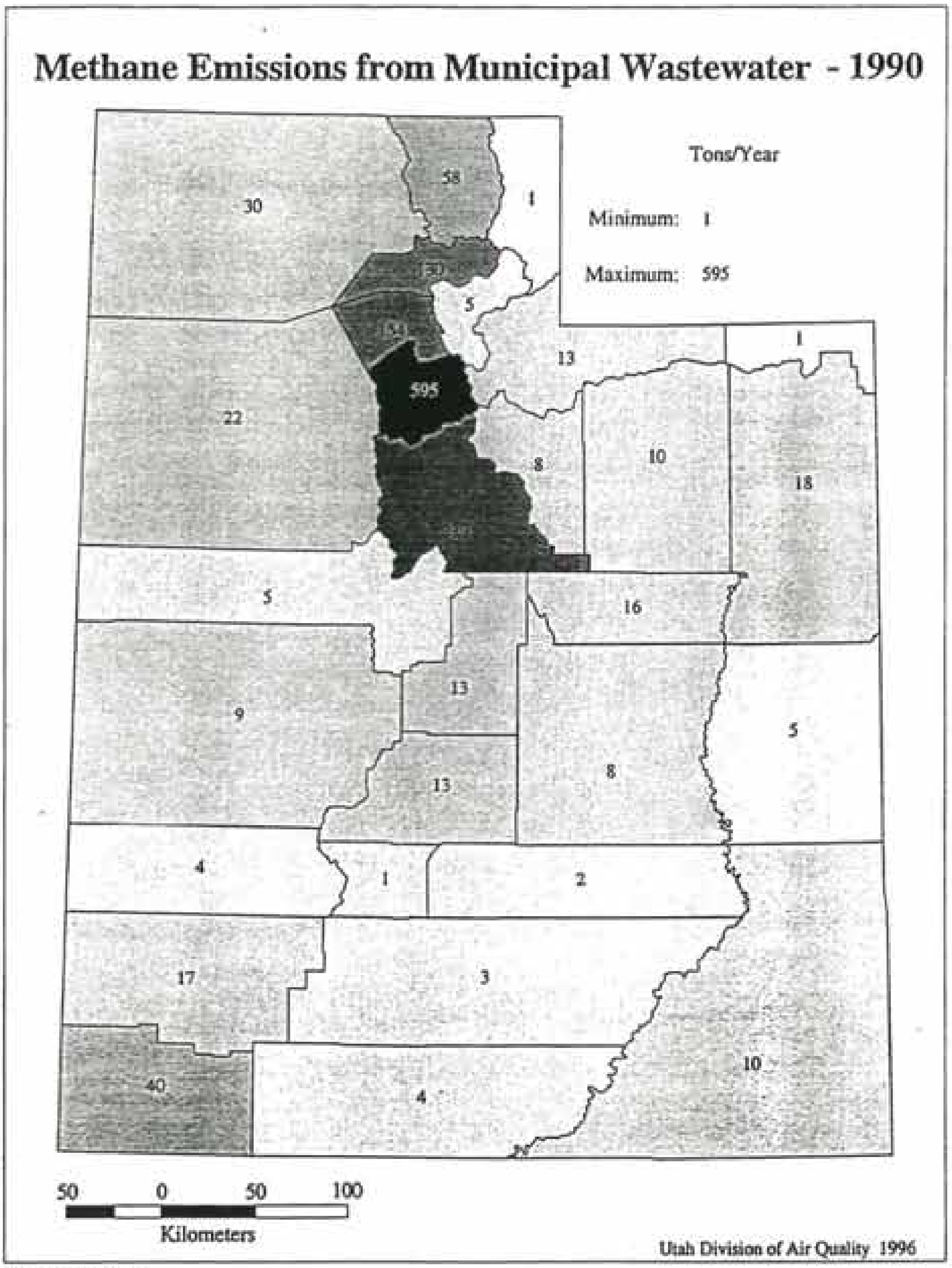

Methane Emissions from Municipal Wastewater - 1990
Tons/Year
Minimum: 1
Maximum: 595
30
58
1
5
595
22
13
1
10
18
8
5
16
13
9
5
8
13
4
1
2
17
3
40
4
10
50 0 50 100
Kilometers
Utah Division of Air Quality 1996

Figure XI-1

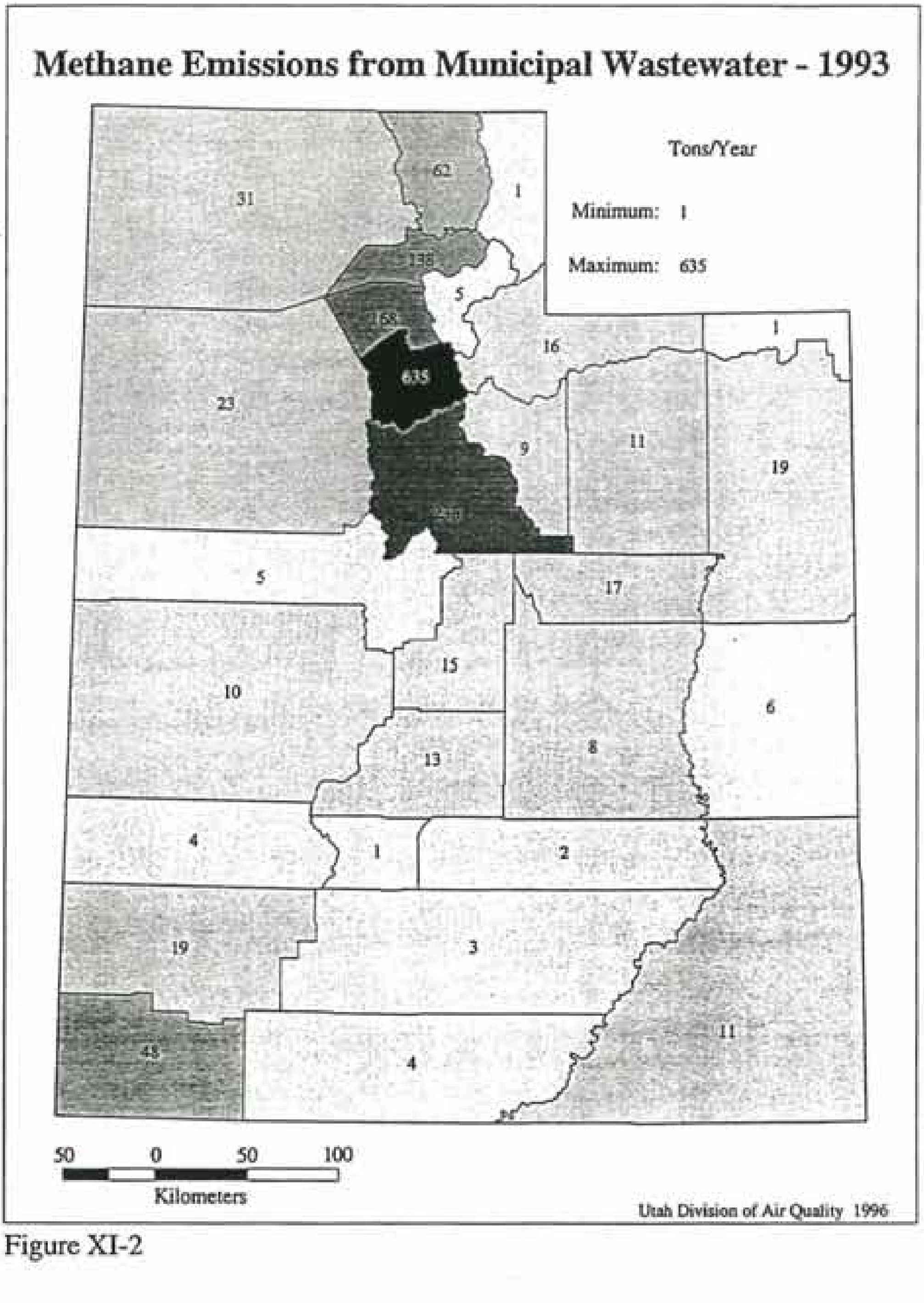

Methane Emissions from Municipal Wastewater - 1993
Tons/Year
Minimum: 1
Maximum: 635
31
62
1
5
635
16
23
9
11
19
5
17
15
10
6
13
8
4
1
2
19
3
11
4
50 0 50 100
Kilometers
Utah Division of Air Quality 1996

Figure XI-2

Appendix A

Fossil and Biomass Fuels

Table A-1 Calculation of 1990 Utah Residential Carbon Dioxide Emmissions by County (Tons CO2)

County	Asphalt & Road Oil	Aviation Gasoline	Distillate Fuel Oil	Jet Fuel Kerosene	Kerosene	LPG	Lubricants	Motor Gasoline	Residual Fuel Oil	Bituminous Coal	Coke	Natural Gas	Wood	Other
Beaver	0	0	177	0	6	65	0	0	0	627	0	7,155	20	0
Box Elder	0	0	1,345	0	47	493	0	0	0	4,767	0	54,404	149	0
Cache	0	0	2,598	0	91	951	0	0	0	9,207	0	105,082	288	0
Carbon	0	0	745	0	26	273	0	0	0	2,638	0	30,109	82	0
Daggett	0	0	26	0	1	9	0	0	0	91	0	1,043	3	0
Davis	0	0	6,929	0	243	2,537	0	0	0	24,553	0	280,220	767	0
Duchesne	0	0	464	0	16	170	0	0	0	1,646	0	18,781	51	0
Emery	0	0	380	0	13	139	0	0	0	1,345	0	15,352	42	0
Garfield	0	0	146	0	5	53	0	0	0	516	0	5,888	16	0
Grand	0	0	243	0	9	89	0	0	0	862	0	9,837	27	0
Iron	0	0	770	0	27	282	0	0	0	2,730	0	31,152	85	0
Juab	0	0	214	0	8	78	0	0	0	757	0	8,645	24	0
Kane	0	0	190	0	7	70	0	0	0	673	0	7,676	21	0
Millard	0	0	416	0	15	153	0	0	0	1,476	0	16,843	46	0
Morgan	0	0	205	0	7	75	0	0	0	725	0	8,272	23	0
Piute	0	0	46	0	2	17	0	0	0	163	0	1,863	5	0
Rich	0	0	65	0	2	24	0	0	0	229	0	2,608	7	0
Salt Lake	0	0	26,832	0	942	9,825	0	0	0	95,077	0	1,085,106	2,970	0
San Juan	0	0	464	0	16	170	0	0	0	1,646	0	18,781	51	0
Sanpete	0	0	601	0	21	220	0	0	0	2,129	0	24,296	66	0
Sevier	0	0	568	0	20	208	0	0	0	2,011	0	22,954	63	0
Summit	0	0	579	0	20	212	0	0	0	2,050	0	23,401	64	0
Tooele	0	0	984	0	35	360	0	0	0	3,487	0	39,797	109	0
Uintah	0	0	818	0	29	300	0	0	0	2,899	0	33,090	91	0
Utah	0	0	9,804	0	344	3,590	0	0	0	34,740	0	396,481	1,085	0
Wasatch	0	0	372	0	13	136	0	0	0	1,319	0	15,054	41	0
Washington	0	0	1,810	0	64	663	0	0	0	6,412	0	73,185	200	0
Wayne	0	0	79	0	3	29	0	0	0	281	0	3,205	9	0
Weber	0	0	5,860	0	206	2,146	0	0	0	20,765	0	236,994	649	0
Total Statewide	0	0	63,730	0	2,238	23,335	0	0	0	225,821	0	2,577,276	7,054	0

Table A-2 Calculation of 1990 Utah Commercial Carbon Dioxide Emissions by County (Tons CO2)

County	Asphalt & Road Oil	Aviation Gasoline	Distillate Fuel Oil	Jet Fuel Kerosene	Kerosene	LPG	Lubricants	Motor Gasoline	Residual Fuel Oil	Bituminous Coal	Coke	Natural Gas	Wood	Other
Beaver	0	0	329	0	4	8	0	76	0	830	0	1,885	0	0
Box Elder	0	0	2,052	0	27	51	0	475	0	5,177	0	11,749	0	0
Cache	0	0	5,749	0	77	142	0	1,331	0	14,505	0	32,924	0	0
Carbon	0	0	1,676	0	22	41	0	388	0	4,229	0	9,599	0	0
Daggett	0	0	89	0	1	2	0	21	0	224	0	509	0	0
Davis	0	0	14,802	0	198	365	0	3,427	0	37,345	0	84,765	0	0
Duchesne	0	0	848	0	11	21	0	196	0	2,139	0	4,856	0	0
Emery	0	0	531	0	7	13	0	123	0	1,341	0	3,043	0	0
Garfield	0	0	376	0	5	9	0	87	0	948	0	2,151	0	0
Grand	0	0	661	0	9	16	0	153	0	1,667	0	3,785	0	0
Iron	0	0	1,913	0	26	47	0	443	0	4,827	0	10,955	0	0
Juab	0	0	404	0	5	10	0	94	0	1,019	0	2,313	0	0
Kane	0	0	460	0	6	11	0	107	0	1,161	0	2,636	0	0
Millard	0	0	718	0	10	18	0	166	0	1,811	0	4,111	0	0
Morgan	0	0	249	0	3	6	0	58	0	627	0	1,424	0	0
Piute	0	0	50	0	1	1	0	12	0	127	0	289	0	0
Rich	0	0	114	0	2	3	0	26	0	288	0	655	0	0
Salt Lake	0	0	83,684	0	1,118	2,063	0	19,372	0	211,127	0	479,211	0	0
San Juan	0	0	786	0	10	19	0	182	0	1,982	0	4,498	0	0
Sanpete	0	0	981	0	13	24	0	227	0	2,475	0	5,617	0	0
Sevier	0	0	1,182	0	16	29	0	274	0	2,981	0	6,767	0	0
Summit	0	0	2,196	0	29	54	0	508	0	5,541	0	12,576	0	0
Tooele	0	0	2,600	0	35	64	0	602	0	6,561	0	14,891	0	0
Uintah	0	0	1,487	0	20	37	0	344	0	3,751	0	8,514	0	0
Utah	0	0	23,419	0	313	577	0	5,421	0	59,085	0	134,109	0	0
Wasatch	0	0	683	0	9	17	0	158	0	1,724	0	3,913	0	0
Washington	0	0	3,758	0	50	93	0	870	0	9,482	0	21,522	0	0
Wayne	0	0	136	0	2	3	0	32	0	343	0	779	0	0
Weber	0	0	15,531	0	208	383	0	3,595	0	39,184	0	88,940	0	0
Total Statewide	0	0	167,466	0	2,238	4,128	0	38,766	0	422,503	0	958,986	0	0

Table A-3 Calculation of 1990 Industrial Carbon Dioxide Emmissions by County (Tons CO2)

County	Asphalt Road Oil	Aviation Gasoline	Distillate Fuel Oil	Jet Fuel Kerosene	Kerosene	LPG	Lubricants	Motor Gasoline	Residual Fuel Oil	Bituminous Coal	Coke	Natural Gas	Wood	Other
Beaver	0	0	1,875	0	5	77	71	215	0	12,411	0	8,836	0	3,835
Box Elder	0	0	42,872	0	110	1,764	1,625	4,926	0	283,749	0	202,003	0	87,675
Cache	0	0	48,515	0	124	1,996	1,838	5,574	0	321,095	0	228,590	0	99,215
Carbon	0	0	8,634	0	22	355	327	992	0	57,143	0	40,680	0	17,656
Daggett	0	0	199	0	1	8	8	23	0	1,320	0	940	0	408
Davis	0	0	48,027	0	123	1,976	1,820	5,518	0	317,866	0	226,291	0	98,217
Duchesne	0	0	6,856	0	18	282	260	788	0	45,377	0	32,304	0	14,021
Emery	0	0	7,560	0	19	311	286	869	0	50,039	0	35,623	0	15,461
Garfield	0	0	2,232	0	6	92	85	256	0	14,770	0	10,515	0	4,564
Grand	0	0	1,667	0	4	69	63	192	0	11,035	0	7,856	0	3,410
Iron	0	0	7,119	0	18	293	270	818	0	47,118	0	33,544	0	14,559
Juab	0	0	3,237	0	8	133	123	372	0	21,425	0	15,253	0	6,620
Kane	0	0	1,099	0	3	45	42	126	0	7,273	0	5,178	0	2,247
Millard	0	0	6,449	0	17	265	244	741	0	42,682	0	30,385	0	13,188
Morgan	0	0	2,944	0	8	121	112	338	0	19,488	0	13,873	0	6,021
Piute	0	0	781	0	2	32	30	90	0	5,167	0	3,678	0	1,596
Rich	0	0	1,107	0	3	46	42	127	0	7,329	0	5,217	0	2,265
Salt Lake	0	0	299,168	0	766	12,308	11,336	34,374	0	1,980,036	0	1,409,602	0	611,808
San Juan	0	0	4,171	0	11	172	158	479	0	27,603	0	19,651	0	8,529
Sanpete	0	0	8,808	0	23	362	334	1,012	0	58,294	0	41,500	0	18,012
Sevier	0	0	6,474	0	17	266	245	744	0	42,850	0	30,505	0	13,240
Summit	0	0	6,546	0	17	269	248	752	0	43,327	0	30,845	0	13,388
Tooele	0	0	8,570	0	22	353	325	985	0	56,722	0	40,381	0	17,526
Uintah	0	0	9,915	0	25	408	376	1,139	0	65,623	0	46,718	0	20,277
Utah	0	0	83,763	0	214	3,446	3,174	9,624	0	554,384	0	394,670	0	171,298
Wasatch	0	0	3,534	0	9	145	134	406	0	23,391	0	16,652	0	7,227
Washington	0	0	13,581	0	35	559	515	1,560	0	89,884	0	63,989	0	27,773
Wayne	0	0	1,549	0	4	64	59	178	0	10,249	0	7,296	0	3,167
Weber	0	0	62,384	0	160	2,567	2,364	7,168	0	412,889	0	293,939	0	127,578
Total Statewide	0	0	699,637	0	1,791	28,784	26,512	80,389	0	4,630,538	0	3,296,515	0	1,430,783

Table A-4 Calculation of 1990 Utah Transportation Carbon Dioxide Emissions by County (Tons CO2)

County	Asphalt & Road Oil	Aviation Gasoline	Distillate Fuel Oil	Jet Fuel Kerosene	Kerosene	LPG	Lubricants	Motor Gasoline	Residual Fuel Oil	Bituminous Coal	Coke	Natural Gas	Wood	Other
Beaver	0	112	6,785	6,380	0	8	135	18,504	0	0	0	166	0	0
Box Elder	0	853	51,593	48,514	0	59	1,026	140,708	0	0	0	1,265	0	0
Cache	0	1,647	99,652	93,704	0	114	1,982	271,779	0	0	0	2,444	0	0
Carbon	0	472	28,553	26,849	0	33	568	77,871	0	0	0	700	0	0
Daggett	0	16	989	930	0	1	20	2,699	0	0	0	24	0	0
Davis	0	4,393	265,738	249,879	0	305	5,285	724,744	0	0	0	6,517	0	0
Duchesne	0	294	17,810	16,747	0	20	354	48,573	0	0	0	437	0	0
Emery	0	241	14,559	13,690	0	17	290	39,707	0	0	0	357	0	0
Garfield	0	92	5,583	5,250	0	6	111	15,227	0	0	0	137	0	0
Grand	0	154	9,329	8,772	0	11	186	25,443	0	0	0	229	0	0
Iron	0	488	29,542	27,779	0	34	587	80,570	0	0	0	724	0	0
Juab	0	136	8,198	7,709	0	9	163	22,359	0	0	0	201	0	0
Kane	0	120	7,280	6,845	0	8	145	19,853	0	0	0	179	0	0
Millard	0	264	15,973	15,019	0	18	318	43,562	0	0	0	392	0	0
Morgan	0	130	7,845	7,377	0	9	156	21,395	0	0	0	192	0	0
Piute	0	29	1,767	1,661	0	2	35	4,819	0	0	0	43	0	0
Rich	0	41	2,474	2,326	0	3	49	6,746	0	0	0	61	0	0
Salt Lake	0	17,010	1,029,027	967,615	0	1,182	20,464	2,806,456	0	0	0	25,235	0	0
San Juan	0	294	17,810	16,747	0	20	354	48,573	0	0	0	437	0	0
Sanpete	0	381	23,040	21,665	0	26	458	62,837	0	0	0	565	0	0
Sevier	0	360	21,768	20,469	0	25	433	59,367	0	0	0	534	0	0
Summit	0	367	22,192	20,868	0	25	441	60,524	0	0	0	544	0	0
Tooele	0	624	37,740	35,488	0	43	751	102,929	0	0	0	926	0	0
Uintah	0	519	31,380	29,507	0	36	624	85,581	0	0	0	770	0	0
Utah	0	6,215	375,990	353,552	0	432	7,477	1,025,436	0	0	0	9,220	0	0
Wasatch	0	236	14,276	13,424	0	16	284	38,936	0	0	0	350	0	0
Washington	0	1,147	69,403	65,261	0	80	1,380	189,282	0	0	0	1,702	0	0
Wayne	0	50	3,039	2,858	0	3	60	8,288	0	0	0	75	0	0
Weber	0	3,715	224,746	211,333	0	258	4,469	612,948	0	0	0	5,511	0	0
Total Statewide	0	40,401	2,444,079	2,298,218	0	2,807	48,605	6,665,718	0	0	0	59,937	0	0

Table A-5 Calculation of 1990 Utah Electric Utility Carbon Dioxide Emmisions by County (Tons CO2)

County	Asphalt & Road Oil	Aviation Gasoline	Distillate Fuel Oil	Jet Fuel Kerosene	Kerosene	LPG	Lubricants	Motor Gasoline	Residual Fuel Oil	Bituminous Coal	Coke	Natural Gas	Wood	Other
Beaver	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Box Elder	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cache	0	0	103	0	0	0	0	0	0	0	0	0	0	0
Carbon	0	0	259	0	0	0	0	0	0	609,288	0	0	0	0
Daggett	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Davis	0	0	318	0	0	0	0	0	0	0	0	143	0	0
Duchesne	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Emery	0	0	15,071	0	0	0	0	0	0	16,704,433	0	0	0	0
Garfield	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iron	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Juab	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kane	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Millard	0	0	19,449	0	0	0	0	0	0	12,428,333	0	0	0	0
Morgan	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Piute	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rich	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salt Lake	0	0	1,186	0	0	0	0	0	0	4,994	0	54,103	0	0
San Juan	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sanpete	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sevier	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Summit	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tooele	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Uintah	0	0	0	0	0	0	0	0	0	3,112,397	0	0	0	0
Utah	0	0	377	0	0	0	0	0	0	73,955	0	563	0	0
Wasatch	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Washington	0	0	0	0	0	0	0	0	0	0	0	5,128	0	0
Wayne	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weber	0	0	2,312	0	0	0	0	0	0	0	0	0	0	0
Total Statewide	0	0	39,075	0	0	0	0	0	0	32,933,400	0	59,937	0	0

Table A-6 Calculation of 1993 Utah Residential Carbon Dioxide Emmissions by County (Tons CO2)

County	Asphalt & Road Oil	Aviation Gasoline	Distillate Fuel Oil	Jet Fuel Kerosene	Kerosene	LPG	Lubricants	Motor Gasoline	Residual Fuel Oil	Bituminous Coal	Coke	Natural Gas	Wood	Other
Beaver	0	0	184	0	4	30	0	0	0	273	0	8,349	19	0
Box Elder	0	0	1,405	0	27	227	0	0	0	2,082	0	63,622	144	0
Cache	0	0	2,807	0	55	453	0	0	0	4,158	0	127,074	288	0
Carbon	0	0	764	0	15	123	0	0	0	1,131	0	34,566	78	0
Daggett	0	0	26	0	1	4	0	0	0	38	0	1,169	3	0
Davis	0	0	7,599	0	148	1,227	0	0	0	11,256	0	343,992	779	0
Duchesne	0	0	487	0	9	79	0	0	0	721	0	22,042	50	0
Emery	0	0	384	0	7	62	0	0	0	568	0	17,366	39	0
Garfield	0	0	155	0	3	25	0	0	0	229	0	7,013	16	0
Grand	0	0	277	0	5	45	0	0	0	410	0	12,522	28	0
Iron	0	0	878	0	17	142	0	0	0	1,300	0	39,743	90	0
Juab	0	0	229	0	4	37	0	0	0	339	0	10,353	23	0
Kane	0	0	201	0	4	32	0	0	0	298	0	9,101	21	0
Millard	0	0	432	0	8	70	0	0	0	639	0	19,537	44	0
Morgan	0	0	227	0	4	37	0	0	0	336	0	10,270	23	0
Piute	0	0	50	0	1	8	0	0	0	74	0	2,254	5	0
Rich	0	0	66	0	1	11	0	0	0	98	0	3,006	7	0
Salt Lake	0	0	28,661	0	559	4,628	0	0	0	42,456	0	1,297,480	2,936	0
San Juan	0	0	483	0	9	78	0	0	0	716	0	21,875	50	0
Sanpete	0	0	668	0	13	108	0	0	0	989	0	30,224	68	0
Sevier	0	0	605	0	12	98	0	0	0	896	0	27,384	62	0
Summit	0	0	727	0	14	117	0	0	0	1,076	0	32,896	74	0
Tooele	0	0	1,037	0	20	167	0	0	0	1,535	0	46,923	106	0
Uintah	0	0	871	0	17	141	0	0	0	1,290	0	39,409	89	0
Utah	0	0	10,734	0	209	1,733	0	0	0	15,900	0	485,930	1,100	0
Wasatch	0	0	413	0	8	67	0	0	0	612	0	18,702	42	0
Washington	0	0	2,165	0	42	350	0	0	0	3,207	0	98,022	222	0
Wayne	0	0	81	0	2	13	0	0	0	120	0	3,674	8	0
Weber	0	0	6,234	0	122	1,007	0	0	0	9,234	0	282,207	639	0
Total Statewide	0	0	68,847	0	1,343	11,117	0	0	0	101,984	0	3,116,705	7,054	0

Table A-7 Calculation of 1993 Utah Commercial Carbon Dioxide Emmissions by County (Tons CO2)

County	Asphalt & Road Oil	Aviation Gasoline	Distillate Fuel Oil	Jet Fuel Kerosene	Kerosene	LPG	Lubricants	Motor Gasoline	Residual Fuel Oil	Bituminous Coal	Coke	Natural Gas	Wood	Other
Beaver	0	0	347	0	3	4	0	17	0	391	0	2,807	0	0
Box Elder	0	0	1,936	0	15	23	0	93	0	2,182	0	15,679	0	0
Cache	0	0	6,010	0	47	70	0	288	0	6,771	0	48,659	0	0
Carbon	0	0	1,586	0	13	18	0	76	0	1,787	0	12,845	0	0
Daggett	0	0	91	0	1	1	0	4	0	102	0	736	0	0
Davis	0	0	14,280	0	113	166	0	685	0	16,089	0	115,624	0	0
Duchesne	0	0	833	0	7	10	0	40	0	938	0	6,744	0	0
Emery	0	0	484	0	4	6	0	23	0	545	0	3,917	0	0
Garfield	0	0	403	0	3	5	0	19	0	454	0	3,265	0	0
Grand	0	0	807	0	6	9	0	39	0	909	0	6,531	0	0
Iron	0	0	2,134	0	17	25	0	102	0	2,404	0	17,276	0	0
Juab	0	0	434	0	3	5	0	21	0	489	0	3,513	0	0
Kane	0	0	493	0	4	6	0	24	0	555	0	3,990	0	0
Millard	0	0	702	0	6	8	0	34	0	791	0	5,685	0	0
Morgan	0	0	245	0	2	3	0	12	0	276	0	1,983	0	0
Piute	0	0	48	0	0	1	0	2	0	54	0	389	0	0
Rich	0	0	113	0	1	1	0	5	0	127	0	913	0	0
Salt Lake	0	0	85,510	0	675	995	0	4,099	0	96,343	0	692,360	0	0
San Juan	0	0	838	0	7	10	0	40	0	944	0	6,782	0	0
Sanpete	0	0	1,102	0	9	13	0	53	0	1,242	0	8,922	0	0
Sevier	0	0	1,163	0	9	14	0	56	0	1,311	0	9,420	0	0
Summit	0	0	2,452	0	19	29	0	118	0	2,763	0	19,857	0	0
Tooele	0	0	2,063	0	16	24	0	99	0	2,324	0	16,701	0	0
Uintah	0	0	1,502	0	12	17	0	72	0	1,692	0	12,157	0	0
Utah	0	0	24,376	0	192	284	0	1,168	0	27,464	0	197,370	0	0
Wasatch	0	0	687	0	5	8	0	33	0	774	0	5,561	0	0
Washington	0	0	4,376	0	35	51	0	210	0	4,930	0	35,429	0	0
Wayne	0	0	157	0	1	2	0	8	0	177	0	1,271	0	0
Weber	0	0	15,087	0	119	176	0	723	0	16,998	0	122,156	0	0
Total Statewide	0	0	170,258	0	1,343	1,981	0	8,161	0	191,826	0	1,378,543	0	0

Table A-8 Calculation of 1993 Utah Industrial Carbon Dioxide Emmissions by County (Tons CO2)

County	Asphalt & Road Oil	Aviation Gasoline	Distillate Fuel Oil	Jet Fuel Kerosene	Kerosene	LPG	Lubricants	Motor Gasoline	Residual Fuel Oil	Bituminous Coal	Coke	Natural Gas	Wood	Other
Beaver	0	0	2,060	0	2	66	60	244	0	10,187	0	7,985	0	3,208
Box Elder	0	0	50,737	0	53	1,635	1,479	6,014	0	250,931	0	196,689	0	79,032
Cache	0	0	60,189	0	63	1,940	1,755	7,134	0	297,675	0	233,329	0	93,754
Carbon	0	0	8,898	0	9	287	259	1,055	0	44,007	0	34,495	0	13,860
Daggett	0	0	178	0	0	6	5	21	0	881	0	690	0	277
Davis	0	0	67,071	0	71	2,162	1,956	7,950	0	331,710	0	260,007	0	104,474
Duchesne	0	0	8,590	0	9	277	250	1,018	0	42,484	0	33,301	0	13,381
Emery	0	0	7,786	0	8	251	227	923	0	38,510	0	30,185	0	12,129
Garfield	0	0	2,093	0	2	67	61	248	0	10,353	0	8,115	0	3,261
Grand	0	0	2,281	0	2	74	67	270	0	11,282	0	8,843	0	3,553
Iron	0	0	9,172	0	10	296	267	1,087	0	45,364	0	35,558	0	14,288
Juab	0	0	3,561	0	4	115	104	422	0	17,613	0	13,805	0	5,547
Kane	0	0	1,333	0	1	43	39	158	0	6,593	0	5,168	0	2,076
Millard	0	0	6,126	0	6	197	179	726	0	30,298	0	23,749	0	9,543
Morgan	0	0	3,619	0	4	117	106	429	0	17,898	0	14,029	0	5,637
Piute	0	0	833	0	1	27	24	99	0	4,118	0	3,227	0	1,297
Rich	0	0	1,203	0	1	39	35	143	0	5,950	0	4,664	0	1,874
Salt Lake	0	0	354,184	0	373	11,416	10,327	41,981	0	1,751,684	0	1,373,037	0	551,702
San Juan	0	0	5,424	0	6	175	158	643	0	26,823	0	21,025	0	8,448
Sanpete	0	0	9,067	0	10	292	264	1,075	0	44,841	0	35,148	0	14,123
Sevier	0	0	7,647	0	8	246	223	906	0	37,819	0	29,644	0	11,911
Summit	0	0	8,585	0	9	277	250	1,018	0	42,460	0	33,282	0	13,373
Tooele	0	0	10,178	0	11	328	297	1,206	0	50,338	0	39,457	0	15,854
Uintah	0	0	10,838	0	11	349	316	1,285	0	53,599	0	42,013	0	16,881
Utah	0	0	108,486	0	114	3,497	3,163	12,859	0	536,539	0	420,560	0	168,986
Wasatch	0	0	4,134	0	4	133	121	490	0	20,445	0	16,025	0	6,439
Washington	0	0	21,329	0	22	687	622	2,528	0	105,485	0	82,683	0	33,223
Wayne	0	0	1,550	0	2	50	45	184	0	7,664	0	6,007	0	2,414
Weber	0	0	73,206	0	77	2,360	2,134	8,677	0	362,056	0	283,793	0	114,032
Total Statewide	0	0	850,357	0	895	27,408	24,793	100,792	0	4,205,607	0	3,296,515	0	1,324,579

Table A-9 Calculation of 1993 Utah Transportation Carbon Dioxide Emmissions by County (Tons CO2)

County	Asphalt & Road Oil	Aviation Gasoline	Distillate Fuel Oil	Jet Fuel Kerosene	Kerosene	LPG	Lubricant	Motor Gasoline	Residual Fuel Oil	Bituminous Coal	Coke	Natural Gas	Wood	Other
Beaver	0	116	6,982	6,433	0	6	121	20,293	0	0	0	482	0	0
Box Elder	0	887	53,205	49,019	0	47	922	154,635	0	0	0	3,670	0	0
Cache	0	1,772	106,269	97,908	0	94	1,842	308,860	0	0	0	7,331	0	0
Carbon	0	482	28,907	26,632	0	26	501	84,014	0	0	0	1,994	0	0
Daggett	0	16	978	901	0	1	17	2,841	0	0	0	67	0	0
Davis	0	4,796	287,673	265,039	0	255	4,985	836,088	0	0	0	19,846	0	0
Duchesne	0	307	18,433	16,983	0	16	319	53,574	0	0	0	1,272	0	0
Emery	0	242	14,523	13,381	0	13	252	42,210	0	0	0	1,002	0	0
Garfield	0	98	5,865	5,404	0	5	102	17,046	0	0	0	405	0	0
Grand	0	175	10,472	9,648	0	9	181	30,436	0	0	0	722	0	0
Iron	0	554	33,236	30,621	0	29	576	96,596	0	0	0	2,293	0	0
Juab	0	144	8,658	7,977	0	8	150	25,164	0	0	0	597	0	0
Kane	0	127	7,611	7,012	0	7	132	22,120	0	0	0	525	0	0
Millard	0	272	16,339	15,053	0	14	283	47,486	0	0	0	1,127	0	0
Morgan	0	143	8,588	7,913	0	8	149	24,961	0	0	0	592	0	0
Piute	0	31	1,885	1,737	0	2	33	5,479	0	0	0	130	0	0
Rich	0	42	2,514	2,316	0	2	44	7,306	0	0	0	173	0	0
Salt Lake	0	18,088	1,085,052	999,681	0	962	18,803	3,153,582	0	0	0	74,855	0	0
San Juan	0	305	18,294	16,854	0	16	317	53,168	0	0	0	1,262	0	0
Sanpete	0	421	25,276	23,287	0	22	438	73,462	0	0	0	1,744	0	0
Sevier	0	382	22,901	21,099	0	20	397	66,558	0	0	0	1,580	0	0
Summit	0	459	27,510	25,346	0	24	477	79,956	0	0	0	1,898	0	0
Tooele	0	654	39,241	36,153	0	35	680	114,048	0	0	0	2,707	0	0
Uintah	0	549	32,956	30,364	0	29	571	95,784	0	0	0	2,274	0	0
Utah	0	6,774	406,372	374,399	0	360	7,042	1,181,074	0	0	0	28,034	0	0
Wasatch	0	261	15,640	14,410	0	14	271	45,457	0	0	0	1,079	0	0
Washington	0	1,367	81,974	75,524	0	73	1,421	238,247	0	0	0	5,655	0	0
Wayne	0	51	3,072	2,830	0	3	53	8,929	0	0	0	212	0	0
Weber	0	3,934	236,003	217,435	0	209	4,090	685,917	0	0	0	16,281	0	0
Total Statewide	0	43,450	2,606,429	2,401,357	0	2,312	45,168	7,575,292	0	0	0	179,810	0	0

Table A-10 Calculation of 1993 Utah Electric Utility Carbon Dioxide Emmissions by County (Tons CO2)

County	Asphalt & Road Oil	Aviation Gasoline	Distillate Fuel Oil	Jet Fuel Kerosene	Kerosene	LPG	Lubricants	Motor Gasoline	Residual Fuel Oil	Bituminous Coal	Coke	Natural Gas	Wood	Other
Beaver	0	0	139	0	0	0	0	0	0	0	0	0	0	0
Box Elder	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cache	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	0	0	740	0	0	0	0	0	0	161,817	0	0	0	0
Daggett	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Davis	0	0	754	0	0	0	0	0	0	0	0	4,639	0	0
Duchesne	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Emery	0	0	11,852	0	0	0	0	0	0	17,958,291	0	0	0	0
Garfield	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iron	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Juab	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kane	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Millard	0	0	10,025	0	0	0	0	0	0	12,244,929	0	0	0	0
Morgan	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Piute	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rich	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salt Lake	0	0	0	0	0	0	0	0	0	1,902	0	265,041	0	0
San Juan	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sanpete	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sevier	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Summit	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tooele	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Uintah	0	0	0	0	0	0	0	0	0	3,583,226	0	0	0	0
Utah	0	0	2,075	0	0	0	0	0	0	32,209	0	36,426	0	0
Wasatch	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Washington	0	0	0	0	0	0	0	0	0	0	0	53,514	0	0
Wayne	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weber	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Statewide	0	0	25,585	0	0	0	0	0	0	33,982,374	0	359,620	0	0

Table A-11 County Population and Employment as a Ratio of Statewide Population and Employment

County	Year	Actual Number of Resident	Commercial	Industrial	Transportation	Electric	Fraction of State Total Resident	Commercial	Industrial	Transportation	Electric
Beaver	1990	4,800	1,149	442	113	30	0.00	0.00	0.00	0.01	0.01
	1993	5,000	1,343	428	107	28	0.00	0.00	0.00	0.00	0.01
Box Elder	1990	36,500	7,162	10,105	183	0	0.02	0.01	0.06	0.02	0.00
	1993	38,100	7,502	10,543	241	0	0.02	0.01	0.06	0.01	0.00
Cache	1990	70,500	20,069	11,435	435	0	0.04	0.03	0.07	0.05	0.00
	1993	76,099	23,282	12,507	587	0	0.04	0.04	0.07	0.02	0.00
Carbon	1990	20,200	5,851	2,035	246	116	0.01	0.01	0.01	0.03	0.03
	1993	20,700	6,146	1,849	210	152	0.01	0.01	0.01	0.01	0.04
Daggett	1990	700	310	47	18	0	0.00	0.00	0.00	0.00	0.00
	1993	700	352	37	0	0	0.00	0.00	0.00	0.00	0.00
Davis	1990	188,000	51,669	11,320	2,018	0	0.11	0.09	0.07	0.22	0.00
	1993	206,001	55,323	13,937	1,882	0	0.11	0.08	0.08	0.06	0.00
Duchesne	1990	12,600	2,960	1,616	271	70	0.01	0.01	0.01	0.03	0.02
	1993	13,200	3,227	1,785	319	76	0.01	0.00	0.01	0.01	0.02
Emery	1990	10,300	1,855	1,782	116	609	0.01	0.00	0.01	0.01	0.16
	1993	10,400	1,874	1,618	147	579	0.01	0.00	0.01	0.00	0.16
Garfield	1990	3,950	1,311	526	13	25	0.00	0.00	0.00	0.00	0.01
	1993	4,200	1,562	435	10	21	0.00	0.00	0.00	0.00	0.01
Grand	1990	6,600	2,307	393	69	0	0.00	0.00	0.00	0.01	0.00
	1993	7,499	3,125	474	66	0	0.00	0.00	0.00	0.00	0.00
Iron	1990	20,900	6,678	1,678	163	145	0.01	0.01	0.01	0.02	0.04
	1993	23,800	8,266	1,906	148	54	0.01	0.01	0.01	0.00	0.02
Juab	1990	5,800	1,410	763	28	0	0.00	0.00	0.00	0.00	0.00
	1993	6,200	1,681	740	60	0	0.00	0.00	0.00	0.00	0.00
Kane	1990	5,150	1,607	259	31	0	0.00	0.00	0.00	0.00	0.00
	1993	5,450	1,909	277	9	0	0.00	0.00	0.00	0.00	0.00
Millard	1990	11,300	2,506	1,520	52	610	0.01	0.00	0.01	0.01	0.16
	1993	11,700	2,720	1,273	60	593	0.01	0.00	0.01	0.00	0.17
Morgan	1990	5,550	868	694	0	0	0.00	0.00	0.00	0.00	0.00
	1993	6,150	949	752	5	0	0.00	0.00	0.00	0.00	0.00
Piute	1990	1,250	176	184	12	0	0.00	0.00	0.00	0.00	0.00
	1993	1,350	186	173	15	0	0.00	0.00	0.00	0.00	0.00
Rich	1990	1,750	399	261	0	0	0.00	0.00	0.00	0.00	0.00
	1993	1,800	437	250	0	0	0.00	0.00	0.00	0.00	0.00
Salt Lake	1990	728,000	292,107	70,514	0	1,875	0.42	0.50	0.43	0.00	0.49
	1993	777,001	331,275	73,598	22,433	1,712	0.42	0.50	0.42	0.72	0.48
San Juan	1990	12,600	2,742	983	143	0	0.01	0.00	0.01	0.02	0.00
	1993	13,100	3,245	1,127	160	0	0.01	0.00	0.01	0.01	0.00
Sanpete	1990	16,300	3,424	2,076	74	0	0.01	0.01	0.01	0.01	0.00
	1993	18,100	4,269	1,884	79	0	0.01	0.01	0.01	0.00	0.00
Sevier	1990	15,400	4,125	1,526	285	93	0.01	0.01	0.01	0.03	0.02
	1993	16,399	4,507	1,589	329	82	0.01	0.01	0.01	0.01	0.02
Summit	1990	15,700	7,666	1,543	165	0	0.01	0.01	0.01	0.02	0.00
	1993	19,700	9,501	1,784	125	0	0.01	0.01	0.01	0.00	0.00
Tooele	1990	26,700	9,077	2,020	177	0	0.02	0.02	0.01	0.02	0.00
	1993	28,100	7,991	2,115	166	0	0.02	0.01	0.01	0.01	0.00
Uintah	1990	22,200	5,190	2,337	262	0	0.01	0.01	0.01	0.03	0.00
	1993	23,600	5,817	2,252	289	0	0.01	0.01	0.01	0.01	0.00
Utah	1990	266,000	81,747	19,743	1,933	0	0.15	0.14	0.12	0.21	0.00
	1993	291,001	94,436	22,543	1,483	0	0.16	0.14	0.13	0.05	0.00
Wasatch	1990	10,100	2,385	833	69	0	0.01	0.00	0.01	0.01	0.00
	1993	11,200	2,661	859	65	0	0.01	0.00	0.00	0.00	0.00
Washington	1990	49,100	13,119	3,201	743	0	0.03	0.02	0.02	0.08	0.00
	1993	58,701	16,952	4,432	812	0	0.03	0.03	0.03	0.03	0.00
Wayne	1990	2,150	475	365	0	0	0.00	0.00	0.00	0.00	0.00
	1993	2,200	608	322	0	0	0.00	0.00	0.00	0.00	0.00
Weber	1990	159,000	54,214	14,704	1,477	227	0.09	0.09	0.09	0.16	0.06
	1993	169,001	58,448	15,212	1,488	236	0.09	0.09	0.09	0.05	0.07
Statewide	1990	1,729,100	584,558	164,905	9,096	3,800					
Statewide	1993	1,866,452	659,594	176,701	31,295	3,533					

State of Utah Economic and Demographic Projections for 1994, Governor's Office of Planning and Budget

Table A-12 Utah Counties with Electric Utilities.

County	*Electric Utility*
Cache	Logan City Light and Power
Carbon	PacifiCorp Helper Plant
Davis	Bountiuful City Light and Power
Emery	PacifiCorp Huntington and Castledale Plants
Millard	Intermountain Power Generation
Salt Lake	LDS Hospital University of Utah PacifiCorp Gadsby and South Temple
Uintah	Deseret Generation
Utah	Payson City BYU Springville City
Weber	PacifiCorp Ogden
Washington	City of St George

Appendix B

Coal Mining

Calculations for 1990 Totals
Underground mines

Low:

$$\mathbf{22{,}012{,}000}(tons)\times 370(\frac{ft^3}{ton})=8{,}144{,}440{,}000ft^3 methane$$

$$\frac{8{,}144{,}440{,}000ft^3 methane}{1{,}000{,}000}=8{,}144.44\times 10^6 ft^3 methane$$

High:

$$22{,}012{,}000(tons)\times 470(\frac{ft^3}{ton})=10{,}345{,}640.00ft^3 methane$$

$$\frac{10{,}345{,}640.00ft^3 methane}{1{,}000{,}000}=10{,}345.64\times 10^6 ft^3 methane$$

Post-mining
Low:

$$22{,}012{,}000(tons)\times 55\frac{ft^3}{ton}=1{,}210{,}660{,}000ft^3 methane$$

$$\frac{1{,}210{,}660{,}000ft^3 methane}{1{,}000{,}000}=1{,}210.66\times 10^6 ft^3 methane$$

High:

$$\mathbf{22{,}012{,}000}(tons)\times 90\frac{ft^3}{ton}=1{,}981{,}080{,}000ft^3 methane$$

$$\frac{1{,}981080{,}000ft^3 methane}{1{,}000{,}000}=1{,}981.08\times 10^6 ft^3 methane$$

Low:

$$8{,}144.44\times 10^6 ft^3 methane+1{,}210.66\times 10^6 ft^3 methane=9{,}355.1\times 10^6 ft^3 methane$$

High:

$$10{,}345.44\times 10^6 ft^3 methane+1{,}981.08\times 10^6 ft^3 methane=12{,}326.72\times 10^6 ft^3 methane$$

Low plus High:

$$9{,}355.1\times 10^6 ft^3 methane+12{,}326.72\times 10^6 ft^3 methane=21{,}681.82\times 10^6 ft^3 methane$$

Average:

$$\frac{21{,}681.82\times 10^6 ft^3 methane}{2}=10{,}840.91\times 10^6 ft^3 methane$$

Subtract Recovered Methane:

$$10{,}840.91\times 10^6 ft^3 methane-126.503\times 10^6 ft^3 methane=10{,}714.407\times 10^6 ft^3 methane$$

Convert Cubic Feet Methane to Tons Methane

$$10{,}714.407\times 10^6 ft^3 methane\times 20.66\frac{tons}{10^6 ft^3}=221{,}359.65 tons$$

Calculations for 1993 Totals
Underground mines

Low:

$$21{,}723{,}000(tons)\times 370(\frac{ft^3}{ton})=8{,}037{,}510{,}000 ft^3 methane$$

$$\frac{8{,}037{,}510{,}000 ft^3 methane}{1{,}000{,}000}=8{,}037.51\times 10^6 ft^3 methane$$

High:

$$21{,}723{,}000(tons)\times 470(\frac{ft^3}{ton})=10{,}209{,}810{,}000 ft^3 methane$$

$$\frac{10{,}209{,}810{,}000 ft^3 methane}{1{,}000{,}000}=10{,}209.81\times 10^6 ft^3 methane$$

Post-mining
Low:

$$21{,}723{,}000(tons)\times 55\frac{ft^3}{ton}=1{,}194{,}765{,}000 ft^3 methane$$

$$\frac{1{,}194{,}765{,}000 ft^3 methane}{1{,}000{,}000}=1{,}194.765\times 10^6 ft^3 methane$$

High:

$$\mathbf{21{,}723{,}000}(tons)\times 90\frac{ft^3}{ton}=1{,}955{,}070{,}000ft^3 methane$$

$$\frac{1{,}955{,}070{,}000ft^3 methane}{1{,}000{,}000}=1{,}955.07\times 10^6 ft^3 methane$$

Low:

$$8{,}037.51\times 10^6 ft^3 methane+1{,}194.765\times 10^6 ft^3 methane=9{,}232.275\times 10^6 ft^3 methane$$

High:

$$10{,}209.81\times 10^6 ft^3 methane+1{,}955.07\times 10^6 ft^3 methane=12{,}164.88\times 10^6 ft^3 methane$$

Low plus High:

$$9{,}232.275\times 10^6 ft^3 methane+12{,}164.88\times 10^6 ft^3 methane=21{,}397.15\times 10^6 ft^3 methane$$

Average:

$$\frac{21{,}397.15\times 10^6 ft^3 methane}{2}=10{,}698.58\times 10^6 ft^3 methane$$

Subtract Recovered Methane:

$$10{,}698.58\times 10^6 ft^3 methane-383.271\times 10^6 ft^3 methane=10{,}315.31\times 10^6 ft^3 methane$$

Convert Cubic Feet Methane to Tons Methane

Appendic C

Methane Emissions from Landfills

Table C-1 Estimates of Methane Emissions from Landfills in Utah

County	Year	Population	Avg. Annual Growth Rate (%)	Correction Factor	Est. Waste in Place (Tons)	Methane Generated (Tons/Year) Small MSW Landfills	Large MSW Landfills	Industrial Landfills	Total Methane after Adjustment for Flaring, Rec and Oxidation (Tons/Year)
Beaver	1990	4,800	0.41	0.87	72,154.53	21.00	0.00	1.47	20.22
	1993	5,000	0.61	0.86	73,920.96	21.52	0.00	1.51	20.72
Box Elder	1990	36,500	0.84	0.84	529,213.18	154.03	0.00	10.78	148.33
	1993	38,100	0.68	0.85	559,970.64	162.99	0.00	11.41	156.95
Cache	1990	70,500	2.22	0.74	901,538.77	262.40	5785.60	423.36	5824.22
	1993	76,099	2.22	0.74	973,137.57	283.24	5958.10	436.89	6010.41
Carbon	1990	20,200	0.02	0.90	313,419.07	91.22	5785.60	411.38	5659.38
	1993	20,700	0.39	0.87	311,679.77	90.72	5958.10	423.42	5825.01
Daggett	1990	700	-0.99	0.97	11,737.74	3.42	0.00	0.24	3.29
	1993	700	-0.18	0.91	11,034.66	3.21	0.00	0.22	3.09
Davis	1990	188,000	3.48	0.65	2,110,370.91	614.24	11571.20	852.98	11734.58
	1993	206,001	3.21	0.67	2,381,408.36	693.13	11916.20	882.65	12142.79
Duchesne	1990	12,600	2.08	0.75	163,313.45	47.53	0.00	3.33	45.78
	1993	13,200	2.26	0.74	168,144.03	48.94	0.00	3.43	47.13
Emery	1990	10,300	2.33	0.73	130,309.25	37.93	0.00	2.65	36.52
	1993	10,400	2.35	0.73	131,316.47	38.22	0.00	2.68	36.81
Garfield	1990	3,950	0.45	0.87	59,181.24	17.23	0.00	1.21	16.59
	1993	4,200	0.74	0.85	61,416.57	17.88	0.00	1.25	17.21
Grand	1990	6,600	-0.60	0.94	107,478.35	31.28	0.00	2.19	30.13
	1993	7,499	-0.33	0.92	119,607.53	34.81	0.00	2.44	33.52
Iron	1990	20,900	2.20	0.74	267,783.01	77.94	0.00	5.46	75.06
	1993	23,800	2.72	0.71	289,593.19	84.29	0.00	5.90	81.17
Juab	1990	5,800	0.91	0.84	83,590.71	24.33	0.00	1.70	23.43
	1993	6,200	1.03	0.83	88,433.02	25.74	0.00	1.80	24.79
Kane	1990	5,150	2.33	0.73	65,154.62	18.96	0.00	1.33	18.26
	1993	5,450	2.44	0.73	68,206.66	19.85	0.00	1.39	19.12
Millard	1990	11,300	1.24	0.81	158,233.78	46.06	0.00	3.22	44.35
	1993	11,700	1.57	0.79	159,047.31	46.29	0.00	3.24	44.58
Morgan	1990	5,550	2.17	0.75	71,316.30	20.76	0.00	1.45	19.99
	1993	6,150	2.44	0.73	76,967.14	22.40	0.00	1.57	21.57

Table C-1 Estimates of Methane Emissions from Landfills in Utah (Continued)

County	Year	Population	Avg. Annual Growth Rate (%)	Correction Factor	Est. Waste in Place (Tons)	Methane Generated (Tons/Year) Small MSW Landfills	Large MSW Landfills	Industrial Landfills	Total Methane after Adjustment for Flaring, Rec and Oxidation (Tons/Year)
Piute	1990	1,250	-0.55	0.94	20,278.25	5.90	0.00	0.41	5.68
	1993	1,350	-0.04	0.90	21,046.76	6.13	0.00	0.43	5.90
Rich	1990	1,750	0.20	0.89	26,762.04	7.79	0.00	0.55	7.50
	1993	1,800	0.29	0.88	27,325.79	7.95	0.00	0.56	7.66
Salt Lake	1990	713,000	2.00	0.76	9,312,197.19	2,710.41	11,571.20	999.71	13,753.18
	1993	747,001	1.92	0.76	9,830,372.97	2,861.23	11,916.20	1,034.42	14,230.66
San Juan	1990	12,600	1.34	0.80	174,875.26	50.90	0.00	3.56	49.02
	1993	13,100	1.86	0.77	173,367.83	50.46	0.00	3.53	48.59
Sanpete	1990	16,300	1.55	0.79	221,982.98	64.61	0.00	4.52	62.22
	1993	18,100	1.85	0.77	239,763.21	69.79	0.00	4.88	67.20
Sevier	1990	15,400	1.36	0.80	213,354.50	62.10	0.00	4.35	59.80
	1993	16,399	1.65	0.78	221,297.73	64.41	0.00	4.51	62.03
Summit	1990	15,700	3.6	0.64	173,902.25	50.62	0.00	3.54	48.74
	1993	19,700	4.32	0.59	200,620.32	58.39	0.00	4.09	56.23
Tooele	1990	26,700	1.18	0.82	375,866.30	109.40	0.00	7.66	105.35
	1993	28,100	0.94	0.83	403,937.24	117.57	0.00	8.23	113.22
Uintah	1990	22,200	2.11	0.75	286,916.90	83.51	0.00	5.85	80.42
	1993	23,600	2.09	0.75	305,596.04	88.95	0.00	6.23	85.66
Utah	1990	266,000	3.26	0.67	3,058,515.44	890.21	5,785.60	467.31	6,428.80
	1993	291,001	3.38	0.66	3,302,680.26	961.28	5,958.10	484.36	6,663.36
Wasatch	1990	10,100	2.37	0.73	127,278.01	37.05	0.00	2.59	35.67
	1993	11,200	2.64	0.71	137,390.19	39.99	0.00	2.80	38.51
Washington	1990	49,100	5.74	0.49	413,567.58	120.37	5,785.60	413.42	5,687.45
	1993	58,701	6.23	0.45	458,769.59	133.53	5,958.10	426.41	5,866.24
Wayne	1990	2,150	0.75	0.85	31,412.77	9.14	0.00	0.64	8.80
	1993	2,200	0.81	0.84	31,979.62	9.31	0.00	0.65	8.96
Weber	1990	159,000	1.08	0.82	2,258,021.02	657.22	5,785.60	451.00	6,204.43
	1993	169,001	1.19	0.82	2,376,997.29	691.85	5,958.10	465.50	6,403.90
Statewide Total	**1990**	**1,714,100**			**21,739,725.42**	**6,327.56**	**52,070.38**	**4,087.86**	**56,237.22**
	1993	**1,836,452**			**23,205,028.73**	**6,754.06**	**53,622.90**	**4,226.39**	**58,143.01**

Appendix D

Domesticated Animals

Table D-1 Methane Emissions from Domesticated Animals

Average Animal Population (head)			Statewide Populations 1990	Statewide Populations 1993	Western U.S. emissions factors (lbs methane/head/yr)	1990 Emissions (lbs)	1990 Emissions (tons	1993 Emissions (lbs)	1993 Emissions (tons
Cattle*									
	Dairy								
		0-12 month replacements	27,000	26,000	45.5	1,228,500.00	614.25	1,183,000.00	591.50
		12-24 month replacements**	52,000	45,000	134.6	6,999,200.00	3,499.60	6,057,000.00	3,028.50
		Mature Cows	80,000	80,000	262.5	21,000,000.00	10,500.00	21,000,000.00	10,500.00
		Total Dairy	159,000	151,000		29,227,700.00	14,613.85	28,240,000.00	14,120.00
	Beef								
		0-12 month replacements	108,000	110,000	49.9	5,389,200.00	2,694.60	5,489,000.00	2,744.50
		12-24 month replacements**	58,000	69,000	142.7	8,276,600.00	4,138.30	9,846,300.00	4,923.15
		Mature Cows	321,000	340,000	152.0	48,792,000.00	24,396.00	51,680,000.00	25,840.00
		Bulls #	19,000	20,000	220.0	4,180,000.00	2,090.00	4,400,000.00	2,200.00
		Steers ##	109,000	115,000	220.0	23,980,000.00	11,990.00	25,300,000.00	12,650.00
		Total Beef	615,000	654,000		90,617,800.00	45,308.90	96,715,300.00	48,357.65
Buffalo			950	950	220.0	209,000.00	104.50	209,000.00	104.50
Sheep			509,000	440,000	17.6	8,958,400.00	4,479.20	7,744,000.00	3,872.00
Goats ^			2,120	2,129	11.0	23,320.00	11.66	23,419.00	11.71
Swine			33,000	40,000	3.3	108,900.00	54.45	132,000.00	66.00
Horses ^^			34,700	34,778	39.6	1,374,120.00	687.06	1,377,208.80	688.60
Mules/Asses ^^^			560	565	48.5	27,160.00	13.58	27,402.50	13.70
		Total	1,354,330	1,323,422		130,546,400	65,273.20	134,468,330	67,234.17
Big Game			428,505	293,260		16,446,047.63	8,223.02	12,023,997.30	6,012.00
		Total Including Big Game	1,782,835	1,616,682		146,992,447.62	73,496.22	146,492,327.60	73,246.16

* Beginning 1/1/71, classification estimates for Cattle were changed from sex and age to sex and weight.
** Heifers 500 lbs and over are assumed to be at least 12 months old, and will be categorized as 12-24 month replacements.
\# Bulls 500 lbs and over are categorized only as Beef Cattle.
\## Steers 500 lbs and over are added to the Bulls category for Beef Cattle.
Steers, Heifers, and Bulls under 500 lbs are assumed to be less than 12 months old,
and are ratioed to the Beef and Dairy 0-12 month replacements category based on the total beef cows and dairy cows for 1/1/91.
^ Goat populations are based on a 1992 Deparment of Agriculture census.
^^ Horse populations are based on a 1992 Deparment of Agriculture census. Category includes ponies.
^^^ Mules/Asses populations are based on a 1992 Deparment of Agriculture census. Category includes Mules, Burros, Donkeys.

1990				1993			
All Cows & Heifers that have calved (1000 head)				All Cows & Heifers that have calved (1000 head)			
Beef Cows	Dairy Cows		Total	Beef Cows	Dairy Cows		Total
321	80	=	401	340	80	=	420
80.05%	19.95%	=	100.00%	80.95%	19.05%	=	100.00%
Steers, Heifers, Bulls under 500 lbs (1000 head)				Steers, Heifers, Bulls under 500 lbs (1000 head)			
108	27	=	135	110	26	=	136

Table D-2 Methane Emissions from Domesticated Animals - by County

Livestock/Products (million $)			Statewide Populations		Beaver			
1990	1993	Average Animal Population (head)	1990	1993	1990	Emissions Tons	1993	Emissions Tons
574.3	556.3	Cattle*			2.70%		3.20%	
		Dairy						
		0-12 month replacements	27,000	26,000	1,013	23.03	878	19.96
		12-24 month replacements**	52,000	45,000	1,950	131.24	1,519	102.21
		Mature Cows	80,000	80,000	3,000	393.75	2,700	354.38
		Beef						
		0-12 month replacements	108,000	110,000	3,364	83.94	4,432	110.59
		12-24 month replacements**	58,000	69,000	1,807	128.92	2,780	198.37
		Mature Cows	321,000	340,000	10,000	760.00	13,700	1,041.20
		Bulls #	19,000	20,000	592	65.11	806	88.65
		Steers ##	109,000	115,000	3,396	373.52	4,634	509.72
		Buffalo	950	950	0	0.00	0	0.00
		Sheep	509,000	440,000	1,000	8.80	499	4.39
		Goats ^	2,120	2,129	57	0.31	68	0.37
		Swine	33,000	40,000	891	1.47	1,280	2.11
		Horses ^^	34,700	34,778	937	18.54	1,113	22.03
		Mules/Asses ^^^	560	565	15	0.37	18	0.44
		Big Game @	427,555	292,310		326.83		238.39
		Total 1990 County Totals	1,781,885	1,615,732	1990	2,385.31		
		1993 County Totals			1993			2,692.82

Table D-2 Methane Emissions from Domesticated Animals - by County (continued)

Livestock/Products (million $)			Box Elder				Cache		
1990	1993	Average Animal Population (head)	1990	Emissions Tons	1993	Emissions Tons	1990	Emissions Tons	1993
574.3	556.3	Cattle*	8.41%		8.25%		13.01%		14.36%
		Dairy							
		0-12 month replacements	2,700	61.43	2,860	65.07	7,425	168.92	7,053
		12-24 month replacements**	5,200	349.96	4,950	333.14	14,300	962.39	12,206
		Mature Cows	8,000	1,050.00	8,800	1,155.00	22,000	2,887.50	21,700
		Beef							
		0-12 month replacements	9,757	243.44	8,509	212.30	2,019	50.37	2,815
		12-24 month replacements**	5,240	373.87	5,337	380.82	1,084	77.35	1,766
		Mature Cows	29,000	2,204.00	26,300	1,998.80	6,000	456.00	8,700
		Bulls #	1,598	175.77	1,547	170.18	355	39.07	512
		Steers ##	9,847	1,083.21	8,896	978.51	2,037	224.11	2,943
		Buffalo	0	0.00	0	0.00	0	0.00	0
		Sheep	41,000	360.80	36,800	323.84	6,000	52.80	5,000
		Goats ^	178	0.98	176	0.97	276	1.52	306
		Swine	2,775	4.58	3,300	5.45	4,293	7.08	5,744
		Horses ^^	2,918	57.78	2,870	56.82	4,514	89.39	4,994
		Mules/Asses ^^^	47	1.14	47	1.13	73	1.77	81
		Big Game @		326.83		238.39		326.83	
		Total 1990 County Totals		6,482.60				5,505.44	
		1993 County Totals				5,920.40			

Table D-2 Methane Emissions from Domesticated Animals - by County (continued)

Livestock/Products (million $)			Carbon				Daggett		
1990	1993	Average Animal Population (head)	1990	Emissions Tons	1993	Emissions Tons	1990	Emissions Tons	1993
574.3	556.3	Cattle*	0.78%		0.63%		0.26%		0.18%
		Dairy							
		0-12 month replacements	0	0.00	0	0.00	0	0.00	0
		12-24 month replacements**	0	0.00	0	0.00	0	0.00	0
		Mature Cows	0	0.00	0	0.00	0	0.00	0
		Beef							
		0-12 month replacements	2,355	58.76	2,459	61.35	673	16.79	809
		12-24 month replacements**	1,265	90.24	1,542	110.05	361	25.78	507
		Mature Cows	7,000	532.00	7,600	577.60	2,000	152.00	2,500
		Bulls #	414	45.58	447	49.18	118	13.02	147
		Steers ##	2,377	261.46	2,571	282.76	679	74.70	846
		Buffalo	400	44.00	400	44.00	0	0.00	0
		Sheep	7,900	69.52	6,300	55.44	1,000	8.80	700
		Goats ^	17	0.09	13	0.07	6	0.03	4
		Swine	257	0.42	252	0.42	86	0.14	72
		Horses ^^	271	5.36	219	4.34	90	1.79	63
		Mules/Asses ^^^	4	0.11	4	0.09	1	0.04	1
		Big Game @		326.83		238.39		0.00	
		Total 1990 County Totals		1,477.41				301.88	
		1993 County Totals				1,423.68			

Table D-2 Methane Emissions from Domesticated Animals - by County (continued)

Livestock/Products (million $) 1990	1993	Average Animal Population (head)	Davis 1990	Emissions Tons	1993	Emissions Tons	Duchesne 1990	Emissions Tons	1993	Emissions Tons
574.3	556.3	Cattle*	2.09%		2.07%		4.48%		4.55%	
		Dairy								
		0-12 month replacements	506	11.52	390	8.87	1,013	23.03	878	19.96
		12-24 month replacements**	975	65.62	675	45.43	1,950	131.24	1,688	113.57
		Mature Cows	1,500	196.88	1,200	157.50	3,000	393.75	2,700	354.38
		Beef								
		0-12 month replacements	1,682	41.97	2,038	50.85	8,748	218.25	10,353	258.31
		12-24 month replacements**	903	64.46	1,279	91.22	4,698	335.19	6,494	463.36
		Mature Cows	5,000	380.00	6,300	478.80	26,000	1,976.00	32,000	2,432.00
		Bulls #	296	32.55	371	40.76	1,539	169.28	1,882	207.06
		Steers ##	1,698	186.76	2,131	234.40	8,829	971.15	10,824	1,190.59
		Buffalo	550	60.50	550	60.50	0	0.00	0	0.00
		Sheep	14,000	123.20	14,000	123.20	14,000	123.20	11,600	102.08
		Goats ^	44	0.24	44	0.24	95	0.52	97	0.53
		Swine	690	1.14	828	1.37	1,478	2.44	1,820	3.00
		Horses ^^	725	14.36	720	14.25	1,555	30.78	1,582	31.33
		Mules/Asses ^^^	12	0.28	12	0.28	25	0.61	26	0.62
		Big Game @		0.00		0.00		326.83		238.39
		Total — 1990 County Totals		1,214.87				4,843.35		
		1993 County Totals				1,307.69				5,415.18

Table D-2 Methane Emissions from Domesticated Animals - by County (continued)

Livestock/Products (million $) 1990	1993	Average Animal Population (head)	Emery 1990	Emissions Tons	1993	Emissions Tons	Garfield 1990	Emissions Tons	1993	Emissions Tons
574.3	556.3	Cattle*	1.79%		1.94%		1.38%		1.26%	
		Dairy								
		0-12 month replacements	270	6.14	195	4.44	101	2.30	3,250	73.94
		12-24 month replacements**	520	35.00	338	22.71	195	13.12	5,625	378.56
		Mature Cows	800	105.00	600	78.75	300	39.38	10,000	1,312.50
		Beef								
		0-12 month replacements	4,374	109.13	4,012	100.09	370	9.23	162	4.04
		12-24 month replacements**	2,349	167.59	2,516	179.55	199	14.18	101	7.24
		Mature Cows	13,000	988.00	12,400	942.40	1,100	83.60	499	37.92
		Bulls #	769	84.64	729	80.24	65	7.16	29	3.24
		Steers ##	4,414	485.58	4,194	461.35	374	41.09	169	18.60
		Buffalo	0	0.00	0	0.00	0	0.00	0	0.00
		Sheep	8,000	70.40	6,600	58.08	3,000	26.40	2,100	18.48
		Goats ^	38	0.21	41	0.23	29	0.16	27	0.15
		Swine	591	0.97	776	1.28	455	0.75	504	0.83
		Horses ^^	621	12.30	675	13.36	479	9.48	438	8.68
		Mules/Asses ^^^	10	0.24	11	0.27	8	0.19	7	0.17
		Big Game @		326.83		238.39		326.83		238.39
		Total — 1990 County Totals		2,463.79				591.09		
		1993 County Totals				2,181.13				2,102.74

Table D-2 Methane Emissions from Domesticated Animals - by County (continued)

Livestock/Products (million $) 1990	1993	Average Animal Population (head)	Grand 1990	Emissions Tons	1993	Emissions Tons	Iron 1990	Emissions Tons	1993	Emissions Tons
574.3	556.3	Cattle*	0.40%		0.25%		2.11%		1.87%	
		Dairy								
		0-12 month replacements	0	0.00	65	1.49	405	9.21	260	5.92
		12-24 month replacements**	0	0.00	113	7.62	780	52.49	450	30.29
		Mature Cows	0	0.00	201	26.42	1,200	157.50	800	105.00
		Beef								
		0-12 month replacements	1,009	25.18	647	16.14	3,364	83.94	3,462	86.37
		12-24 month replacements**	542	38.68	406	28.96	1,807	128.92	2,171	154.93
		Mature Cows	3,000	228.00	2,000	152.00	10,000	760.00	10,700	813.20
		Bulls #	178	19.53	118	12.94	592	65.11	629	69.24
		Steers ##	1,019	112.06	676	74.41	3,396	373.52	3,619	398.10
		Buffalo	0	0.00	0	0.00	0	0.00	0	0.00
		Sheep	100	0.88	600	5.28	52,000	457.60	42,100	370.48
		Goats ^	8	0.05	5	0.03	45	0.25	40	0.22
		Swine	132	0.22	100	0.17	696	1.15	748	1.23
		Horses ^^	139	2.75	87	1.72	732	14.50	650	12.88
		Mules/Asses ^^^	2	0.05	1	0.03	12	0.29	11	0.26
		Big Game @		326.83		238.39		326.83		238.39
		Total — 1990 County Totals		776.85				2,504.25		
		1993 County Totals				565.61				2,286.50

Table D-2 Methane Emissions from Domesticated Animals - by County (continued)

Livestock/Products (million $) 1990	1993	Average Animal Population (head)	Juab 1990	Emissions Tons	1993	Emissions Tons	Kane 1990	Emissions Tons	1993	Emissions Tons
574.3	556.3	Cattle*	1.06%		0.92%		0.80%		0.67%	
		Dairy								
		0-12 month replacements	68	1.54	163	3.70	34	0.77	33	0.74
		12-24 month replacements**	130	8.75	281	18.93	65	4.37	56	3.79
		Mature Cows	200	26.25	500	65.63	100	13.13	100	13.13
		Beef								
		0-12 month replacements	3,028	75.55	1,941	48.43	1,682	41.97	1,779	44.40
		12-24 month replacements**	1,626	116.03	1,218	86.88	903	64.46	1,116	79.64
		Mature Cows	9,000	684.00	6,000	456.00	5,000	380.00	5,500	418.00
		Bulls #	533	58.60	353	38.82	296	32.55	324	35.59
		Steers ##	3,056	336.17	2,029	223.24	1,698	186.76	1,860	204.63
		Buffalo	0	0.00	0	0.00	0	0.00	0	0.00
		Sheep	4,000	35.20	4,200	36.96	2,000	17.60	1,900	16.72
		Goats ^	23	0.12	20	0.11	17	0.09	14	0.08
		Swine	351	0.58	367	0.61	264	0.44	266	0.44
		Horses ^^	369	7.30	319	6.31	278	5.50	231	4.58
		Mules/Asses ^^^	6	0.14	5	0.13	4	0.11	4	0.09
		Big Game @		326.83		238.39		326.83		238.39
		Total 1990 County Totals		1,727.36				1,106.82		
		1993 County Totals				1,224.12				1,060.20

Table D-2 Methane Emissions from Domesticated Animals - by County (continued)

Livestock/Products (million $) 1990	1993	Average Animal Population (head)	Millard 1990	Emissions Tons	1993	Emissions Tons	Morgan 1990	Emissions Tons	1993	Emissions Tons
574.3	556.3	Cattle*	4.95%		4.40%		1.99%		1.96%	
		Dairy								
		0-12 month replacements	844	19.20	683	15.53	506	11.52	520	11.83
		12-24 month replacements**	1,625	109.36	1,181	79.50	975	65.62	900	60.57
		Mature Cows	2,500	328.13	2,100	275.63	1,500	196.88	1,600	210.00
		Beef								
		0-12 month replacements	5,720	142.70	6,826	170.32	1,009	25.18	1,003	25.02
		12-24 month replacements**	3,072	219.16	4,282	305.52	542	38.68	629	44.89
		Mature Cows	17,000	1,292.00	21,100	1,603.60	3,000	228.00	3,100	235.60
		Bulls #	1,006	110.69	1,241	136.53	178	19.53	182	20.06
		Steers ##	5,773	634.98	7,137	785.04	1,019	112.06	1,049	115.34
		Buffalo	0	0.00	0	0.00	0	0.00	0	0.00
		Sheep	7,000	61.60	4,100	36.08	16,000	140.80	11,000	96.80
		Goats ^	105	0.58	94	0.52	42	0.23	42	0.23
		Swine	1,632	2.69	1,762	2.91	655	1.08	784	1.29
		Horses ^^	1,716	33.98	1,532	30.33	689	13.64	681	13.49
		Mules/Asses ^^^	28	0.67	25	0.60	11		11	0.27
		Big Game @		326.83		238.39		326.83		238.39
		Total 1990 County Totals		3,381.04				1,215.44		
		1993 County Totals				3,680.49				1,073.78

Table D-2 Methane Emissions from Domesticated Animals - by County (continued)

Livestock/Products (million $) 1990	1993	Average Animal Population (head)	Piute 1990	Emissions Tons	1993	Emissions Tons	Rich 1990	Emissions Tons	1993	Emissions Tons
574.3	556.3	Cattle*	1.17%		1.15%		3.01%		3.02%	
		Dairy								
		0-12 month replacements	405	9.21	553	12.57	34	0.77	33	0.74
		12-24 month replacements**	780	52.49	956	64.36	65	4.37	56	3.79
		Mature Cows	1,200	157.50	1,700	223.13	100	13.13	100	13.13
		Beef								
		0-12 month replacements	1,682	41.97	1,456	36.32	9,084	226.65	9,479	236.51
		12-24 month replacements**	903	64.46	913	65.16	4,879	348.08	5,946	424.26
		Mature Cows	5,000	380.00	4,500	342.00	27,000	2,052.00	29,300	2,226.80
		Bulls #	296	32.55	265	29.12	1,598	175.79	1,724	189.59
		Steers ##	1,698	186.76	1,522	167.43	9,132	1,004.56	9,910	1,090.13
		Buffalo	0	0.00	0	0.00	0	0.00	0	0.00
		Sheep	5,000	44.00	4,800	42.24	18,000	158.40	11,500	101.20
		Goats ^	25	0.14	24	0.13	64	0.35	64	0.35
		Swine	385	0.64	460	0.76	994	1.64	1,208	1.99
		Horses ^^	405	8.02	400	7.92	1,045	20.70	1,050	20.80
		Mules/Asses ^^^	7	0.16	7	0.16	17	0.41	17	0.41
		Big Game @		326.83		238.39		326.83		238.39
		Total 1990 County Totals		1,343.87				4,463.69		
		1993 County Totals				1,229.68				4,548.09

Table D-2 Methane Emissions from Domesticated Animals - by County (continued)

Livestock/Products (million $) 1990	1993	Average Animal Population (head)	Salt Lake 1990	Emissions Tons	1993	Emissions Tons	San Juan 1990	Emissions Tons	1993	Emissions Tons
574.3	556.3	Cattle*	4.25%		4.35%		1.43%		1.22%	
		Dairy								
		0-12 month replacements	608	13.82	943	21.44	34	0.77	33	0.74
		12-24 month replacements**	1,170	78.74	1,631	109.78	65	4.37	56	3.79
		Mature Cows	1,800	236.25	2,900	380.63	100	13.13	100	13.13
		Beef								
		0-12 month replacements	1,346	33.58	1,682	41.97	3,701	92.34	4,918	122.70
		12-24 month replacements**	723	51.57	1,055	75.30	1,988	141.81	3,085	220.09
		Mature Cows	4,000	304.00	5,200	395.20	11,000	836.00	15,200	1,155.20
		Bulls #	237	26.04	306	33.65	651	71.62	894	98.35
		Steers ##	1,358	149.41	1,759	193.47	3,735	410.87	5,141	565.53
		Buffalo	0	0.00	0	0.00	0	0.00	0	0.00
		Sheep	21,000	184.80	24,500	215.60	3,000	26.40	3,000	26.40
		Goats ^	90	0.50	93	0.51	30	0.17	26	0.14
		Swine	1,402	2.31	1,740	2.87	471	0.78	488.94	0.81
		Horses ^^	1,474	29.19	1,513	29.96	495	9.81	425	8.42
		Mules/Asses ^^^	24	0.58	25	0.60	8	0.19	7	0.17
		Big Game @		0.00		0.00		326.83		238.39
		Total 1990 County Totals		1,144.11				1,993.14		
		1993 County Totals				1,500.97				2,453.85

Table D-2 Methane Emissions from Domesticated Animals - by County (continued)

Livestock/Products (million $) 1990	1993	Average Animal Population (head)	Sanpete 1990	Emissions Tons	1993	Emissions Tons	Sevier 1990	Emissions Tons	1993	Emissions Tons
574.3	556.3	Cattle*	12.95%		12.71%		4.27%		4.57%	
		Dairy								
		0-12 month replacements	1,958	44.53	2,015	45.84	1,350	30.71	1,430	32.53
		12-24 month replacements**	3,770	253.72	3,488	234.71	2,600	174.98	2,475	166.57
		Mature Cows	5,800	761.25	6,200	813.75	4,000	525.00	4,400	577.50
		Beef								
		0-12 month replacements	5,047	125.92	4,529	113.01	4,374	109.13	4,206	104.94
		12-24 month replacements**	2,710	193.38	2,841	202.72	2,349	167.59	2,638	188.24
		Mature Cows	15,000	1,140.00	14,000	1,064.00	13,000	988.00	13,000	988.00
		Bulls #	888	97.66	824	90.59	769	84.64	765	84.12
		Steers ##	5,093	560.28	4,735	520.88	4,414	485.58	4,397	483.68
		Buffalo	0	0.00	0	0.00	0	0.00	0	0.00
		Sheep	89,000	783.20	74,600	656.48	14,000	123.20	11,000	96.80
		Goats ^	275	1.51	271	1.49	90	0.50	97	0.53
		Swine	4,275	7.05	5,084	8.39	1,408	2.32	1,826	3.01
		Horses ^^	4,495	89.01	4,420	87.51	1,480	29.31	1,588	31.44
		Mules/Asses ^^^	73	1.76	72	1.74	24	0.58	26	0.63
		Big Game @		326.83		238.39		326.83		238.39
		Total 1990 County Totals		4,517.69				3,139.82		
		1993 County Totals				4,079.50				2,996.37

Table D-2 Methane Emissions from Domesticated Animals - by County (continued)

Livestock/Products (million $) 1990	1993	Average Animal Population (head)	Summit 1990	Emissions Tons	1993	Emissions Tons	Tooele 1990	Emissions Tons	1993	Emissions Tons
574.3	556.3	Cattle*	2.86%		2.41%		1.69%		1.29%	
		Dairy								
		0-12 month replacements	709	16.12	585	13.31	34	0.77	33	0.74
		12-24 month replacements**	1,365	91.86	1,013	68.14	65	4.37	56	3.79
		Mature Cows	2,100	275.63	1,800	236.25	100	13.13	100	13.13
		Beef								
		0-12 month replacements	3,028	75.55	2,976	74.26	4,710	117.52	3,268	81.53
		12-24 month replacements**	1,626	116.03	1,867	133.21	2,530	180.49	2,050	146.25
		Mature Cows	9,000	684.00	9,200	699.20	14,000	1,064.00	10,100	767.60
		Bulls #	533	58.60	541	59.53	829	91.15	594	65.35
		Steers ##	3,056	336.17	3,112	342.29	4,754	522.93	3,416	375.78
		Buffalo	0	0.00	0	0.00	0	0.00	0	0.00
		Sheep	42,000	369.60	29,500	259.60	12,000	105.60	9,300	81.84
		Goats ^	61	0.33	51	0.28	36	0.20	28	0.15
		Swine	942	1.55	964	1.59	557	0.92	518	0.85
		Horses ^^	991	19.62	838	16.59	586	11.60	450	8.91
		Mules/Asses ^^^	16	0.39	14	0.33	9	0.23	7	0.18
		Big Game @		326.83		238.39		326.83		238.39
		Total 1990 County Totals		2,443.45				2,512.93		
		1993 County Totals				2,142.98				1,784.48

Table D-2 Methane Emissions from Domesticated Animals - by County (continued)

Livestock/Products (million $) 1990	1993	Average Animal Population (head)	Uintah 1990	Emissions Tons	1993	Emissions Tons	Utah 1990	Emissions Tons	1993	Emissions Tons
574.3	556.3	Cattle*	3.47%		3.49%		9.93%		10.52%	
		Dairy								
		0-12 month replacements	439	9.98	553	12.57	2,869	65.26	2,535	57.67
		12-24 month replacements**	845	56.87	956	64.36	5,525	371.83	4,388	295.28
		Mature Cows	1,300	170.63	1,700	223.13	8,500	1115.63	7,800	1023.75
		Beef								
		0-12 month replacements	8,075	201.47	7,182	179.20	5,383	134.31	6,115	152.56
		12-24 month replacements**	4,336	309.41	4,505	321.45	2,891	206.27	3,836	273.67
		Mature Cows	24,000	1824.00	22,200	1687.20	16,000	1216.00	18,900	1436.40
		Bulls #	1,421	156.26	1,306	143.65	947	104.17	1,112	122.29
		Steers ##	8,150	896.45	7,509	825.97	5,433	597.63	6,393	703.19
		Buffalo	0	0.00	0	0.00	0	0.00	0	0.00
		Sheep	23,000	202.40	18,200	160.16	41,000	360.80	46,100	405.68
		Goats ^	73	0.40	74	0.41	210	1.16	224	1.23
		Swine	1,143	1.89	1,395	2.30	3,275	5.40	4,206	6.94
		Horses ^^	1,202	23.81	1,213	24.01	3,444	68.19	3,657	72.41
		Mules/Asses ^^^	19	0.47	20	0.48	56	1.35	59	1.44
		Big Game @		326.83		238.39		0.00		0.00
		Total 1990 County Totals		4,306.28				4,375.45		
		1993 County Totals				3,883.27				4,552.52

Table D-2 Methane Emissions from Domesticated Animals - by County (continued)

Livestock/Products (million $) 1990	1993	Average Animal Population (head)	Wasatch 1990	Emissions Tons	1993	Emissions Tons	Washington 1990	Emissions Tons	1993	Emissions Tons
574.3	556.3	Cattle*	1.65%		1.71%		1.24%		1.24%	
		Dairy								
		0-12 month replacements	911	20.73	650	14.79	34	0.77	33	0.74
		12-24 month replacements**	1,755	118.11	1,125	75.71	65	4.37	56	3.79
		Mature Cows	2,700	354.38	2,000	262.50	100	13.13	100	13.13
		Beef								
		0-12 month replacements	1,009	25.18	1,262	31.48	3,028	75.55	3,171	79.11
		12-24 month replacements**	542	38.68	791	56.47	1,626	116.03	1,989	141.90
		Mature Cows	3,000	228.00	3,900	296.40	9,000	684.00	9,800	744.80
		Bulls #	178	19.53	229	25.24	533	58.60	576	63.41
		Steers ##	1,019	112.06	1,319	145.10	3,056	336.17	3,315	364.62
		Buffalo	0	0.00	0	0.00	0	0.00	0	0.00
		Sheep	15,000	132.00	12,500	110.00	1,000	8.80	499	4.39
		Goats ^	35	0.19	36	0.20	26	0.14	26	0.15
		Swine	546	0.90	683	1.13	408	0.67	496	0.82
		Horses ^^	574	11.37	594	11.76	429	8.49	431	8.54
		Mules/Asses ^^^	9	0.22	10	0.23	7	0.17	7	0.17
		Big Game @		326.83		238.39		326.83		238.39
		Total 1990 County Totals		1,429.82				1,682.73		
		1993 County Totals				1,269.40				1,663.94

Table D-2 Methane Emissions from Domesticated Animals - by County (continued)

Livestock/Products (million $) 1990	1993	Average Animal Population (head)	Wayne 1990	Emissions Tons	1993	Emissions Tons	Weber 1990	Emissions Tons	1993	Emissions Tons
574.3	556.3	Cattle*	1.57%		1.55%		4.34%		4.28%	
		Dairy								
		0-12 month replacements	371	8.45	195	4.44	2,363	53.75	2,275	51.76
		12-24 month replacements**	715	48.12	338	22.71	4,550	306.22	3,938	264.99
		Mature Cows	1,100	144.38	600	78.75	7,000	918.75	7,000	918.75
		Beef								
		0-12 month replacements	3,701	92.34	3,171	79.11	1,346	33.58	2,265	56.50
		12-24 month replacements**	1,988	141.81	1,989	141.90	723	51.57	1,421	101.36
		Mature Cows	11,000	836.00	9,800	744.80	4,000	304.00	7,000	532.00
		Bulls #	651	71.62	576	63.41	237	26.04	412	45.29
		Steers ##	3,735	410.87	3,315	364.62	1,358	149.41	2,368	260.44
		Buffalo	0	0.00	0	0.00	0	0.00	0	0.00
		Sheep	12,000	105.60	8,300	73.04	7,000	61.60	8,900	78.32
		Goats ^	33	0.18	33	0.18	92	0.51	91	0.50
		Swine	517	0.85	618	1.02	1,431	2.36	1,711	2.82
		Horses ^^	544	10.77	538	10.65	1,504	29.79	1,488	29.46
		Mules/Asses ^^^	9	0.21	9	0.21	24	0.59	24	0.59
		Big Game @		326.83		238.39		0.00		0.00
		Total 1990 County Totals		2,263.97				1,996.30		
		1993 County Totals				1,823.23				2,413.07

Table D-2 notes:

- * Beginning 1/1/71, Utah classification estimates for Cattle were changed from sex and age to sex and weight.
- ** Heifers 500 lbs and over are assumed to be at least 12 months old, and will be categorized as 12-24 month replacements.
- \# Bulls 500 lbs and over are categorized only as Beef Cattle.
- \## Steers 500 lbs and over are added to the Bulls category for Beef Cattle.
  Steers, Heifers, and Bulls under 500 lbs are assumed to be less than 12 months old,
  and are ratioed to the Beef and Dairy 0-12 month replacements category based on the total beef cows and dairy cows for 1/1/91.
- ^ 1993 Goat populations are based on a 1992 Deparment of Agriculture census.
- ^^ 1993 Horse populations are based on a 1992 Deparment of Agriculture census. Category includes ponies.
- ^^ 1993 Mules/Asses populations are based on a 1992 Deparment of Agriculture census. Category includes Mules, Burros, Donkeys.
  There is an estimated 0.48% overall average livestock population increase from 1990 to 1993. This was used to back-calculate estimated 1990 populations for the Goats, Horses, and Mules/Asses categories.
  As only selected items were provided in the Enterprise Budgets reports (in bold), remaining Cattle categories were estimated as a percentage of each county's reported share of the Dairy and Beef Cattle categories; other categories were estimated based on each county's reported share of the Annual Livestock Cash Receipts.
- @ Big Game animals include: moose, elk, mule deer, antelope, bighorn sheep, and mountain goats. Populations were distributed equally among all counties, except for Davis, Salt Lake, Utah, and Weber - where the greatest human populations reside.
  To adjust for estimating animal populations in each county, and the resulting discrepancies in emission totals between the Statewide totals and the County grand total, each county total was normalized against the Statewide total for each year.

Appendix E

Methane from Manure Management

Table E-1 Methane Emissions from Manure Management: 1990

		Type	Populations: 1990	Emissions (tons)	Beaver Emissions (tons) % of State Cash Value = 2.70	Box Elder Emissions (tons) % of State Cash Value =8.41%	Cache Emissions (tons) % of State Cash Value = 13.01	Carbon Emissions (tons) % of State Cash Value = .78%
Cattle								
	Beef	Steers	109,000	17.13	0.46	1.44	2.23	0.13
		Heifers*	58,000	9.11	0.25	0.77	1.19	0.07
		Calves**	108,000	8.48	0.23	0.71	1.10	0.07
		Cows	321,000	70.00	1.89	5.89	9.11	0.55
		Bulls	19,000	5.97	0.16	0.50	0.78	0.05
		Beef Totals	615000	110.69	2.99	9.31	14.40	0.86
	Dairy	Heifers***	79,000	241.78	6.53	20.33	31.46	1.89
		Cows	80,000	364.68	9.85	30.67	47.45	2.84
		Dairy Totals	159000	606.46	16.37	51.00	78.90	4.73
Swine^		Market	28,000	923.56	24.94	77.67	120.16	7.20
		Breeding	5,000	499.24	13.48	41.99	64.95	3.89
		Swine Totals	33000	1422.80	38.42	119.66	185.11	11.10
Poultry^		Layers	1,817,000	340.56	9.20	28.64	44.31	2.66
		Broilers	1,190,000	109.92	2.97	9.24	14.30	0.86
		Ducks	n/a	0.00	0.00	0.00	0.00	0.00
		Turkeys	3,930,000	8.75	0.24	0.74	1.14	0.07
		Poultry Totals	6937000	459.24	12.40	38.62	59.75	3.58
Other Animals		Sheep	509,000	14.14	0.38	1.19	1.84	0.11
		Goats	2,120	0.05	0.00	0.00	0.01	0.00
		Mules/Asses^	560	0.13	0.00	0.01	0.02	0.00
		Horses^^	34,700	12.35	0.33	1.04	1.61	0.10
		Emission Totals		2,625.86	70.90	220.83	341.62	20.48

Table E-1 Methane Emissions from Manure Management: 1990 (continued)

		Type	Daggett Emissions (tons) % of State Cash Value = .26%	Davis Emissions (tons) % of State Cash Value = 2.09	Duchesne Emissions (tons) % of State Cash Value =4.48%	Emery Emissions (tons) % of State Cash Value =1.79%	Garfield Emissions (tons) % of State Cash Value =1.38%	Grand Emissions (tons) % of State Cash Value =.40%
Cattle								
	Beef	Steers	0.04	0.36	0.77	0.31	0.24	0.07
		Heifers*	0.02	0.19	0.41	0.16	0.13	0.04
		Calves**	0.02	0.18	0.38	0.15	0.12	0.03
		Cows	0.18	1.46	3.14	1.25	0.97	0.28
		Bulls	0.02	0.12	0.27	0.11	0.08	0.02
		Beef Totals	0.29	2.31	4.96	1.98	1.53	0.44
	Dairy	Heifers***	0.63	5.05	10.83	4.33	3.34	0.97
		Cows	0.95	7.62	16.34	6.53	5.03	1.46
		Dairy Totals	1.58	12.67	27.17	10.86	8.37	2.43
Swine^		Market	2.40	19.30	41.38	16.53	12.75	3.69
		Breeding	1.30	10.43	22.37	8.94	6.89	2.00
		Swine Totals	3.70	29.74	63.74	25.47	19.63	5.69
Poultry^		Layers	0.89	7.12	15.26	6.10	4.70	1.36
		Broilers	0.29	2.30	4.92	1.97	1.52	0.44
		Ducks	0.00	0.00	0.00	0.00	0.00	0.00
		Turkeys	0.02	0.18	0.39	0.16	0.12	0.03
		Poultry Totals	1.19	9.60	20.57	8.22	6.34	1.84
Other Animals		Sheep	0.04	0.30	0.63	0.25	0.20	0.06
		Goats	0.00	0.00	0.00	0.00	0.00	0.00
		Mules/Asses^	0.00	0.00	0.01	0.00	0.00	0.00
		Horses^^	0.03	0.26	0.55	0.22	0.17	0.05
		Emission Totals	6.83	54.88	117.64	47.00	36.24	18.50

Table E-1 Methane Emissions from Manure Management: 1990 (continued)

		Type	Iron Emissions (tons) % of State Cash Value =2.11%	Juab Emissions (tons) % of State Cash Value =1.06%	Kane Emissions (tons) % of State Cash Value =.80%	Millard Emissions (tons) % of State Cash Value = 4.95	Morgan Emissions (tons) % of State Cash Value = 1.99	Piute Emissions (tons) % of State Cash Value = 1.17
Cattle								
	Beef	Steers	0.36	0.18	0.14	0.85	0.34	0.20
		Heifers*	0.19	0.10	0.07	0.45	0.18	0.11
		Calves**	0.18	0.09	0.07	0.42	0.17	0.10
		Cows	1.48	0.74	0.56	3.46	1.39	0.82
		Bulls	0.13	0.06	0.05	0.30	0.12	0.07
		Beef Totals	2.34	1.17	0.89	5.48	2.20	1.30
	Dairy	Heifers***	5.10	2.56	1.93	11.97	4.81	2.83
		Cows	7.69	3.87	2.92	18.05	7.26	4.27
		Dairy Totals	12.80	6.43	4.85	30.02	12.07	7.10
Swine^		Market	19.49	9.79	7.39	45.72	18.38	10.81
		Breeding	10.53	5.29	3.99	24.71	9.93	5.84
		Swine Totals	30.02	15.08	11.38	70.43	28.31	16.65
Poultry^		Layers	7.19	3.61	2.72	16.86	6.78	3.98
		Broilers	2.32	1.17	0.88	5.44	2.19	1.29
		Ducks	0.00	0.00	0.00	0.00	0.00	0.00
		Turkeys	0.18	0.09	0.07	0.43	0.17	0.10
		Poultry Totals	9.69	4.87	3.67	22.73	9.14	5.37
Other Animals		Sheep	0.30	0.15	0.11	0.70	0.28	0.17
		Goats	0.00	0.00	0.00	0.00	0.00	0.00
		Mules/Asses^	0.00	0.00	0.00	0.01	0.00	0.00
		Horses^^	0.26	0.13	0.10	0.61	0.25	0.14
		Emission Totals	55.41	27.83	21.01	129.98	52.25	30.72

Table E-1 Methane Emissions from Manure Management: 1990 (continued)

		Type	Rich Emissions (tons) % of State Cash Value =3.01%	Salt Lake Emissions (tons) % of State Cash Value = 4.25	San Juan Emissions (tons) % of State Cash Value = 1.43	Sanpete Emissions (tons) % of State Cash Value = 12.95	Sevier Emissions (tons) % of State Cash Value = 4.27	Summit Emissions (tons) % of State Cash Value = 2.86
Cattle								
	Beef	Steers	0.52	0.73	0.24	2.22	0.73	0.49
		Heifers*	0.27	0.39	0.13	1.18	0.39	0.26
		Calves**	0.26	0.36	0.12	1.10	0.36	0.24
		Cows	2.11	f	1.00	9.06	2.99	2.00
		Bulls	0.18	0.25	0.09	0.77	0.25	0.17
		Beef Totals	3.33	1.73	1.58	14.33	4.73	3.17
	Dairy	Heifers***	7.28	10.28	3.46	31.31	10.28	6.91
		Cows	10.98	15.50	5.21	47.23	15.50	10.43
		Dairy Totals	18.25	25.77	8.67	78.54	25.77	17.34
Swine^		Market	27.80	39.25	13.21	119.60	39.25	26.41
		Breeding	15.03	21.22	7.14	64.65	21.22	14.28
		Swine Totals	42.83	60.47	20.35	184.25	60.47	40.69
Poultry^		Layers	10.25	14.47	4.87	44.10	14.47	9.74
		Broilers	3.31	4.67	1.57	14.24	4.67	3.14
		Ducks	0.00	0.00	0.00	0.00	0.00	0.00
		Turkeys	0.26	0.37	0.13	1.13	0.37	0.25
		Poultry Totals	13.82	19.52	6.57	59.47	19.52	13.13
Other Animals		Sheep	0.43	0.60	0.20	1.83	0.60	0.40
		Goats	0.00	0.00	0.00	0.01	0.00	0.00
		Mules/Asses^	0.00	0.01	0.00	0.02	0.01	0.00
		Horses^^	0.37	0.52	0.18	1.60	0.52	0.35
		Emission Totals	79.04	108.62	37.55	340.05	111.62	75.10

Table E-1 Methane Emissions from Manure Management: 1990 (continued)

		Type	Tooele Emissions (tons) % of State Cash Value = 1.69%	Uintah Emissions (tons) % of State Cash Value = 3.47%	Utah Emissions (tons) % of State Cash Value = 9.93%	Wasatch Emissions (tons) % of State Cash Value = 1.65%	Washington Emissions (tons) % of State Cash Value = 1.24%	Wayne Emissions (tons) % of State Cash Value = 1.57%	Weber Emissions (tons) % of State Cash Value = 4.34%
Cattle									
	Beef	Steers	0.29	0.59	1.70	0.28	0.21	0.27	0.74
		Heifers*	0.15	0.32	0.90	0.15	0.11	0.14	0.40
		Calves**	0.14	0.29	0.84	0.14	0.11	0.13	0.37
		Cows	1.18	2.43	6.95	1.15	0.87	1.10	3.04
		Bulls	0.10	0.21	0.59	0.10	0.07	0.09	0.26
		Beef Totals	1.87	3.84	10.99	1.83	1.37	1.74	4.89
	Dairy	Heifers***	4.09	8.39	24.01	3.99	3.00	3.80	10.49
		Cows	6.16	12.65	36.21	6.02	4.52	5.73	15.83
		Dairy Totals	10.25	21.04	60.22	10.01	7.52	9.52	26.32
Swine^		Market	15.61	32.05	91.71	15.24	11.45	14.50	40.08
		Breeding	8.44	17.32	49.57	8.24	6.19	7.84	21.67
		Swine Totals	24.05	49.37	141.28	23.48	17.64	22.34	61.75
Poultry^		Layers	5.76	11.82	33.82	5.62	4.22	5.35	14.78
		Broilers	1.86	3.81	10.92	1.81	1.36	1.73	4.77
		Ducks	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Turkeys	0.15	0.30	0.87	0.14	0.11	0.14	0.38
		Poultry Totals	7.76	15.94	45.60	7.58	5.69	7.21	19.93
Other Animals		Sheep	0.24	0.49	1.40	0.23	0.18	0.22	0.61
		Goats	0.00	0.00	0.01	0.00	0.00	0.00	0.00
		Mules/Asses^	0.00	0.00	0.01	0.00	0.00	0.00	0.01
		Horses^^	0.21	0.43	1.23	0.20	0.15	0.19	0.54
		Emission Totals	44.38	91.12	260.75	43.33	32.56	41.23	113.96

^ The category of Mules/Asses was retained from the Domestic Animals section, including Donkeys, to make use of the already calculated populations.

^^ Horses were left as a separate category, like Mules/Asses, to make use of the already calculated populations.

Both the Mules/Asses and Horses categories used the default manure management system for Horses.

Table E-2 1990 Maximum Potential Emissions

		Type	Populations: 1990	Typical Animal Mass (lbs/head)	Volatile Solids (VS) (lbs VS/lb mass)	Total Volatile Solids Produced (lbs)	Methane (CH4) Producing Capacity (Bo) (cu ft/lbs VS)	Maximum Potential Emission (cubic feet)
Cattle								
	Beef	Steers	109,000	794	2.6	225,019,600	2.72	612,053,312
		Heifers*	58,000	794	2.6	119,735,200	2.72	325,679,744
		Calves**	108,000	397	2.6	111,477,600	2.72	303,219,072
		Cows	321,000	1102	2.6	919,729,200	2.72	2,501,663,424
		Bulls	19,000	1587	2.6	78,397,800	2.72	213,242,016
	Dairy	Heifers***	79,000	903	3.65	260,380,050	3.84	999,859,392
		Cows	80,000	1345	3.65	392,740,000	3.84	1,508,121,600
Swine		Market	28,000	101	3.1	8,766,800	7.53	66,014,004
		Breeding	5,000	399	3.1	6,184,500	5.77	35,684,565
Poultry		Layers	1,817,000	3.5	4.4	60,522,000	5.45	329,844,900
		Broilers	1,190,000	1.5	6.2	11,067,000	4.81	53,232,270
		Ducks	n/a	3.1	6.75	0	5.13	0
		Turkeys	3,930,000	7.5	3.32	97,857,000	4.81	470,692,170
Other Animals								
		Sheep	509,000	154	3.36	263,376,960	3.04	800,665,958
		Goats	2,120	141	3.48	1,040,242	2.72	2,829,457
		Mules/Asses^	560	661	3.65	1,351,084	5.29	7,147,234
		Horses^^	34,700	992	3.65	125,641,760	5.29	664,644,910

Table E-3 1990 Methane Emissions from Manure Management

Animal Category	CH4 (lbs/yr)	CH4 (tons/yr)		
Dairy Cattle	1,212,917.29	606.46	23.10%	
Beef Cattle	221,375.72	110.69	4.22%	5.23%
Swine	2,845,602.23	1,422.80	54.18%	
Poultry	918,474.62	459.24	17.49%	
Sheep	28,272.72	14.14	0.54%	
Goats	105.17	0.05	0.00%	
Mules/Asses	265.66	0.13	0.01%	
Horses	24,704.85	12.35	0.47%	
	5,251,718.27	2,625.86	100.00%	

Table E-4 1990 Methane Emissions by Animal Type

Utah Methane Convergence Factor (MCF) (%)	Manure System	Utah Waste System Useage (WS%) (%) Beef	Dairy	Swine	Poultry-Layers	Poultry-Broiler	Poultry-Turkeys	Sheep	Goats	Horses
0.09%	Pasture/Range	95.00%					100.00%	95.00%	100.00%	80.00%
0.20%	Daily Spread		8.00%							
0.09%	Solid Storage		90.00%							
1.00%	Drylot	5.00%		25.00%						
10.00%	Deep Pit Stacks				50.00%					
10.00%	Litter					100.00%	0.00%			
0.09%	Paddock									20.00%
17.40%	Liquid/Slurry	0.00%	1.00%		0.00%					
90.00%	Anaerobic Lagoon	0.00%	1.00%	75.00%	0.00%					
8.70%	Pit Storage < 1 month			0.00%						
17.40%	Pit Storage > 1 month			0.00%						
	Other	0.00%	0.00%	0.00%	50.00%		0.00%	5.00%	0.00%	0.00%
		100.00%	100.00%	100.00%	100.00%		100.00%	100.00%	100.00%	100.00%

Beef Steers	Manure System	Methane Emissions (Cubic Feet)	Methane Emissions (lbs)
	Pasture/Range	523,305.58	21,612.52
	Daily Spread	0.00	0.00
	Solid Storage	0.00	0.00
	Drylot	306,026.66	12,638.90
	Deep Pit Stacks	0.00	0.00
	Litter	0.00	0.00
	Paddock	0.00	0.00
	Liquid/Slurry	0.00	0.00
	Anaerobic Lagoon	0.00	0.00
	Pit Storage < 1 month	0.00	0.00
	Pit Storage > 1 month	0.00	0.00
		Total	34,251.42

Beef Heifers	Manure System	Methane Emission (Cubic Feet)	Methane Emissions (lbs)
	Pasture/Range	278,456.18	11,500.24
	Daily Spread	0.00	0.00
	Solid Storage	0.00	0.00
	Drylot	162,839.87	6,725.29
	Deep Pit Stacks	0.00	0.00
	Litter	0.00	0.00
	Paddock	0.00	0.00
	Liquid/Slurry	0.00	0.00
	Anaerobic Lagoo	0.00	0.00
	Pit Storage < 1 m	0.00	0.00
	Pit Storage > 1 m	0.00	0.00
		Total	18,225.53

Dairy Heifers	Manure System	Methane Emissions (Cubic Feet)	Methane Emissions (lbs)
	Pasture/Range	0.00	0.00
	Daily Spread	159,977.50	6,607.07
	Solid Storage	809,886.11	33,448.30
	Drylot	0.00	0.00
	Deep Pit Stacks	0.00	0.00
	Litter	0.00	0.00
	Paddock	0.00	0.00
	Liquid/Slurry	1,739,755.34	71,851.90
	Anaerobic Lagoon	8,998,734.53	371,647.74
	Pit Storage < 1 month	0.00	0.00
	Pit Storage > 1 month	0.00	0.00
		Total	483,555.00

Dairy Cows	Manure System	Methane Emission (Cubic Feet)	Methane Emissions (lbs)
	Pasture/Range	0.00	0.00
	Daily Spread	241,299.46	9,965.67
	Solid Storage	1,221,578.50	50,451.19
	Drylot	0.00	0.00
	Deep Pit Stacks	0.00	0.00
	Litter	0.00	0.00
	Paddock	0.00	0.00
	Liquid/Slurry	2,624,131.58	108,376.63
	Anaerobic Lagoo	13,573,094.40	560,568.80
	Pit Storage < 1 m	0.00	0.00
	Pit Storage > 1 m	0.00	0.00
		Total	729,362.29

Table E-4 1990 Methane Emissions by Animal Type (continued)

Swine Market	Manure System	Methane Emissions (Cubic Feet)	Methane Emissions (lbs)	Swine Breeding	Manure System	Methane Emissions (Cubic Feet)	Methane Emission (lbs)
	Pasture/Range	0.00	0.00		Pasture/Range	0.00	0.00
	Daily Spread	0.00	0.00		Daily Spread	0.00	0.00
	Solid Storage	0.00	0.00		Solid Storage	0.00	0.00
	Drylot	165,035.01	6,815.95		Drylot	89,211.41	3,684.43
	Deep Pit Stacks	0.00	0.00		Deep Pit Stacks	0.00	0.00
	Litter	0.00	0.00		Litter	0.00	0.00
	Paddock	0.00	0.00		Paddock	0.00	0.00
	Liquid/Slurry	0.00	0.00		Liquid/Slurry	0.00	0.00
	Anaerobic Lagoon	44,559,452.70	1,840,305.40		Anaerobic Lagoo	24,087,081.38	994,796.46
	Pit Storage < 1 month	0.00	0.00		Pit Storage < 1	0.00	0.00
	Pit Storage > 1 month	0.00	0.00		Pit Storage > 1	0.00	0.00
		Total	1,847,121.34			Total	998,480.89

Poultry Layers	Manure System	Methane Emissions (Cubic Feet)	Methane Emissions (lbs)	Poultry Broilers	Manure System	Methane Emissions (Cubic Feet)	Methane Emission (lbs)
	Pasture/Range	0.00	0.00		Pasture/Range	0.00	0.00
	Daily Spread	0.00	0.00		Daily Spread	0.00	0.00
	Solid Storage	0.00	0.00		Solid Storage	0.00	0.00
	Drylot	0.00	0.00		Drylot	0.00	0.00
	Deep Pit Stacks	16,492,245.00	681,129.72		Deep Pit Stacks	0.00	0.00
	Litter	0.00	0.00		Litter	5,323,227.00	219,849.28
	Paddock	0.00	0.00		Paddock	0.00	0.00
	Liquid/Slurry	0.00	0.00		Liquid/Slurry	0.00	0.00
	Anaerobic Lagoon	0.00	0.00		Anaerobic Lagoo	0.00	0.00
	Pit Storage < 1 month	0.00	0.00		Pit Storage < 1	0.00	0.00
	Pit Storage > 1 month	0.00	0.00		Pit Storage > 1	0.00	0.00
		Total	681,129.72			Total	219,849.28

Other Animals Sheep	Manure System	Methane Emissions (Cubic Feet)	Methane Emissions (lbs)	Other Animals Goats	Manure System	Methane Emissions (Cubic Feet)	Methane Emission (lbs)
	Pasture/Range	684,569.39	28,272.72		Pasture/Range	2,546.51	105.17
	Daily Spread	0.00	0.00		Daily Spread	0.00	0.00
	Solid Storage	0.00	0.00		Solid Storage	0.00	0.00
	Drylot	0.00	0.00		Drylot	0.00	0.00
	Deep Pit Stacks	0.00	0.00		Deep Pit Stacks	0.00	0.00
	Litter	0.00	0.00		Litter	0.00	0.00
	Paddock	0.00	0.00		Paddock	0.00	0.00
	Liquid/Slurry	0.00	0.00		Liquid/Slurry	0.00	0.00
	Anaerobic Lagoon	0.00	0.00		Anaerobic Lagoo	0.00	0.00
	Pit Storage < 1 month	0.00	0.00		Pit Storage < 1	0.00	0.00
	Pit Storage > 1 month	0.00	0.00		Pit Storage > 1	0.00	0.00
		Total	28,272.72			Total	105.17

Table E-4 1990 Methane Emissions by Animal Type (continued)

Beef Calves	Manure System	Methane Emission (Cubic Feet)	Methane Emissions (lbs)
	Pasture/Range	259,252.31	10,707.12
	Daily Spread	0.00	0.00
	Solid Storage	0.00	0.00
	Drylot	151,609.54	6,261.47
	Deep Pit Stacks	0.00	0.00
	Litter	0.00	0.00
	Paddock	0.00	0.00
	Liquid/Slurry	0.00	0.00
	Anaerobic Lagoon	0.00	0.00
	Pit Storage < 1 month	0.00	0.00
	Pit Storage > 1 month	0.00	0.00
		Total	16,968.59

Beef Cows	Manure System	Methane Emissions (Cubic Feet)	Methane Emissions (lbs)
	Pasture/Range	2,138,922.23	88,337.49
	Daily Spread	0.00	0.00
	Solid Storage	0.00	0.00
	Drylot	1,250,831.71	51,659.35
	Deep Pit Stacks	0.00	0.00
	Litter	0.00	0.00
	Paddock	0.00	0.00
	Liquid/Slurry	0.00	0.00
	Anaerobic Lagoon	0.00	0.00
	Pit Storage < 1 mont	0.00	0.00
	Pit Storage > 1 mont	0.00	0.00
		Total	139,996.84

Beef Bulls	Manure System	Methane Emission (Cubic Feet)	Methane Emissions (lbs)
	Pasture/Range	182,321.92	7,529.90
	Daily Spread	0.00	0.00
	Solid Storage	0.00	0.00
	Drylot	106,621.01	4,403.45
	Deep Pit Stacks	0.00	0.00
	Litter	0.00	0.00
	Paddock	0.00	0.00
	Liquid/Slurry	0.00	0.00
	Anaerobic Lagoon	0.00	0.00
	Pit Storage < 1 month	0.00	0.00
	Pit Storage > 1 month	0.00	0.00
		Total	11,933.34

Poultry Turkeys	Manure System	Methane Emissions (Cubic Feet)	Methane Emissions (lbs)
	Pasture/Range	423,622.95	17,495.63
	Daily Spread	0.00	0.00
	Solid Storage	0.00	0.00
	Drylot	0.00	0.00
	Deep Pit Stacks	0.00	0.00
	Litter	0.00	0.00
	Paddock	0.00	0.00
	Liquid/Slurry	0.00	0.00
	Anaerobic Lagoon	0.00	0.00
	Pit Storage < 1 mont	0.00	0.00
	Pit Storage > 1 mont	0.00	0.00
		Total	17,495.63

Other Animals Mules/Asses	Manure System	Methane Emission (Cubic Feet)	Methane Emissions (lbs)
	Pasture/Range	5,146.01	212.53
	Daily Spread	0.00	0.00
	Solid Storage	0.00	0.00
	Drylot	0.00	0.00
	Deep Pit Stacks	0.00	0.00
	Litter	0.00	0.00
	Paddock	1,286.50	53.13
	Liquid/Slurry	0.00	0.00
	Anaerobic Lagoon	0.00	0.00
	Pit Storage < 1 month	0.00	0.00
	Pit Storage > 1 month	0.00	0.00
		Total	265.66

Other Animals Horses	Manure System	Methane Emissions (Cubic Feet)	Methane Emissions (lbs)
	Pasture/Range	478,544.34	19,763.88
	Daily Spread	0.00	0.00
	Solid Storage	0.00	0.00
	Drylot	0.00	0.00
	Deep Pit Stacks	0.00	0.00
	Litter	0.00	0.00
	Paddock	119,636.08	4,940.97
	Liquid/Slurry	0.00	0.00
	Anaerobic Lagoon	0.00	0.00
	Pit Storage < 1 mont	0.00	0.00
	Pit Storage > 1 mont	0.00	0.00
		Total	24,704.85

Table E-5 Methane Emissions from Manure Management: 1993

Type			Populations: 1993	Emissions (tons)	Beaver Emissions (tons) % of State Cash Value = 3.20	Box Elder Emissions (tons) % of State Cash Value = 8.25	Cache Emissions (tons) % of State Cash Value = 14.36	Carbon Emissions (tons) % of State Cash Value = .63%
Cattle								
	Beef	Steers	115,000	18.07	0.58	1.49	2.59	0.11
		Heifers*	69,000	10.84	0.35	0.89	1.56	0.07
		Calves**	110,000	8.64	0.28	0.71	1.24	0.05
		Cows	340,000	74.14	2.37	6.12	10.65	0.47
		Bulls	20,000	6.28	0.20	0.52	0.90	0.04
		Total Beef	654000	117.97	3.78	9.73	16.94	0.74
	Dairy	Heifers***	71,000	217.29	6.95	17.93	31.20	1.37
		Cows	80,000	364.68	11.67	30.09	52.37	2.30
		Total Dairy	151000	581.97	18.62	48.01	83.57	3.67
Swine^		Market	35,000	1,154.45	36.94	95.24	165.78	7.27
		Breeding	5,000	499.24	15.98	41.19	71.69	3.15
		Total Swine	40000	1653.69	52.92	136.43	237.47	10.42
Poultry^		Layers	1,880,000	333.63	10.68	27.52	47.91	2.10
		Broilers	1,210,000	111.77	3.58	9.22	16.05	0.70
		Ducks	n/a		0.00	0.00	0.00	0.00
		Turkeys	3,850,000	8.57	0.27	0.71	1.23	0.05
		Total Poultry	6940000	453.97	14.53	37.45	65.19	2.86
Other Animals		Sheep	440,000	12.22	0.39	1.01	1.75	0.08
		Goats	2,129	0.05	0.00	0.00	0.01	0.00
		Mules/Asses^	565	0.13	0.00	0.01	0.02	0.00
		Horses^^	34,778	12.38	0.40	1.02	1.78	0.08
		Total Emissions		2,832.40	90.64	233.67	406.73	17.84

Table E-5 Methane Emissions from Manure Management: 1993 (continued)

Type			Daggett Emissions (tons) % of State Cash Value = .18%	Davis Emissions (tons) % of State Cash Value = 2.07	Duchesne Emissions (tons) % of State Cash Value = 4.55	Emery Emissions (tons) % of State Cash Value = 1.94	Garfield Emissions (tons) % of State Cash Value = 1.26%	Grand Emissions (tons) % of State Cash Value = .25%
Cattle								
	Beef	Steers	0.03	0.37	0.82	0.35	0.23	0.05
		Heifers*	0.02	0.22	0.49	0.21	0.14	0.03
		Calves**	0.02	0.18	0.39	0.17	0.11	0.02
		Cows	0.13	1.53	3.37	1.44	0.93	0.19
		Bulls	0.01	0.13	0.29	0.12	0.08	0.02
		Total Beef	0.21	2.44	5.37	2.29	1.49	0.29
	Dairy	Heifers***	0.39	4.50	9.89	4.22	2.74	0.54
		Cows	0.66	7.55	16.59	7.07	4.59	0.91
		Total Dairy	1.05	12.05	26.48	11.29	7.33	1.45
Swine^		Market	2.08	23.90	52.53	22.40	14.55	2.89
		Breeding	0.90	10.33	22.72	9.69	6.29	1.25
		Total Swine	2.98	34.23	75.24	32.08	20.84	4.13
Poultry^		Layers	0.60	6.91	15.18	6.47	4.20	0.83
		Broilers	0.20	2.31	5.09	2.17	1.41	0.28
		Ducks	0.00	0.00	0.00	0.00	0.00	0.00
		Turkeys	0.02	0.18	0.39	0.17	0.11	0.02
		Total Poultry	0.82	9.40	20.66	8.81	5.72	1.13
Other Animals		Sheep	0.02	0.25	0.56	0.24	0.15	0.03
		Goats	0.00	0.00	0.00	0.00	0.00	0.00
		Mules/Asses^	0.00	0.00	0.01	0.00	0.00	0.00
		Horses^^	0.02	0.26	0.56	0.24	0.16	0.03
		Total Emissions	5.10	58.63	128.87	54.95	35.69	7.08

Table E-5 Methane Emissions from Manure Management: 1993 (continued)

		Type	Iron Emissions (tons) % of State Cash Value = 1.87	Juab Emissions (tons) % of State Cash Value = .92%	Kane Emissions (tons) % of State Cash Value = .67%	Millard Emissions (tons) % of State Cash Value = 4.40	Morgan Emissions (tons) % of State Cash Value = 1.56	Piute Emissions (tons) % of State Cash Value = 1.15
Cattle								
	Beef	Steers	0.34	0.17	0.12	0.80	0.35	0.21
		Heifers*	0.20	0.10	0.07	0.48	0.21	0.12
		Calves**	0.16	0.08	0.06	0.38	0.17	0.10
		Cows	1.39	0.68	0.50	3.26	1.45	0.85
		Bulls	0.12	0.06	0.04	0.28	0.12	0.07
		Total Beef	2.21	1.09	0.79	5.19	2.31	1.36
	Dairy	Heifers***	4.06	2.00	1.46	9.56	4.26	2.50
		Cows	6.82	3.36	2.44	16.05	7.15	4.19
		Total Dairy	10.88	5.35	3.90	25.61	11.41	6.69
Swine^		Market	21.59	10.62	7.73	50.80	22.63	13.28
		Breeding	9.34	4.59	3.34	21.97	9.79	5.74
		Total Swine	30.92	15.21	11.08	72.76	32.41	19.02
Poultry^		Layers	6.24	3.07	2.24	14.68	6.54	3.84
		Broilers	2.09	1.03	0.75	4.92	2.19	1.29
		Ducks	0.00	0.00	0.00	0.00	0.00	0.00
		Turkeys	0.16	0.08	0.06	0.38	0.17	0.10
		Total Poultry	8.49	4.18	3.04	19.97	8.90	5.22
Other Animals		Sheep	0.23	0.11	0.08	0.54	0.24	0.14
		Goats	0.00	0.00	0.00	0.00	0.00	0.00
		Mules/Asses^	0.00	0.00	0.00	0.01	0.00	0.00
		Horses^^	0.23	0.11	0.08	0.54	0.24	0.14
		Total Emissions	52.97	26.06	18.98	124.63	55.52	32.57

Table E-5 Methane Emissions from Manure Management: 1993 (continued)

		Type	Rich Emissions (tons) % of State Cash Value = 3.02	Salt Lake Emissions (tons) % of State Cash Value = 4.35	San Juan Emissions (tons) % of State Cash Value = 1.22	Sanpete Emissions (tons) % of State Cash Value = 12.71	Sevier Emissions (tons) % of State Cash Value = 4.57	Summit Emissions (tons) % of State Cash Value = 2.41
Cattle								
	Beef	Steers	0.55	0.79	0.22	2.30	0.83	0.44
		Heifers*	0.33	0.47	0.13	1.38	0.50	0.26
		Calves**	0.26	0.38	0.11	1.10	0.39	0.21
		Cows	2.24	3.23	0.90	9.42	3.39	1.79
		Bulls	0.19	0.27	0.08	0.80	0.29	0.15
		Total Beef	3.56	5.13	1.44	14.99	5.39	2.84
	Dairy	Heifers***	6.56	9.45	2.65	27.62	9.93	5.24
		Cows	11.01	15.86	4.45	46.35	16.67	8.79
		Total Dairy	17.58	25.32	7.10	73.97	26.60	14.03
Swine^		Market	34.86	50.22	14.08	146.73	52.76	27.82
		Breeding	15.08	21.72	6.09	63.45	22.82	12.03
		Total Swine	49.94	71.94	20.18	210.18	75.57	39.85
Poultry^		Layers	10.08	14.51	4.07	42.40	15.25	8.04
		Broilers	3.38	4.86	1.36	14.21	5.11	2.69
		Ducks	0.00	0.00	0.00	0.00	0.00	0.00
		Turkeys	0.26	0.37	0.10	1.09	0.39	0.21
		Total Poultry	13.71	19.75	5.54	57.70	20.75	10.94
Other Animals		Sheep	0.37	0.53	0.15	1.55	0.56	0.29
		Goats	0.00	0.00	0.00	0.01	0.00	0.00
		Mules/Asses^	0.00	0.01	0.00	0.02	0.01	0.00
		Horses^^	0.37	0.54	0.15	1.57	0.57	0.30
		Total Emissions	85.54	123.21	34.56	360.00	129.44	68.26

Table E-5 Methane Emissions from Manure Management: 1993 (continued)

		Type	Tooele Emissions (tons) % of State Cash Value = 1.29	Uintah Emissions (tons) % of State Cash Value = 3.49	Utah Emissions (tons) % of State Cash Value = 10.52	Wasatch Emissions (tons) % of State Cash Value = 1.71	Washington Emissions (tons) % of State Cash Value = 1.24	Wayne Emissions (tons) % of State Cash Value = 1.55	Weber Emissions (tons) % of State Cash Value = 4.28%
Cattle									
	Beef	Steers	0.23	0.63	1.90	0.31	0.22	0.28	0.77
		Heifers*	0.14	0.38	1.14	0.19	0.13	0.17	0.46
		Calves**	0.11	0.30	0.91	0.15	0.11	0.13	0.37
		Cows	0.96	2.59	7.80	1.27	0.92	1.15	3.17
		Bulls	0.08	0.22	0.66	0.11	0.08	0.10	0.27
		Total Beef	1.52	4.13	12.41	2.02	1.46	1.83	5.05
	Dairy	Heifers***	2.80	7.58	22.86	3.72	2.69	3.37	9.30
		Cows	4.70	12.73	38.36	6.24	4.52	5.65	15.61
		Total Dairy	7.51	20.31	61.22	9.95	7.22	9.02	24.91
Swine^		Market	14.89	40.29	121.45	19.74	14.32	17.89	49.41
		Breeding	6.44	17.42	52.52	8.54	6.19	7.74	21.37
		Total Swine	21.33	57.71	173.97	28.28	20.51	25.63	70.78
Poultry^		Layers	4.30	11.64	35.10	5.71	4.14	5.17	14.28
		Broilers	1.44	3.90	11.76	1.91	1.39	1.73	4.78
		Ducks	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Turkeys	0.11	0.30	0.90	0.15	0.11	0.13	0.37
		Total Poultry	5.86	15.84	47.76	7.76	5.63	7.04	19.43
Other Animals		Sheep	0.16	0.43	1.29	0.21	0.15	0.19	0.52
		Goats	0.00	0.00	0.01	0.00	0.00	0.00	0.00
		Mules/Asses^	0.00	0.00	0.01	0.00	0.00	0.00	0.01
		Horses^^	0.16	0.43	1.30	0.21	0.15	0.19	0.53
		Total Emissions	36.54	98.85	297.97	48.43	35.12	43.90	121.23

Table E-6 1993 Maximum Potential Emissions

		Type	Populations: 1993	Typical Animal Mas (lbs/head)	Volatile Solids (VS) (lbs VS/lb mass)	Total Volatile Solids Produced (lbs)	Methane (CH4) Producing Capacit (cu ft/lbs VS)	Maximum Potential Emissions (cubic feet)
Cattle								
	Beef	Steers	115,000	794	2.6	237,406,000	2.72	645,744,320
		Heifers*	69,000	794	2.6	142,443,600	2.72	387,446,592
		Calves**	110,000	397	2.6	113,542,000	2.72	308,834,240
		Cows	340,000	1102	2.6	974,168,000	2.72	2,649,736,960
		Bulls	20,000	1587	2.6	82,524,000	2.72	224,465,280
	Dairy	Heifers***	71,000	903	3.65	234,012,450	3.84	898,607,808
		Cows	80,000	1345	3.65	392,740,000	3.84	1,508,121,600
Swine		Market	35,000	101	3.1	10,958,500	7.53	82,517,505
		Breeding	5,000	399	3.1	6,184,500	5.77	35,684,565
Poultry		Layers	1,880,000	3.5	4.4	59,290,000	5.45	323,130,500
		Broilers	1,210,000	1.5	6.2	11,253,000	4.81	54,126,930
		Ducks		3.1	6.75	0	5.13	0
		Turkeys	3,850,000	7.5	3.32	95,865,000	4.81	461,110,650
Other Animals								
	Goats		2,129	141	3.48	1,044,658	2.72	2,841,469
	Mules/Asses^		565	661	3.65	1,363,147	5.29	7,211,049
	Horses^^		34,778	992	3.65	125,924,182	5.29	666,138,925

Table E-7 1993 Methane Emissions from Manure Management

Animal Category	CH4 (lbs/yr)	CH4 (tons/yr)
Dairy Cattle	1,163,949.70	581.97
Beef Cattle	235,946.41	117.97
Swine	3,307,382.57	1,653.69
Poultry	907,948.19	453.97
Sheep	24,440.07	12.22
Goats	105.62	0.05
Mules/Asses	268.03	0.13
Horses	24,760.38	12.38
	5,664,800.97	2,832.40

Table E-8 1993 Methane Emissions by Animal Type

Utah Methane Convergence Factor (MCF) (%)	Manure System	Utah Waste System Useage (WS%) (%) Beef	Dairy	Swine	Poultry-Layer	Poultry-Broilers*	Poultry-Turkeys	Sheep	Goats	Horses
0.09%	Pasture/Range	95.00%					100.00%	95.00%	100.00%	80.00%
0.20%	Daily Spread		8.00%							
0.09%	Solid Storage		90.00%							
1.00%	Drylot	5.00%		25.00%						
10.00%	Deep Pit Stacks				50.00%					
10.00%	Litter					100.00%	0.00%			
0.09%	Paddock									20.00%
17.40%	Liquid/Slurry	0.00%	1.00%		0.00%					
90.00%	Anaerobic Lagoon	0.00%	1.00%	75.00%	0.00%					
8.70%	Pit Storage < 1 month			0.00%						
17.40%	Pit Storage > 1 month			0.00%						
	Other	0.00%	0.00%	0.00%	50.00%		0.00%	5.00%	0.00%	0.00%
		100.00%	100.00%	100.00%	100.00%		100.00%	100.00%	100.00%	100.00%

Beef Steers	Manure System	Methane Emission (Cubic Feet)	Methane Emissions (lbs)	Beef Heifers	Manure System	Methane Emissions (Cubic Feet)	Methane Emissions (lbs)
	Pasture/Range	552,111.39	22,802.20		Pasture/Range	331,266.84	13,681.32
	Daily Spread	0.00	0.00		Daily Spread	0.00	0.00
	Solid Storage	0.00	0.00		Solid Storage	0.00	0.00
	Drylot	322,872.16	13,334.62		Drylot	193,723.30	8,000.77
	Deep Pit Stacks	0.00	0.00		Deep Pit Stacks	0.00	0.00
	Litter	0.00	0.00		Litter	0.00	0.00
	Paddock	0.00	0.00		Paddock	0.00	0.00
	Liquid/Slurry	0.00	0.00		Liquid/Slurry	0.00	0.00
	Anaerobic Lagoon	0.00	0.00		Anaerobic Lagoon	0.00	0.00
	Pit Storage < 1 month	0.00	0.00		Pit Storage < 1 month	0.00	0.00
	Pit Storage > 1 month	0.00	0.00		Pit Storage > 1 month	0.00	0.00
		Total	36,136.82			Total	21,682.09

Dairy Heifers	Manure System	Methane Emission (Cubic Feet)	Methane Emissions (lbs)	Dairy Cows	Manure System	Methane Emissions (Cubic Feet)	Methane Emissions (lbs)
	Pasture/Range	0.00	0.00		Pasture/Range	0.00	0.00
	Daily Spread	143,777.25	5,938.00		Daily Spread	241,299.46	9,965.67
	Solid Storage	727,872.32	30,061.13		Solid Storage	1,221,578.50	50,451.19
	Drylot	0.00	0.00		Drylot	0.00	0.00
	Deep Pit Stacks	0.00	0.00		Deep Pit Stacks	0.00	0.00
	Litter	0.00	0.00		Litter	0.00	0.00
	Paddock	0.00	0.00		Paddock	0.00	0.00
	Liquid/Slurry	1,563,577.59	64,575.75		Liquid/Slurry	2,624,131.58	108,376.63
	Anaerobic Lagoon	8,087,470.27	334,012.52		Anaerobic Lagoon	13,573,094.40	560,568.80
	Pit Storage < 1 month	0.00	0.00		Pit Storage < 1 month	0.00	0.00
	Pit Storage > 1 month	0.00	0.00		Pit Storage > 1 month	0.00	0.00
		Total	434,587.40			Total	729,362.29

Table E-8 1993 Methane Emissions by Animal Type (continued)

Swine Market	Manure System	Methane Emission (Cubic Feet)	Methane Emissions (lbs)	Swine Breeding	Manure System	Methane Emissions (Cubic Feet)	Methane Emissions (lbs)
	Pasture/Range	0.00	0.00		Pasture/Range	0.00	0.00
	Daily Spread	0.00	0.00		Daily Spread	0.00	0.00
	Solid Storage	0.00	0.00		Solid Storage	0.00	0.00
	Drylot	206,293.76	8,519.93		Drylot	89,211.41	3,684.43
	Deep Pit Stacks	0.00	0.00		Deep Pit Stacks	0.00	0.00
	Litter	0.00	0.00		Litter	0.00	0.00
	Paddock	0.00	0.00		Paddock	0.00	0.00
	Liquid/Slurry	0.00	0.00		Liquid/Slurry	0.00	0.00
	Anaerobic Lagoon	55,699,315.88	2,300,381.75		Anaerobic Lagoon	24,087,081.38	994,796.46
	Pit Storage < 1 month	0.00	0.00		Pit Storage < 1 month	0.00	0.00
	Pit Storage > 1 month	0.00	0.00		Pit Storage > 1 month	0.00	0.00
		Total	2,308,901.68			Total	998,480.89

Poultry Layers	Manure System	Methane Emission (Cubic Feet)	Methane Emissions (lbs)	Poultry Broilers	Manure System	Methane Emissions (Cubic Feet)	Methane Emissions (lbs)
	Pasture/Range	0.00	0.00		Pasture/Range	0.00	0.00
	Daily Spread	0.00	0.00		Daily Spread	0.00	0.00
	Solid Storage	0.00	0.00		Solid Storage	0.00	0.00
	Drylot	0.00	0.00		Drylot	0.00	0.00
	Deep Pit Stacks	16,156,525.00	667,264.48		Deep Pit Stacks	0.00	0.00
	Litter	0.00	0.00		Litter	5,412,693.00	223,544.22
	Paddock	0.00	0.00		Paddock	0.00	0.00
	Liquid/Slurry	0.00	0.00		Liquid/Slurry	0.00	0.00
	Anaerobic Lagoon	0.00	0.00		Anaerobic Lagoon	0.00	0.00
	Pit Storage < 1 month	0.00	0.00		Pit Storage < 1 month	0.00	0.00
	Pit Storage > 1 month	0.00	0.00		Pit Storage > 1 month	0.00	0.00
		Total	667,264.48			Total	223,544.22

Other Animals Sheep	Manure System	Methane Emission (Cubic Feet)	Methane Emissions (lbs)	Other Animals Goats	Manure System	Methane Emissions (Cubic Feet)	Methane Emissions (lbs)
	Pasture/Range	591,769.22	24,440.07		Pasture/Range	2,557.32	105.62
	Daily Spread	0.00	0.00		Daily Spread	0.00	0.00
	Solid Storage	0.00	0.00		Solid Storage	0.00	0.00
	Drylot	0.00	0.00		Drylot	0.00	0.00
	Deep Pit Stacks	0.00	0.00		Deep Pit Stacks	0.00	0.00
	Litter	0.00	0.00		Litter	0.00	0.00
	Paddock	0.00	0.00		Paddock	0.00	0.00
	Liquid/Slurry	0.00	0.00		Liquid/Slurry	0.00	0.00
	Anaerobic Lagoon	0.00	0.00		Anaerobic Lagoon	0.00	0.00
	Pit Storage < 1 month	0.00	0.00		Pit Storage < 1 month	0.00	0.00
	Pit Storage > 1 month	0.00	0.00		Pit Storage > 1 month	0.00	0.00
		Total	24,440.07			Total	105.62

Table E-8 1993 Methane Emissions by Animal Type (continued)

Beef Calves	Manure System	Methane Emissions (Cubic Feet)	Methane Emissions (lbs)
	Pasture/Range	264,053.28	10,905.40
	Daily Spread	0.00	0.00
	Solid Storage	0.00	0.00
	Drylot	154,417.12	6,377.43
	Deep Pit Stacks	0.00	0.00
	Litter	0.00	0.00
	Paddock	0.00	0.00
	Liquid/Slurry	0.00	0.00
	Anaerobic Lagoon	0.00	0.00
	Pit Storage < 1 month	0.00	0.00
	Pit Storage > 1 month	0.00	0.00
		Total	17,282.83

Beef Cows	Manure System	Methane Emissions (Cubic Feet)	Methane Emissions (lbs)
	Pasture/Range	2,265,525.10	93,566.19
	Daily Spread	0.00	0.00
	Solid Storage	0.00	0.00
	Drylot	1,324,868.48	54,717.07
	Deep Pit Stacks	0.00	0.00
	Litter	0.00	0.00
	Paddock	0.00	0.00
	Liquid/Slurry	0.00	0.00
	Anaerobic Lagoon	0.00	0.00
	Pit Storage < 1 month	0.00	0.00
	Pit Storage > 1 month	0.00	0.00
		Total	148,283.25

Beef Bulls	Manure System	Methane Emissions (Cubic Feet)	Methane Emissions (lbs)
	Pasture/Range	191,917.81	7,926.21
	Daily Spread	0.00	0.00
	Solid Storage	0.00	0.00
	Drylot	112,232.64	4,635.21
	Deep Pit Stacks	0.00	0.00
	Litter	0.00	0.00
	Paddock	0.00	0.00
	Liquid/Slurry	0.00	0.00
	Anaerobic Lagoon	0.00	0.00
	Pit Storage < 1 month	0.00	0.00
	Pit Storage > 1 month	0.00	0.00
		Total	12,561.41

Poultry Turkeys	Manure System	Methane Emissions (Cubic Feet)	Methane Emissions (lbs)
	Pasture/Range	414,999.59	17,139.48
	Daily Spread	0.00	0.00
	Solid Storage	0.00	0.00
	Drylot	0.00	0.00
	Deep Pit Stacks	0.00	0.00
	Litter	0.00	0.00
	Paddock	0.00	0.00
	Liquid/Slurry	0.00	0.00
	Anaerobic Lagoon	0.00	0.00
	Pit Storage < 1 month	0.00	0.00
	Pit Storage > 1 month	0.00	0.00
		Total	17,139.48

Other Animals Mules/Asses	Manure System	Methane Emissions (Cubic Feet)	Methane Emissions (lbs)
	Pasture/Range	5,191.96	214.43
	Daily Spread	0.00	0.00
	Solid Storage	0.00	0.00
	Drylot	0.00	0.00
	Deep Pit Stacks	0.00	0.00
	Litter	0.00	0.00
	Paddock	1,297.99	53.61
	Liquid/Slurry	0.00	0.00
	Anaerobic Lagoon	0.00	0.00
	Pit Storage < 1 month	0.00	0.00
	Pit Storage > 1 month	0.00	0.00
		Total	268.03

Other Animals Horses	Manure System	Methane Emissions (Cubic Feet)	Methane Emissions (lbs)
	Pasture/Range	479,620.03	19,808.31
	Daily Spread	0.00	0.00
	Solid Storage	0.00	0.00
	Drylot	0.00	0.00
	Deep Pit Stacks	0.00	0.00
	Litter	0.00	0.00
	Paddock	119,905.01	4,952.08
	Liquid/Slurry	0.00	0.00
	Anaerobic Lagoon	0.00	0.00
	Pit Storage < 1 month	0.00	0.00
	Pit Storage > 1 month	0.00	0.00
		Total	24,760.38

Appendix F

Agricultural Soil Management

Table F-1 Fertilizer Consumption (Tons) by County 1991

Fertilizer Types	% Nitrogen Content	Content Ref.	Beaver	Box Elder	Cache	Carbon	Daggett	Duchesne	Davis	Emery	Garfield	Grand	Iron	Juab	Kane	Millard	Morgan	Piute
Nitrogen																		
Ammonium Nitrate	33.5	EPA		4321.02	2521.13	208.82		2330.79	725.10	26.67			433.73	117.43		1027.24	0.80	
Ammonium Sulfate	21	EPA	0.59	334.42	244.41	12.63	0.11	206.61	34.88		0.83		1.20	0.39	0.76	0.80	44.50	0.10
Anhydrous Ammonia	82	EPA		1676.54														
Calcium Nitrate	15	EPA																
Nitrogen Solution 28%	28	EPA			24.54													
Nitrogen Solution 30%	30	EPA																
Nitrogen Solution 32%	32	EPA		3945.16	344.76				165.83							864.26		
Sodium Nitrate	16	EPA																
Sulfur coated Urea	38	EPA																
Urea	46	EPA	0.08	0.44	836.92	0.23	0.03	28.39	0.16	0.09	0.11		0.20	34.76	0.10	1.28	0.05	0.01
Phosphate																		
Superphosphate, Triple	-		0.80	870.58	1231.99	0.28		14.96	114.22	186.87	0.06		0.23	545.71	0.11	219.35	93.82	7452.30
Potash																		
Murite of Potash 60%	-				63.35			1544.36	370.03									
Potassium Sulfate	-							288.72										
Multiple Nutrient																		
Ammonium Phosphate Sulfate	14.5	EPA	80.30			1.09							1.06					
Diammonium Phosphate	18.5	EPA		2.85														
Epson Salt	-																	
Gypsum (Calcium Sulfate)	-																	
Lime Product - Code Unk.	-																	
Monoammonium Phosphate	11	EPA	285.89	1143.97	792.59			871.04	316.95				183.83	77.72		445.57	203.72	
Potash - Not Identified	15	EPA																
Potassium Nitrate	13	EPA																
Sulfur	-		62.14					3.18				25.40		0.13				
Unknown																		
Ammonium Thiosulfate	-			812.17	24.11													
Borax	-																	
Calcium Chelate	-																	
Manure	5	UDADPI																
Copper Sulfate	-																	
Ferric Sulfate	-																	
Ferrous Sulfate	-																	
Iron Chelate	-							0.73										
Iron compound	-																	
Liquid Amm Polyphosphate	11	UDADPI		461.43	918.53				104.36									
Mangesium Chelate	-																	
Manganese Chelate	-																	
Manganese Sulfate	-																	
Mixed Grades	17.2	WOGE	0.10	0.77	1.63			42.59		0.26			1930.60	0.13		2.34		
Mult. Nutrient-Code/Grade Un.	14.2	TVA																
Nitric Acid	33	UDADPI																
Phosphate Prod. Code Unk.	-			485.27	41.35											633.92	313.77	
Zinc Chelate	-					14.07												0.28
Zinc Sulfate	-																	
TOTAL			429.90	16234.61	7268.34	237.14	0.14	5551.77	1831.52	213.88	0.99	25.40	2552.89	776.26	0.97	3195.77	658.67	7452.69

Mixed Grades Include: Fert. Prod. Code/Grade Unknown, Sec./Micro-Code Unknown, Sec./Micro-Code Unknown,/Grade Unknown, and Single Nutrient - Unknown

Table F-1 Fertilizer Consumption (Tons) by County 1991 (continued)

Fertilizer Types	% Nitrogen Content	Content Ref.	Rich	Salt Lake	San Juan	Sanpete	Sevier	Summit	Tooele	Uintah	Utah	Wasatch	Washington	Wayne	Weber	Statewide Total
Nitrogen																
Ammonium Nitrate	33.5	EPA		2934.07		444.86	281.35	1609.58		615.46	2933.79	245.27	1187.78	173.36	1812.43	24406.16
Ammonium Sulfate	21	EPA	0.26	1450.90	4.18	0.99	1.27	0.70	4.19	624.13	11971.90	17.51	108.78		178.95	15247.06
Anhydrous Ammonia	82	EPA		82.80							164.31					2065.67
Calcium Nitrate	15	EPA														15.00
Nitrogen Solution 28%	28	EPA														52.54
Nitrogen Solution 30%	30	EPA														30.00
Nitrogen Solution 32%	32	EPA		36.23				1.78		1311.10	243.37					9144.48
Sodium Nitrate	16	EPA														16.00
Sulfur coated Urea	38	EPA														28.00
Urea	46	EPA	0.03	3090.63	0.38		0.21	1.53	9.63	0.23	312.62	1.04	0.82		1.90	6588.29
Phosphate																0.00
Superphosphate, Triple	-			1469.56				0.14			2.95	0.11	0.60		2.09	12106.73
Potash																0.00
Muriate of Potash 60%	-					144.83					78.34				940.49	3143.80
Potassium Sulfate	-															288.72
Multiple Nutrient																0.00
Ammonium Phosphate Sulfate	14.5	EPA											219.44			316.39
Diammonium Phosphate	18.5	EPA		733.05							53.33				227.80	1034.53
Epsom Salt	-															0.00
Gypsum (Calcium Sulfate)	-			3992.37		433.39			435.19							4861.35
Lime Product - Code Unk.	-															0.00
Monoammonium Phosphate	11	EPA								914.19	688.36		405.63			4343.47
Potash - Not Identified	15	EPA														15.00
Potassium Nitrate	13	EPA														13.00
Sulfur	-			1348.10		0.25										1429.28
Unknown																0.00
Ammonium Thiosulfate	-			33.98												870.24
Borax	-															0.00
Calcium Chelate	-															0.00
Manure	3	UDADPI		415.67												418.67
Copper Sulfate	-															0.00
Ferric Sulfate	-			248.20												248.20
Ferrous Sulfate	-															0.00
Iron Chelate	-														0.03	0.75
Iron compound	-															0.00
Liquid Amm Polyphosphate	11	UDADPI														1495.35
Magnesium Chelate	-															0.00
Manganese Chelate	-															0.00
Manganese Sulfate	-															0.00
Mixed Grades	17.2	WGGE		2799.72					0.04		8.51	0.08	106.21		126.78	5039.00
Mult. Nutrient-Code/Grade U	14.2	TVA		0.04												14.24
Nitric Acid	33	UDADPI		0.07							4.63					37.72
Phosphate Prod. Code Unk.	-			45.90												1538.21
Zinc Chelate	-															14.34
Zinc Sulfate	-															0.00
TOTAL	493.90	0.00	0.29	20679.31	4.76	1024.52	282.83	1613.72	449.06	3465.11	16662.35	264.01	2029.26	173.36	3290.46	96863.88

Mixed Grades Include: Fert. Prod. Code/Grade Unknown, Sec./Micro-Code Unknown, Sec./Micro-Code Unknown/Grade Unknown, and Single Nutrient - Unknown

Table F-2 Fertilizer Consumption (Tons) by County 1992

Fertilizer Types	%Nitrogen Content	Content Ref.	Beaver	Box Elder	Cache	Carbon	Daggett	Duchesne	Davis	Emery	Garfield	Grand	Iron	Juab	Kane	Millard	Morgan
Nitrogen																	
Ammonium Nitrate	33.5	EPA	166.04	4835.98	2850.33	295.55	24.62	1396.46	882.50	70.89				261.05		705.99	260.20
Ammonium Sulfate	21	EPA	209.40	1235.45	18.17			103.82								448.39	
Anhydrous Ammonia	82	EPA		2134.07													
Calcium Nitrate	15	EPA															
Nitrogen Solution 28%	28	EPA															
Nitrogen Solution 30%	30	EPA															
Nitrogen Solution 32%	32	EPA	274.18		153.82			2.86	246.88							528.37	
Sodium Nitrate	16	EPA															
Sulfur coated Urea	38	EPA															
Urea	46	EPA			1372.18			469.00						56.63			
Phosphate																	
Superphosphate, Triple	-							39.80									
Potash																	
Murite of Potash 60%	-			170.39	133.09			93.78									
Potassium Sulfate	-																
Multiple Nutrient																	
Ammonium Phosphate Sulfate	14.5	EPA															
Diammonium Phosphate	18.5	EPA															
Epson Salt	-																
Gypsum (Calcium Sulfate)	-																
Lime Product - Code Unk.	-																
Monoammonium Phosphate	11	EPA	777.22	836.33	246.21	329.72	37.23	660.54	828.36					34.53		2501.33	
Potash - Not Identified	13	EPA															
Potassium Nitrate	13	EPA															
Sulfur	-				13.43			142.63	343.39			31.94				100.33	
Unknown																	
Ammonium Thiosulfate	-		70.49	209.95													
Borax	-																
Calcium Chelate	-																
Manure	5	UDADPI															
Copper Sulfate	-																
Ferric Sulfate	-																
Ferrous Sulfate	-																
Iron Chelate	-							3.68									
Iron compound	-																
Liquid Amm Polyphosphate	11	UDADPI		1320.63	128.11											405.82	
Mangesium Chelate	-																
Manganese Chelate	-																
Manganese Sulfate	-																
Mixed Grades	17.3	WGGE		130.51	17.63			1.01	1570.29	0.95			981.51		0.28	3.16	
Mult. Nutrient-Code/Grade Un.	14.2	TVA		-				65.06									
Nitric Acid	33	UDADPI															
Phosphate Prod. Code Unk.	-		1160.23	210.48	712.47			0.33		343.53				306.53			
Zinc Chelate	-							2.18									
Zinc Sulfate	-																
TOTAL			2657.57	11083.78	5645.46	525.27	61.85	2980.05	3871.41	415.36	0.00	31.94	981.51	558.74	0.28	4693.59	260.20

Mixed Grades Include: Fert. Prod. Code/Grade Unknown, Sec./Micro-Code Unknown, Sec./Micro-Code Unknown/Grade Unknown, and Single Nutrient - Unknown

Table F-2 Fertilizer Consumption (Tons) by County 1992 (continued)

Fertilizer Types	%Nitrogen Content	Content Ref.	Piute	Rich	Salt Lake	San Juan	Sanpete	Sevier	Summit	Tooele	Uintah	Utah	Wasatch	Washington	Wayne	Weber	Statewide Total
Nitrogen																	
Ammonium Nitrate	33.5	EPA	56.66		2843.06		202.32		2001.00			3632.73		155.22	103.38	1407.46	11185.17
Ammonium Sulfate	21	EPA			631.45						1545.69	5119.82	281.57	59.56		39.94	9714.25
Anhydrous Ammonia	82	EPA									1131.07						3347.14
Calcium Nitrate	15	EPA															15.00
Nitrogen Solution 28%	28	EPA															28.00
Nitrogen Solution 30%	30	EPA															30.00
Nitrogen Solution 32%	32	EPA			2.29		1872.54				1479.98						4592.92
Sodium Nitrate	16	EPA															16.00
Sulfur coated Urea	38	EPA															38.00
Urea	46	EPA			3407.87	174.27						192.25					5718.20
Phosphate																	0.00
Superphosphate, Triple	-				855.31						1851.38					3852.63	6559.32
Potash																	0.00
Murite of Potash 60%	-				81.27		118.76									39.31	456.60
Potassium Sulfate	-																0.00
Multiple Nutrient																	0.00
Ammonium Phosphate Sulfate	14.5	EPA			1.68												16.18
Diammonium Phosphate	18.5	EPA			2482.57						575.07	100.48		495.83			2672.45
Epsom Salt	-																0.00
Gypsum (Calcium Sulfate)	-				13438.72		323.93			350.10				454.25			14566.99
Lime Product - Code Unk.	-																0.00
Monoammonium Phosphate	11	EPA	99.80				98.57				497.15	3488.37		255.53			10601.90
Potash - Not Identified	15	EPA															15.00
Potassium Nitrate	13	EPA															13.00
Sulfur	-				164.69		0.14					140.70		214.60			1152.04
Unknown																	0.00
Ammonium Thiosulfate	-				71.37												351.81
Borax	-																0.00
Calcium Chelate	-																0.00
Manure	5	UDADPI			181.49												186.49
Copper Sulfate	-																0.00
Ferric Sulfate	-																0.00
Ferrous Sulfate	-																0.00
Iron Chelate	-				8.41			0.06									11.15
Iron compound	-																0.00
Liquid Amm Polyphosphate	11	UDADPI															1865.56
Mangesium Chelate	-																0.00
Manganese Chelate	-																0.00
Manganese Sulfate	-																0.00
Mixed Grades	17.2	WOGE			3157.29	0.70					0.29	227.34				211.23	6319.41
Mult. Nutrient-Code/Grade Un	14.2	TVA			696.63											395.83	1171.74
Nitric Acid	33	UDADPI															33.00
Phosphate Prod. Code Unk.	-				169.11			488.66				328.52					3619.75
Zinc Chelate	-															0.41	2.59
Zinc Sulfate	-																0.00
TOTAL	493.90	0.00	156.46	0.00	28193.23	174.97	3636.46	488.71	2001.00	350.10	7080.62	13230.21	281.57	1655.01	103.38	5966.85	96539.48

Mixed Grades include: Fert. Prod. Code/Grade Unknown, Sec./Micro-Code Unknown, Sec./Micro-Code Unknown./Grade Unknown, and Single Nutrient - Unknown

Table F-3 Fertilizer Consumption (Tons) by County 1993

Fertilizer Types	% Nitrogen Content	Content Ref.	Beaver	Box Elder	Cache	Carbon	Daggett	Duchesne	Davis	Emery	Garfield	Grand	Iron	Juab	Kane	Millard	Morgan	Piute
Nitrogen																		
Ammonium Nitrate	33.5	EPA	150.50	9233.58	4824.28	277.37	301.01	377.87	967.45	777.33			97.39	984.06		2880.52	2593.83	
Ammonium Sulfate	21	EPA		1478.49	299.50	31.49		326.02	541.41		1.03		3.50		11.69	670.68	90.63	
Anhydrous Ammonia	82	EPA		979.84														
Calcium Nitrate	15	EPA																
Nitrogen Solution 28%	28	EPA		80.62														
Nitrogen Solution 30%	30	EPA																
Nitrogen Solution 32%	32	EPA		5729.67	123.04			7.10		130.85			0.85			448.26		
Sodium Nitrate	16	EPA		46.96														
Sulfur coated Urea	38	EPA																
Urea	46	EPA		115.28	1496.72			73.07										
Phosphate																		
Superphosphate, Triple	-							3159.24								4221.60		
Potash																		
Murite of Potash 60%	-			199.84	361.63			290.35	1775.96					1.88			241.97	
Potassium Sulfate	-																	
Multiple Nutrient																		
Ammonium Phosphate Sulfat	14.5	EPA	80.30			1.09							1.06					77.13
Diammonium Phosphate	18.5	EPA		2.85														
Epson Salt	-																	
Gypsum (Calcium Sulfate)	-																	
Lime Product - Code Unk.	-																	
Monoammonium Phosphate	11	EPA	285.89	1143.97	793.59			871.04	316.95				183.85	77.72		445.57	205.72	
Potash - not identified	15	EPA																
Potassium Nitrate	13	EPA																
Sulfur	-		62.14					3.18				25.40		0.13				
Unknown																		
Ammonium Thiosulfate	-			812.17	24.11													
Borax	-																	
Calcium Chelate	-																	
Manure	5	UDADPI																
Copper Sulfate	-																	
Ferric Sulfate	-																	
Ferrous Sulfate	-																	
Iron Chelate	-							0.73										
Iron compound	-																	
Liquid Amm Polyphosphate	11	UDADPI		461.43	918.55				104.36									
Magnesium Chelate	-																	
Manganese Chelate	-																	
Manganese Sulfate	-																	
Mixed Grades	17.2	WDGE		186.84	0.66			59.06	300.28							11.71		
Mult. Nutrient-Code/Grade U	14.2	TVA																
Nitric Acid	33	UDADPI																
Phosphate Prod. Code Unk.	-			485.27	41.35											633.92	313.77	
Zinc Chelate	-																	
Zinc Sulfate	-																	
TOTAL			578.83	20956.80	8883.43	309.95	301.01	5167.66	4006.41	908.18	1.03	25.40	286.65	1063.79	11.69	9512.25	3445.92	77.13

Mixed Grades Include: Fert. Prod. Code/Grade Unknown, Sec./Micro-Code Unknown, Sec./Micro-Code Unknown./Grade Unknown, and Single Nutrient - Unknown

Table F-3 Fertilizer Consumption (Tons) by County 1993 (continued)

Fertilizer Types	% Nitrogen Content Content	Content Ref.	Rich	Salt Lake	San Juan	Sanpete	Sevier	Summit	Tooele	Uintah	Utah	Wasatch	Washington	Wayne	Weber	Statewide Total
Nitrogen																
Ammonium Nitrate	33.5	EPA		2535.11		1083.66	950.67		2640.70	1270.05	6297.88	192.51	521.41	191.29	1834.85	41016.81
Ammonium Sulfate	21	EPA		6690.97		13.34	5.79	10.70	12317.32		445.51		6.85		79.24	23045.16
Anhydrous Ammonia	82	EPA		197.44												1259.28
Calcium Nitrate	15	EPA														15.00
Nitrogen Solution 28%	28	EPA														108.62
Nitrogen Solution 30%	30	EPA														30.00
Nitrogen Solution 32%	32	EPA		240.42						277.22	4435.28		19.97			11444.64
Sodium Nitrate	16	EPA		0.62		0.31										63.90
Sulfur coated Urea	38	EPA														38.00
Urea	46	EPA		6089.49	53.37						202.18					8076.11
Phosphate																0.00
Superphosphate, Triple	-															7380.85
Potash																0.00
Murite of Potash 60%	-			452.38		194.60					566.00				491.12	4575.71
Potassium Sulfate	-			5.12												5.12
Multiple Nutrient																0.00
Ammonium Phosphate Sulfat	14.5	EPA											219.44			393.51
Diammonium Phosphate	18.5	EPA		733.05							52.33				227.80	1034.53
Epsom Salt	-															0.00
Gypsum (Calcium Sulfate)	-			3992.37		433.59			435.19							4861.15
Lime Product - Code Unk.	-															0.00
Monoammonium Phosphate	11	EPA								914.19	688.36		405.63			6343.47
Potash - not identified	15	EPA														15.00
Potassium Nitrate	13	EPA														13.00
Sulfur	-			1348.10		0.25										1439.20
Unknown																0.00
Ammonium Thiosulfate	-			33.98												870.26
Borax	-															0.00
Calcium Chelate	-															0.00
Manure	5	UDADPI		413.67												418.67
Copper Sulfate	-															0.00
Ferric Sulfate	-			248.20												248.20
Ferrous Sulfate	-															0.00
Iron Chelate	-														0.03	0.75
Iron compound	-															0.00
Liquid Amm Polyphosphate	11	UDADPI														1495.35
Mangesium Chelate	-															0.00
Manganese Chelate	-															0.00
Manganese Sulfate	-															0.00
Mixed Grades	17.2	WOGE		1605.41							459.00		579.01		6.65	3225.82
Mult. Nutrient-Code/Grade U	14.2	TVA		0.04												14.24
Nitric Acid	33	UDADPI		0.07							4.65					37.72
Phosphate Prod. Code Unk.	-			45.90												1520.21
Zinc Chelate	-															0.00
Zinc Sulfate	-															0.00
TOTAL			0.00	24632.35	53.37	1725.76	956.45	10.70	15393.21	2461.46	13151.19	192.51	1732.31	191.29	2639.68	118496.40

Mixed Grades Include: Fert. Prod. Code/Grade Unknown, Sec./Micro-Code Unknown, Sec./Micro-Code Unknown/Grade Unknown, and Single Nutrient - Unknown

Table F-4 Fertilizer Consumption (Tons) by County 1994

Fertilizer Types	Nitrogen Content	Content Ref.	Beaver	Box Elder	Cache	Carbon	Daggett	Duchesne	Davis	Emery	Garfield	Grand	Iron	Juab	Kane	Millard	Morgan
Nitrogen																	
Ammonium Nitrate	33.5	EPA	356.07	7372.73	5371.80	199.80		2737.32	343.31	384.41			415.03	300.13		1903.46	70.67
Ammonium Sulfate	21	EPA	36.99	1424.45	398.47	9.82		192.80	441.07	2.73			70.45		4.10	665.77	
Anhydrous Ammonia	82	EPA		318.13	312.80								1072.86				
Calcium Nitrate	15	EPA															
Nitrogen Solution 28%	28	EPA															
Nitrogen Solution 30%	30	EPA															
Nitrogen Solution 32%	32	EPA		3983.11	427.54				163.07	206.19				69.63		1222.27	
Sodium Nitrate	16	EPA										1.50					
Sulfur coated Urea	38	EPA															
Urea	46	EPA		50.36	1015.41			260.48									
Phosphate																	
Superphosphate, Triple	-		782.80		501.15				89.34	291.88			66.03	4009.80		630.77	53.33
Potash																	
Murite of Potash 60%	-			313.76	303.78			343.16	2316.79					1.51		49.81	431.23
Potassium Sulfate	-																
Multiple Nutrient																	
Ammonium Phosphate Sulfate	14.5	EPA															
Diammonium Phosphate	18.3	EPA															
Epson Salt	-																
Gypsum (Calcium Sulfate)	-																
Lime Product - Code Unk.	-																
Monoammonium Phosphate	11	EPA	777.22	836.33	246.31	229.72	37.23	660.34	828.36					34.53		2301.33	
Potash - Not Identified	13	EPA															
Potassium Nitrate	13	EPA															
Sulfur	-				13.43			142.63	343.39			31.94				100.53	
Unknown																	
Ammonium Thiosulfate	-		70.49	209.95													
Borax	-																
Calcium Chelate	-																
Manure	5	UDADPI															
Copper Sulfate	-																
Ferric Sulfate	-																
Ferrous Sulfate	-																
Iron Chelate	-							2.68									
Iron compound	-																
Liquid Amm Polyphosphate	11	UDADPI		1320.63	128.11											405.82	
Mangesium Chelate	-																
Manganese Chelate	-																
Manganese Sulfate	-																
Mixed Grades	17.2	WOGE										1.50					
Mult. Nutrient-Code/Grade Un.	14.2	TVA						65.06									
Nitric Acid	33	UDADPI															
Phosphate Prod. Code Unk.	-		1160.15	210.48	712.47			0.33		343.52				206.33			
Zinc Chelate	-																
Zinc Sulfate	-																
TOTAL			3183.82	16039.93	9443.17	439.34	37.23	4406.90	4425.53	1128.72	0.00	34.95	1624.40	4622.13	4.10	7479.73	555.23

Mixed Grades Include: Fert. Prod. Code/Grade Unknown, Sec./Micro-Code Unknown, Sec./Micro-Code Unknown/Grade Unknown, and Single Nutrient - Unknown

Table F-4 Fertilizer Consumption (Tons) by County 1994 (continued)

Fertilizer Types	Nitrogen Content	Content Ref.	Piute	Rich	Salt Lake	San Juan	Sanpete	Sevier	Summit	Tooele	Uintah	Utah	Wasatch	Washington	Wayne	Weber	Statewide Total
Nitrogen																	
Ammonium Nitrate	33.5	EPA	105.86		3112.99		847.46	1127.96	2064.10	11.15	1157.67	6197.70	238.36	372.02	129.26	2056.25	34809.33
Ammonium Sulfate	21	EPA			3183.24		65.74	2.73	2.78	11.76		5044.04		217.27		21.83	11817.08
Anhydrous Ammonia	82	EPA			537.57						9.06						3533.42
Calcium Nitrate	15	EPA															15.00
Nitrogen Solution 28%	28	EPA													49.83		77.85
Nitrogen Solution 30%	30	EPA										29.02					59.02
Nitrogen Solution 32%	32	EPA						256.58			434.27	1629.91		118.02			8562.59
Sodium Nitrate	16	EPA			903.73												921.24
Sulfur coated Urea	38	EPA															38.00
Urea	46	EPA			3716.26	106.32			2.99			526.80		15.34		40.66	5790.62
Phosphate																	0.00
Superphosphate, Triple	-				1155.89		1727.25					116.05	217.67	131.51	52.20	617.79	10443.45
Potash																	0.00
Muriate of Potash 60%	-				291.61		179.98	194.20				1472.16				242.91	6044.89
Potassium Sulfate	-				2.80												2.80
Multiple Nutrient																	0.00
Ammonium Phosphate Sulfate	14.5	EPA			1.68												16.18
Diammonium Phosphate	18.5	EPA			3482.57						575.07	100.48		495.83			3672.45
Epsom Salt	-																0.00
Gypsum (Calcium Sulfate)	-				13438.72		323.93			350.10				454.25			14566.99
Lime Product - Code Unk.	-																0.00
Monoammonium Phosphate	11	EPA	99.80				98.57				497.15	3488.37		235.55			10601.90
Potash - Not Identified	15	EPA															15.00
Potassium Nitrate	13	EPA															13.00
Sulfur	-				164.69		0.54					140.70		214.60			1152.04
Unknown																	0.00
Ammonium Thiosulfate	-				71.37												351.82
Borax	-																0.00
Calcium Chelate	-																0.00
Manure	5	UDADPI			181.49												186.49
Copper Sulfate	-																0.00
Ferric Sulfate	-																0.00
Ferrous Sulfate	-																0.00
Iron Chelate	-				8.41			0.06									11.15
Iron compound	-																0.00
Liquid Amm Polyphosphate	11	UDADPI															1865.56
Magnesium Chelate	-																0.00
Manganese Chelate	-																0.00
Manganese Sulfate	-																0.00
Mixed Grades	17.2	WOGE			3515.79	300.89			1097.06					130.77		139.72	5211.93
Mult. Nutrient-Code/Grade Un.	14.2	TVA			696.63											395.83	1171.74
Nitric Acid	33	UDADPI															33.00
Phosphate Prod. Code Unk.	-				169.11			488.66				328.52					3619.75
Zinc Chelate	-																0.00
Zinc Sulfate	-																0.00
TOTAL			205.66	0.00	33634.56	407.21	3343.05	2070.21	3166.93	373.00	2693.23	19072.74	456.04	2614.15	231.31	3515.00	125603.17

Mixed Grades include: Fert. Prod. Code/Grade Unknown, Sec./Micro-Code Unknown, Sec./Micro-Code Unknown./Grade Unknown, and Single Nutrient - Unknown

Table F-5 Average Fertilizer Consumption (tons) by County
1991, 1992, 1993

Fertilizer Types	Beaver	Box Elder	Cache	Carbon	Daggett	Duchesne	Davis	Emery	Garfield	Grand	Iron	Juab	Kane	Millard	Morgan
Nitrogen															
Ammonium Nitrate	105.52	6196.86	3398.58	260.58	108.54	1441.71	858.35	291.63	0.00	0.00	177.71	454.18	0.00	1537.92	951.61
Ammonium Sulfate	70.00	1009.45	187.36	14.71	0.04	212.15	192.10	0.00	0.62	0.00	1.57	0.13	4.15	373.29	45.04
Anhydrous Ammonia	0.00	1596.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calcium Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 28%	0.00	26.87	8.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 30%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 32%	91.39	3891.61	273.87	0.00	0.00	3.32	137.57	43.62	0.00	0.00	0.28	0.00	0.00	613.63	0.00
Sodium Nitrate	0.00	15.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sulfur coated Urea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Urea	0.03	38.57	1241.94	0.08	0.01	190.22	0.05	0.03	0.04	0.00	0.07	30.46	0.03	0.43	0.02
Phosphate															
Superphosphate, Triple	0.27	290.19	410.66	0.09	0.00	1071.34	38.07	62.29	0.02	0.00	0.08	181.90	0.04	1480.32	31.27
Potash															
Murite of Potash 60%	0.00	123.41	186.69	0.00	0.00	642.90	715.33	0.00	0.00	0.00	0.00	0.63	0.00	0.00	80.66
Potassium Sulfate	0.00	0.00	0.00	0.00	0.00	96.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multiple Nutrient															
Ammonium Phosphate Sulf	53.53	0.00	0.00	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.71	0.00	0.00	0.00	0.00
Diammonium Phosphate	0.00	1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Epson Salt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gypsum (Calcium Sulfate)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lime Product - Code Unk	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Monoammonium Phosphat	449.67	1041.42	611.13	76.57	12.41	800.87	487.42	0.00	0.00	0.00	122.57	63.32	0.00	1130.82	137.15
Potash - Not Identified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potassium Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sulfur	41.43	0.00	4.48	0.00	0.00	49.67	114.46	0.00	0.00	27.58	0.00	0.08	0.00	33.51	0.00
Unknown															
Ammonium Thiosulfate	23.50	611.43	16.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Borax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calcium Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manure	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Copper Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferric Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferrous Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron Chelate	0.00	0.00	0.00	0.00	0.00	1.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron compound	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Liquid Amm Polyphosphat	0.00	747.83	655.07	0.00	0.00	0.00	69.57	0.00	0.00	0.00	0.00	0.00	0.00	135.27	0.00
Mangesium Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed Grades	0.03	106.04	6.65	0.00	0.00	34.22	623.52	0.40	0.00	0.00	970.71	0.04	0.09	6.07	0.00
Mult. Nutrient-Code/Grade	0.00	0.00	0.00	0.00	0.00	21.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitric Acid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Phosphate Prod. Code Unk	386.75	393.67	265.06	0.00	0.00	0.08	0.00	114.51	0.00	0.00	0.00	68.84	0.00	422.61	209.18
Zinc Chelate	0.00	0.00	0.00	4.69	0.00	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	1222.10	16091.73	7265.74	357.45	121.00	4566.49	3230.45	512.47	0.67	27.58	1273.68	799.59	4.31	5733.87	1454.93

Table F-5 Average Fertilizer Consumption (tons) by County (continued)
1991, 1992, 1993

Fertilizer Types	Piute	Rich	Salt Lake	San Juan	Sanpete	Sevier	Summit	Tooele	Uintah	Utah	Wasatch	Washington	Wayne	Weber	Statewide Total
Nitrogen															
Ammonium Nitrate	18.89	0.00	2770.75	0.00	577.01	410.67	1203.53	880.23	628.50	4288.13	145.92	621.47	156.01	1684.91	29169.21
Ammonium Sulfate	0.03	0.09	2924.44	1.39	4.78	2.35	3.80	4107.17	723.27	5845.74	99.69	58.40	0.00	99.38	15881.14
Anhydrous Ammonia	0.00	0.00	93.41	0.00	0.00	0.00	0.00	0.00	377.02	54.78	0.00	0.00	0.00	0.00	2122.03
Calcium Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 28%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.05
Nitrogen Solution 30%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 32%	0.00	0.00	92.98	0.00	624.18	0.00	0.59	0.00	1022.77	1559.55	0.00	6.66	0.00	0.00	8362.01
Sodium Nitrate	0.00	0.00	0.21	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.97
Sulfur coated Urea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Urea	0.00	0.01	4862.66	76.07	0.00	0.07	0.51	3.22	0.08	302.35	0.35	0.27	0.00	0.63	6748.20
Phosphate															0.00
Superphosphate, Triple	2484.10	0.00	774.96	0.00	0.00	0.00	0.05	0.00	617.13	0.98	0.04	0.20	0.00	1284.91	8728.90
Potash															0.00
Muriate of Potash 60%	0.00	0.00	177.88	0.00	152.73	0.00	0.00	0.00	0.00	214.85	0.00	0.00	0.00	496.97	2792.04
Potassium Sulfate	0.00	0.00	1.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	97.95
Multiple Nutrient															0.00
Ammonium Phosphate Sulf	25.71	0.00	0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	146.29	0.00	0.00	227.53
Diammonium Phosphate	0.00	0.00	1316.22	0.00	0.00	0.00	0.00	0.00	191.69	68.38	0.00	165.28	0.00	151.86	1895.34
Epson Salt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gypsum (Calcium Sulfate)	0.00	0.00	7141.15	0.00	397.04	0.00	0.00	406.82	0.00	0.00	0.00	151.42	0.00	0.00	8096.43
Lime Product - Code Unk.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Monoammonium Phosphat	33.27	0.00	0.00	0.00	32.86	0.00	0.00	0.00	775.18	1621.70	0.00	355.61	0.00	0.00	7751.95
Potash - Not Identified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potassium Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sulfur	0.00	0.00	953.63	0.00	0.21	0.00	0.00	0.00	0.00	46.90	0.00	71.53	0.00	0.00	1343.48
Unknown															0.00
Ammonium Thiosulfate	0.00	0.00	46.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	697.45
Borax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calcium Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manure	0.00	0.00	336.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	336.28
Copper Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferric Sulfate	0.00	0.00	165.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	165.47
Ferrous Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron Chelate	0.00	0.00	2.80	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	4.22
Iron compound	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Liquid Amm Polyphosphat	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1607.75
Mangesium Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed Grades	0.00	0.00	2520.81	0.23	0.00	0.00	0.00	0.01	0.10	231.95	0.03	228.41	0.00	114.90	4944.21
Mult. Nutrient-Code/Grade	0.00	0.00	232.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	131.95	385.88
Nitric Acid	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	3.10	0.00	0.00	0.00	0.00	3.15
Phosphate Prod. Code Unk	0.00	0.00	86.97	0.00	0.00	162.89	0.00	0.00	0.00	109.51	0.00	0.00	0.00	0.00	2220.06
Zinc Chelate	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	5.64
Zinc Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	2562.09	0.10	24501.63	77.70	1788.91	576.00	1208.48	5397.46	4335.73	14347.92	246.03	1805.53	156.01	3965.66	103637.32

Table F-6 Average Fertilizer Consumption (tons) by County
1992, 1993, 1994

Fertilizer Types	Beaver	Box Elder	Cache	Carbon	Daggett	Duchesne	Davis	Emery	Garfield	Grand	Iron	Juab	Kane	Millard	Morgan
Nitrogen															
Ammonium Nitrate	224.21	7114.09	4348.81	257.57	108.54	1503.88	697.82	377.54	0.00	0.00	170.81	515.08	0.00	1829.99	974.90
Ammonium Sulfate	82.13	1379.46	238.72	13.77	0.00	207.55	327.49	0.91	0.34	0.00	24.55	0.00	5.27	594.95	30.21
Anhydrous Ammonia	0.00	1210.68	104.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	357.62	0.00	0.00	0.00	0.00
Calcium Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 28%	0.00	26.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 30%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 32%	91.39	3237.59	234.80	0.00	0.00	3.32	136.65	112.35	0.00	0.00	0.28	23.21	0.00	732.96	0.00
Sodium Nitrate	0.00	15.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00
Sulfur coated Urea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Urea	0.00	55.21	1298.10	0.00	0.00	267.51	0.00	0.00	0.00	0.00	0.00	18.88	0.00	0.00	0.00
Phosphate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Superphosphate, Triple	260.93	0.00	167.05	0.00	0.00	1066.35	29.78	97.29	0.00	0.00	22.01	1336.60	0.00	1617.46	17.78
Potash	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Murite of Potash 60%	0.00	194.66	266.83	0.00	0.00	243.10	1364.25	0.00	0.00	0.00	0.00	1.13	0.00	16.60	224.40
Potassium Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multiple Nutrient	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ammonium Phosphate Sulf	26.77	0.00	0.00	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.00	0.00	0.00	0.00
Diammonium Phosphate	0.00	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Epson Salt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gypsum (Calcium Sulfate)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lime Product - Code Unk.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Monoammonium Phosphat	613.44	938.87	428.67	153.14	24.82	730.71	657.89	0.00	0.00	0.00	61.28	48.93	0.00	1816.07	68.57
Potash - Not Identified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potassium Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sulfur	20.71	0.00	8.95	0.00	0.00	96.15	226.92	0.00	0.00	29.76	0.00	0.04	0.00	67.02	0.00
Unknown	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ammonium Thiosulfate	46.99	410.69	8.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Borax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calcium Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manure	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Copper Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferric Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferrous Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron Chelate	0.00	0.00	0.00	0.00	0.00	2.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron compound	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Liquid Amm Polyphosphat	0.00	1034.23	391.59	0.00	0.00	0.00	34.79	0.00	0.00	0.00	0.00	0.00	0.00	270.55	0.00
Mangesium Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed Grades	0.00	105.78	6.10	0.00	0.00	20.02	623.52	0.32	0.00	0.50	327.17	0.00	0.09	4.96	0.00
Mult. Nutrient-Code/Grade	0.00	0.00	0.00	0.00	0.00	43.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitric Acid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Phosphate Prod. Code Unk	773.50	302.08	488.76	0.00	0.00	0.15	0.00	229.01	0.00	0.00	0.00	137.68	0.00	211.31	104.59
Zinc Chelate	0.00	0.00	0.00	0.00	0.00	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	2140.07	16026.83	7990.69	424.85	133.36	4184.87	4101.12	817.42	0.34	30.76	964.19	2081.55	5.36	7161.86	1420.45

Table F-6 Average Fertilizer Consumption (tons) by County (Continued)
1992, 1993, 1994*

Fertilizer Types	Piute	Rich	Salt Lake	San Juan	Sanpete	Sevier	Summit	Tooele	Uintah	Utah	Wasatch	Washington	Wayne	Weber	Statewide Total
Nitrogen															
Ammonium Nitrate	54.17	0.00	2830.38	0.00	711.21	692.88	1355.03	883.95	809.24	5376.10	143.62	416.22	141.31	1766.19	33303.5657
Ammonium Sulfate	0.00	0.00	3501.89	0.00	26.36	2.84	4.49	4109.69	515.23	3536.46	93.88	94.56	0.00	47.00	14837.8308
Anhydrous Ammonia	0.00	0.00	245.00	0.00	0.00	0.00	0.00	0.00	380.04	0.00	0.00	0.00	0.00	0.00	2297.61324
Calcium Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Nitrogen Solution 28%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.62	0.00	43.49002
Nitrogen Solution 30%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.67	0.00	0.00	0.00	0.00	9.67224
Nitrogen Solution 32%	0.00	0.00	80.90	0.00	624.18	85.53	0.00	0.00	737.16	2021.73	0.00	45.99	0.00	0.00	8168.04946
Sodium Nitrate	0.00	0.00	301.45	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	317.71222
Sulfur coated Urea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Urea	0.00	0.00	4404.54	111.32	0.00	0.00	1.00	0.00	0.00	307.08	0.00	5.11	0.00	13.55	6482.30866
Phosphate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Superphosphate, Triple	0.00	0.00	670.40	0.00	575.75	0.00	0.00	0.00	617.13	38.68	72.56	43.84	17.40	1490.14	8141.14275
Potash	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Murite of Potash 60%	0.00	0.00	375.09	0.00	184.45	84.73	0.00	0.00	0.00	679.38	0.00	0.00	0.00	264.45	3759.066
Potassium Sulfate	0.00	0.00	2.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.64146733
Multiple Nutrient	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Ammonium Phosphate Sulf	25.71	0.00	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	73.15	0.00	0.00	127.458281
Diammonium Phosphate	0.00	0.00	1899.40	0.00	0.00	0.00	0.00	0.00	383.38	84.43	0.00	330.55	0.00	75.93	2774.64284
Epson Salt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Gypsum (Calcium Sulfate)	0.00	0.00	10289.94	0.00	380.48	0.00	0.00	378.46	0.00	0.00	0.00	302.83	0.00	0.00	11331.7103
Lime Product - Code Unk.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Monoammonium Phosphat	66.53	0.00	0.00	0.00	65.71	0.00	0.00	0.00	636.16	2555.03	0.00	305.58	0.00	0.00	9171.42314
Potash - Not Identified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Potassium Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Sulfur	0.00	0.00	559.16	0.00	0.17	0.00	0.00	0.00	0.00	93.80	0.00	143.07	0.00	0.00	1247.76238
Unknown	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Ammonium Thiosulfate	0.00	0.00	58.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	524.628033
Borax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Calcium Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Manure	0.00	0.00	258.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	258.885767
Copper Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Ferric Sulfate	0.00	0.00	82.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.7349333
Ferrous Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Iron Chelate	0.00	0.00	5.61	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	7.69637367
Iron compound	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Liquid Amm Polyphosphat	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1731.15773
Mangesium Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Manganese Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Manganese Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Mixed Grades	0.00	0.00	2759.49	100.53	0.00	0.00	365.69	0.00	0.10	228.78	0.00	239.59	0.00	119.21	4901.85129
Mult. Nutrient-Code/Grade	0.00	0.00	464.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	263.90	771.708936
Nitric Acid	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	1.55	0.00	0.00	0.00	0.00	1.57343833
Phosphate Prod. Code Unk	0.00	0.00	128.04	0.00	0.00	325.77	0.00	0.00	0.00	219.01	0.00	0.00	0.00	0.00	2915.90425
Zinc Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.86271367
Zinc Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
TOTAL	148.42	0.00	28820.05	211.85	2526.42	1171.79	1726.21	5372.11	4078.44	15151.71	310.04	2000.49	175.33	4040.51	113217.083

Table F-7 Total Nitrogen Content (tons N) by County
1991, 1992, 1993

Fertilizer Types	% Nitrogen Content	Content Ref.	Beaver	Box Elder	Cache	Carbon	Daggett	Duchesne	Davis	Emery	Garfield	Grand	Iron	Juab	Kane	Millard	Morgan
Nitrogen																	
Ammonium Nitrate	33.50	EPA	35.35	2075.95	1138.53	87.29	36.36	482.97	287.55	97.70	0.00	0.00	59.53	152.15	0.00	515.20	318.79
Ammonium Sulfate	21.00	EPA	14.70	211.98	39.35	3.09	0.01	44.55	40.34	0.00	0.13	0.00	0.33	0.03	0.87	78.39	9.46
Anhydrous Ammonia	82.00	EPA	0.00	1309.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calcium Nitrate	15.00	EPA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 28%	28.00	EPA	0.00	7.52	2.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 30%	30.00	EPA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 32%	32.00	EPA	29.25	1245.31	87.64	0.00	0.00	1.06	44.02	13.96	0.00	0.00	0.09	0.00	0.00	196.36	0.00
Sodium Nitrate	16.00	EPA	0.00	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sulfur coated Urea	38.00	EPA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Urea	46.00	EPA	0.01	17.74	571.29	0.04	0.00	87.30	0.02	0.01	0.02	0.00	0.03	14.01	0.02	0.20	0.01
Phosphate																	
Superphosphate, Triple	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potash																	
Murite of Potash 60%	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potassium Sulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multiple Nutrient																	
Ammonium Phosphate Sulfate	14.50	EPA	7.76	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00
Diammonium Phosphate	18.50	EPA	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Epson Salt	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gypsum (Calcium Sulfate)	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lime Product - Code Unk.	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Monoammonium Phosphate	11.00	EPA	49.46	114.56	67.22	8.42	1.37	88.10	53.62	0.00	0.00	0.00	13.48	6.97	0.00	124.39	15.09
Potash - Not Identified	15.00	EPA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potassium Nitrate	13.00	EPA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sulfur	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unknown																	
Ammonium Thiosulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Borax	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calcium Chelate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manure	5.00	UDADPI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Copper Sulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferric Sulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferrous Sulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron Chelate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron compound	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Liquid Amm Polyphosphate	11.00	UDADPI	0.00	82.26	72.06	0.00	0.00	0.00	7.65	0.00	0.00	0.00	0.00	0.00	0.00	14.88	0.00
Mangesium Chelate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Chelate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Sulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed Grades	17.20	WGGE	0.01	18.24	1.14	0.00	0.00	3.89	107.23	0.07	0.00	0.00	166.96	0.01	0.02	1.04	0.00
Mult. Nutrient-Code/Grade U	14.20	TVA	0.00	0.00	0.00	0.00	0.00	3.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitric Acid	33.00	UDADPI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Phosphate Prod. Code Unk.	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc Chelate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc Sulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL			136.54	5085.82	1979.52	98.95	37.74	713.15	540.45	111.74	0.15	0.00	240.53	173.16	0.90	930.47	343.34

Table F-7 Total Nitrogen Content (tons N) by County
1991, 1992, 1993

Fertilizer Types	% Nitrogen Content	Content Ref.	Piute	Rich	Salt Lake	San Juan	Sanpete	Sevier	Summit	Tooele	Uintah	Utah	Wasatch	Washington	Wayne	Weber	State Total N 1990
Nitrogen																	
Ammonium Nitrate	33.50	EPA	6.33	0.00	928.20	0.00	193.30	137.58	403.18	294.88	210.55	1436.52	48.88	208.19	52.26	564.45	9805.19
Ammonium Sulfate	21.00	EPA	0.01	0.02	614.13	0.29	1.00	0.49	0.80	862.51	151.89	1227.61	20.94	12.26	0.00	20.87	3377.04
Anhydrous Ammonia	82.00	EPA	0.00	0.00	76.60	0.00	0.00	0.00	0.00	0.00	309.16	44.92	0.00	0.00	0.00	0.00	1822.06
Calcium Nitrate	15.00	EPA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00
Nitrogen Solution 28%	28.00	EPA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37.81
Nitrogen Solution 30%	30.00	EPA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.00
Nitrogen Solution 32%	32.00	EPA	0.00	0.00	29.75	0.00	199.74	0.00	0.19	0.00	327.29	499.06	0.00	2.13	0.00	0.00	2707.84
Sodium Nitrate	16.00	EPA	0.00	0.00	0.03	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.55
Sulfur coated Urea	38.00	EPA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.00
Urea	46.00	EPA	0.00	0.00	2236.83	34.99	0.00	0.03	0.23	1.48	0.03	139.08	0.16	0.13	0.00	0.29	3150.17
Phosphate																	
Superphosphate, Triple	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potash																	
Murite of Potash 60%	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potassium Sulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multiple Nutriend																	
Ammonium Phosphate Sulfat	14.50	EPA	3.73	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.21	0.00	0.00	47.49
Diammonium Phosphate	18.50	EPA	0.00	0.00	343.50	0.00	0.00	0.00	0.00	0.00	35.46	12.65	0.00	30.58	0.00	28.09	369.14
Epson Salt	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gypsum (Calcium Sulfate)	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lime Product - Code Unk.	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Monoammonium Phosphate	11.00	EPA	3.66	0.00	0.00	0.00	3.61	0.00	0.00	0.00	83.27	178.39	0.00	39.12	0.00	0.00	863.71
Potash - Not Identified	15.00	EPA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00
Potassium Nitrate	13.00	EPA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.00
Sulfur	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unknown																	
Ammonium Thiosulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Borax	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calcium Chelate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manure	5.00	UDADPI	0.00	0.00	16.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.81
Copper Sulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferric Sulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferrous Sulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron Chelate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron compound	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Liquid Amm Polyphosphate	11.00	UDADPI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	187.85
Mangesium Chelate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Chelate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Sulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed Grades	17.20	WGGE	0.00	0.00	433.58	0.04	0.00	0.00	0.00	0.00	0.02	39.90	0.00	39.29	0.00	19.76	850.40
Mult. Nutrient-Code/Grade U	14.20	TVA	0.00	0.00	32.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.74	68.99
Nitric Acid	33.00	UDADPI	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	1.02	0.00	0.00	0.00	0.00	34.04
Phosphate Prod. Code Unk.	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc Chelate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc Sulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL			13.72	0.02	4612.51	35.33	397.67	138.10	404.40	1158.87	1119.66	3579.14	69.98	352.90	52.26	651.20	12979.22

Table F-8 Total Nitrogen Content (tons N) by County
1992, 1993, 1994

Fertilizer Types	% Nitrogen Content	Content Ref.	Beaver	Box Elder	Cache	Carbon	Daggett	Duchesne	Davis	Emery	Garfield	Grand	Iron	Juab	Kane	Millard	Morgan
Nitrogen																	
Ammonium Nitrate	33.50	EPA	75.11	2383.22	1456.85	86.29	36.36	303.80	233.77	126.48	0.00	0.00	57.22	172.55	0.00	613.05	326.59
Ammonium Sulfate	21.00	EPA	17.25	289.69	50.13	2.89	0.00	43.59	68.77	0.19	0.07	0.00	5.18	0.00	1.11	124.94	6.34
Anhydrous Ammonia	82.00	EPA	0.00	992.76	85.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	293.25	0.00	0.00	0.00	0.00
Calcium Nitrate	15.00	EPA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 28%	28.00	EPA	0.00	7.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 30%	30.00	EPA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 32%	32.00	EPA	29.25	1036.03	75.14	0.00	0.00	1.06	45.73	35.95	0.00	0.00	0.09	7.43	0.00	234.55	0.00
Sodium Nitrate	16.00	EPA	0.00	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00
Sulfur coated Urea	38.00	EPA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Urea	46.00	EPA	0.00	25.40	397.13	0.00	0.00	123.06	0.00	0.00	0.00	0.00	0.00	8.68	0.00	0.00	0.00
Phosphate																	
Superphosphate, Triple	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potash																	
Murite of Potash 60%	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potassium Sulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multiple Nutrient																	
Ammonium Phosphate Sulfat	14.50	EPA	3.88	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00
Diammonium Phosphate	18.50	EPA	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Epson Salt	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gypsum (Calcium Sulfate)	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lime Product - Code Unk.	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Monoammonium Phosphate	11.00	EPA	67.48	103.28	47.15	16.85	2.73	80.38	72.37	0.00	0.00	0.00	6.74	5.38	0.00	199.77	7.54
Potash - Not Identified	15.00	EPA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potassium Nitrate	13.00	EPA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sulfur	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unknown																	
Ammonium Thiosulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Borax	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calcium Chelate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manure	5.00	UDADPI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Copper Sulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferric Sulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferrous Sulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron Chelate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron compound	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Liquid Amm Polyphosphate	11.00	UDADPI	0.00	113.77	43.07	0.00	0.00	0.00	3.83	0.00	0.00	0.00	0.00	0.00	0.00	29.16	0.00
Mangesium Chelate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Chelate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Sulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed Grades	17.20	WGGE	0.00	18.19	1.05	0.00	0.00	3.44	107.25	0.05	0.00	0.09	56.27	0.00	0.02	0.85	0.00
Mult. Nutrient-Code/Grade U	14.20	TVA	0.00	0.00	0.00	0.00	0.00	6.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitric Acid	33.00	UDADPI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Phosphate Prod. Code Unk.	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc Chelate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc Sulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL			192.96	4972.53	2356.02	106.08	39.09	561.49	529.71	162.67	0.07	0.17	418.80	194.04	1.12	1202.31	340.48

Table F-8 Total Nitrogen Content (tons N) by County
1992, 1993, 1994

Fertilizer Types	% Nitrogen Content	Content Ref.	Piute	Rich	Salt Lake	San Juan	Sanpete	Sevier	Summit	Tooele	Uintah	Utah	Wasatch	Washington	Wayne	Weber	State Total N 1993
Nitrogen																	
Ammonium Nitrate	33.50	EPA	18.15	0.00	948.18	0.00	238.26	232.11	433.94	296.12	271.10	1800.99	48.11	139.43	47.34	391.67	11190.19
Ammonium Sulfate	21.00	EPA	0.00	0.00	735.40	0.00	5.54	0.60	0.94	863.04	108.20	742.66	19.71	19.86	0.00	9.87	3136.94
Anhydrous Ammonia	82.00	EPA	0.00	0.00	200.90	0.00	0.00	0.00	0.00	0.00	311.64	0.00	0.00	0.00	0.00	0.00	1966.04
Calcium Nitrate	15.00	EPA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00
Nitrogen Solution 28%	28.00	EPA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.65	0.00	40.18
Nitrogen Solution 30%	30.00	EPA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.90	0.00	0.00	0.00	0.00	32.90
Nitrogen Solution 32%	32.00	EPA	0.00	0.00	23.89	0.00	199.74	27.37	0.00	0.00	235.89	646.93	0.00	14.72	0.00	0.00	2645.78
Sodium Nitrate	16.00	EPA	0.00	0.00	48.23	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.83
Sulfur coated Urea	38.00	EPA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.00
Urea	46.00	EPA	0.00	0.00	2026.09	51.21	0.00	0.00	0.46	0.00	0.00	141.26	0.00	2.35	0.00	6.23	3027.86
Phosphate																	
Superphosphate, Triple	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potash																	
Murite of Potash 60%	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potassium Sulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multiple Nutrient																	
Ammonium Phosphate Sulfat	14.50	EPA	3.73	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.61	0.00	0.00	32.98
Diammonium Phosphate	18.50	EPA	0.00	0.00	351.39	0.00	0.00	0.00	0.00	0.00	70.93	15.62	0.00	61.15	0.00	14.05	531.81
Epson Salt	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gypsum (Calcium Sulfate)	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lime Product - Code Unk.	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Monoammonium Phosphate	11.00	EPA	7.32	0.00	0.00	0.00	7.23	0.00	0.00	0.00	69.98	281.05	0.00	33.61	0.00	0.00	1019.86
Potash - Not Identified	15.00	EPA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00
Potassium Nitrate	13.00	EPA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.00
Sulfur	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unknown																	
Ammonium Thiosulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Borax	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calcium Chelate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manure	5.00	UDADPI	0.00	0.00	12.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.94
Copper Sulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferric Sulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferrous Sulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron Chelate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron compound	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Liquid Amm Polyphosphate	11.00	UDADPI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	201.43
Mangesium Chelate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Chelate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Sulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed Grades	17.20	WGGE	0.00	0.00	474.63	17.29	0.00	0.00	62.90	0.00	0.02	39.35	0.00	41.21	0.00	20.30	860.32
Mult. Nutrient-Code/Grade U	14.20	TVA	0.00	0.00	65.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37.47	123.78
Nitric Acid	33.00	UDADPI	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.51	0.00	0.00	0.00	0.00	33.52
Phosphate Prod. Code Unk.	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc Chelate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc Sulfate	-		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL			29.19	0.00	4889.77	68.50	450.78	260.08	518.24	1159.16	1067.74	3671.30	67.82	322.94	51.99	479.80	24515.47

Table F-9 Tons of N20-N by County 1991, 1992, 1993
(Tons N *0.0117)

Fertilizer Types	Beaver	Box Elder	Cache	Carbon	Daggett	Duchesne	Davis	Emery	Garfield	Grand	Iron	Juab	Kane	Millard	Morgan
Nitrogen															
Ammonium Nitrate	0.41	24.29	13.32	1.02	0.43	5.65	3.36	1.14	0.00	0.00	0.70	1.78	0.00	6.03	3.73
Ammonium Sulfate	0.17	2.48	0.46	0.04	0.00	0.52	0.47	0.00	0.00	0.00	0.00	0.00	0.01	0.92	0.11
Anhydrous Ammonia	0.00	15.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calcium Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 28%	0.00	0.09	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 30%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 32%	0.34	14.57	1.03	0.00	0.00	0.01	0.52	0.16	0.00	0.00	0.00	0.00	0.00	2.30	0.00
Sodium Nitrate	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sulfur coated Urea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Urea	0.00	0.21	6.68	0.00	0.00	1.02	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00
Phosphate															
Superphosphate, Triple	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potash															
Murite of Potash 60%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potassium Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multiple Nutrient															
Ammonium Phosphate Sulfate	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diammonium Phosphate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Epson Salt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gypsum (Calcium Sulfate)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lime Product - Code Unk.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Monoammonium Phosphate	0.58	1.34	0.79	0.10	0.02	1.03	0.63	0.00	0.00	0.00	0.16	0.08	0.00	1.46	0.18
Potash - Not Identified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potassium Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sulfur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unknown															
Ammonium Thiosulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Borax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calcium Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manure	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Copper Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferric Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferrous Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron compound	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Liquid Amm Polyphosphate	0.00	0.96	0.84	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00
Magnesium Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed Grades	0.00	0.21	0.01	0.00	0.00	0.07	1.25	0.00	0.00	0.00	1.95	0.00	0.00	0.01	0.00
Mult. Nutrient-Code/Grade Un	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitric Acid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Phosphate Prod. Code Unk.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	1.60	59.50	23.16	1.16	0.44	8.34	6.32	1.31	0.00	0.00	2.81	2.03	0.01	10.89	4.02

Table F-9 Tons of N20-N by County 1991, 1992, 1993(continued)
(Tons N *0.0117)

Fertilizer Types	Piute	Rich	Salt Lake	San Juan	Sanpete	Sevier	Summit	Tooele	Uintah	Utah	Wasatch	Washington	Wayne	Weber	State Total 1990
Nitrogen															
Ammonium Nitrate	0.07	0.00	10.86	0.00	2.26	1.61	4.72	3.45	2.46	16.81	0.57	2.44	0.61	6.60	114.33
Ammonium Sulfate	0.00	0.00	7.19	0.00	0.01	0.01	0.01	10.09	1.78	14.36	0.24	0.14	0.00	0.24	39.27
Anhydrous Ammonia	0.00	0.00	0.90	0.00	0.00	0.00	0.00	0.00	3.62	0.53	0.00	0.00	0.00	0.00	20.36
Calcium Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 28%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11
Nitrogen Solution 30%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 32%	0.00	0.00	0.35	0.00	2.34	0.00	0.00	0.00	3.83	5.84	0.00	0.02	0.00	0.00	31.31
Sodium Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Sulfur coated Urea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Urea	0.00	0.00	26.17	0.41	0.00	0.00	0.00	0.02	0.00	1.63	0.00	0.00	0.00	0.00	36.32
Phosphate															
Superphosphate, Triple	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potash															
Murite of Potash 60%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potassium Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multiple Nutrient															
Ammonium Phosphate Sulfate	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.39
Diammonium Phosphate	0.00	0.00	2.85	0.00	0.00	0.00	0.00	0.00	0.41	0.15	0.00	0.36	0.00	0.33	4.10
Epsom Salt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gypsum (Calcium Sulfate)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lime Product - Code Unk.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Monoammonium Phosphate	0.04	0.00	0.00	0.00	0.04	0.00	0.00	0.00	1.00	2.09	0.00	0.46	0.00	0.00	9.98
Potash - Not Identified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potassium Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sulfur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unknown															
Ammonium Thiosulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Borax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calcium Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manure	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20
Copper Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferric Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferrous Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron compound	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Liquid Amm Polyphosphate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.07
Magnesium Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed Grades	0.00	0.00	5.07	0.00	0.00	0.00	0.00	0.00	0.00	0.47	0.00	0.46	0.00	0.23	9.75
Mult. Nutrient-Code/Grade Un	0.00	0.00	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.64
Nitric Acid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01
Phosphate Prod. Code Unk.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.16	0.00	53.97	0.41	4.65	1.62	4.73	13.56	13.10	41.88	0.82	4.13	0.61	7.63	268.86

Table F-10 Tons of N20-N by County 1992, 1993, 1994
(Tons N *0.0117)

Fertilizer Types	Beaver	Box Elder	Cache	Carbon	Daggett	Duchesne	Davis	Emery	Garfield	Grand	Iron	Juab	Kane	Millard	Morgan
Nitrogen															
Ammonium Nitrate	0.88	27.88	17.05	1.01	0.43	3.89	2.74	1.48	0.00	0.00	0.67	2.02	0.00	7.17	3.82
Ammonium Sulfate	0.20	3.39	0.59	0.03	0.00	0.51	0.80	0.00	0.00	0.00	0.06	0.00	0.01	1.46	0.07
Anhydrous Ammonia	0.00	11.62	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.43	0.00	0.00	0.00	0.00
Calcium Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 28%	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 30%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 32%	0.34	12.12	0.88	0.00	0.00	0.01	0.51	0.42	0.00	0.00	0.00	0.09	0.00	2.74	0.00
Sodium Nitrate	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sulfur coated Urea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Urea	0.00	0.30	6.99	0.00	0.00	1.44	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00
Phosphate															
Superphosphate, Triple	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potash															
Murite of Potash 60%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potassium Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multiple Nutrient															
Ammonium Phosphate Sulfate	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diammonium Phosphate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Epsom Salt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gypsum (Calcium Sulfate)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lime Product - Code Unk.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Monoammonium Phosphate	0.79	1.21	0.55	0.20	0.03	0.94	0.85	0.00	0.00	0.00	0.08	0.06	0.00	2.34	0.09
Potash - Not Identified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potassium Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sulfur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unknowns															
Ammonium Thiosulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Borax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calcium Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manure	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Copper Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferric Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferrous Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron compound	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Liquid Amm Polyphosphate	0.00	1.33	0.30	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00
Mangesium Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed Grades	0.00	0.21	0.01	0.00	0.00	0.04	1.25	0.00	0.00	0.00	0.66	0.00	0.00	0.01	0.00
Mult. Nutrient-Code/Grade Un	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitric Acid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Phosphate Prod. Code Unk.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	2.26	58.18	27.57	1.24	0.46	8.91	6.20	1.90	0.00	0.00	4.90	2.27	0.01	14.07	3.98

Table F-18 Tons of N2O-N by County 1992,1993,1994 (continued)
(Tons N *0.0117)

Fertilizer Types	Piute	Rich	Salt Lake	San Juan	Sanpete	Sevier	Summit	Tooele	Uintah	Utah	Wasatch	Washington	Wayne	Weber	State Total 1993
Nitrogen															
Ammonium Nitrate	0.21	0.00	11.09	0.00	2.79	2.72	5.31	3.46	3.17	21.07	0.56	1.63	0.55	6.92	130.53
Ammonium Sulfate	0.00	0.00	8.60	0.00	0.06	0.01	0.01	10.10	1.27	8.69	0.23	0.23	0.00	0.12	36.46
Anhydrous Ammonia	0.00	0.00	2.33	0.00	0.00	0.00	0.00	0.00	3.65	0.00	0.00	0.00	0.00	0.00	22.04
Calcium Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 28%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.14
Nitrogen Solution 30%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.03
Nitrogen Solution 32%	0.00	0.00	0.30	0.00	2.34	0.32	0.00	0.00	2.76	7.37	0.00	0.17	0.00	0.00	30.38
Sodium Nitrate	0.00	0.00	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.59
Sulfur coated Urea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Urea	0.00	0.00	23.71	0.80	0.00	0.00	0.01	0.00	0.00	1.63	0.00	0.03	0.00	0.07	34.89
Phosphate															
Superphosphate, Triple	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potash															
Murite of Potash 60%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potassium Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multiple Nutrient															
Ammonium Phosphate Sulfate	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.22
Diammonium Phosphate	0.00	0.00	4.11	0.00	0.00	0.00	0.00	0.00	0.83	0.18	0.00	0.72	0.00	0.16	6.01
Epsom Salt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gypsum (Calcium Sulfate)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lime Product - Code Unk.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Monoammonium Phosphate	0.09	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.82	3.29	0.00	0.39	0.00	0.00	11.80
Potash - Not Identified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potassium Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sulfur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unknown															
Ammonium Thiosulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Borax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calcium Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manure	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13
Copper Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferric Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferrous Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron compound	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Liquid Amm Polyphosphate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.23
Magnesium Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed Grades	0.00	0.00	5.55	0.20	0.00	0.00	0.74	0.00	0.00	0.46	0.00	0.48	0.00	0.24	9.86
Mult. Nutrient-Code/Grade Un	0.00	0.00	0.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44	1.28
Nitric Acid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01
Phosphate Prod. Code Unk.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	0.34	0.00	37.21	0.80	5.27	3.04	6.06	13.56	12.49	42.95	0.79	3.78	0.61	7.95	286.83

Table F-11 Tons of N2O by County 1991, 1992, 1993
N2O-N * 44/28

Fetilizer Types	Beaver	Box Elder	Cache	Carbon	Daggett	Duchesne	Davis	Emery	Garfield	Grand	Iron	Juab	Kane	Millard	Morgan
Nitrogen															
Ammonium Nitrate	0.65	38.17	20.93	1.60	0.67	8.88	5.29	1.80	0.00	0.00	1.09	2.80	0.00	9.47	3.86
Ammonium Sulfate	0.27	3.90	0.72	0.06	0.00	0.82	0.74	0.00	0.00	0.00	0.01	0.00	0.02	1.44	0.17
Anhydrous Ammonia	0.00	24.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calcium Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 28%	0.00	0.14	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 30%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 32%	0.54	22.90	1.61	0.00	0.00	0.02	0.81	0.26	0.00	0.00	0.00	0.00	0.00	3.61	0.00
Sodium Nitrate	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sulfur coated Urea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Urea	0.00	0.33	10.30	0.00	0.00	1.61	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.00
Phosphate															
Superphosphate, Triple	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potash															
Murite of Potash 60%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potassium Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multiple Nutrient															
Ammonium Phosphate Sulfate	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diammonium Phosphate	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Epsom Salt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gypsum (Calcium Sulfate)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lime Product - Code Unk.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Monoammonium Phosphate	0.91	2.11	1.24	0.15	0.03	1.62	0.99	0.00	0.00	0.00	0.23	0.13	0.00	2.29	0.28
Potash - Not Identified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potassium Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sulfur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unknown															
Ammonium Thiosulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Borax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calcium Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manure	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Copper Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferric Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferrous Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron compound	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Liquid Amm Polyphosphate	0.00	1.51	1.32	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.00
Magnesium Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed Grades	0.00	0.34	0.02	0.00	0.00	0.11	1.97	0.00	0.00	0.00	3.07	0.00	0.00	0.02	0.00
Mult. Nutrient-Code/Grade Un	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitric Acid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Phosphate Prod. Code Unk.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	2.51	93.51	36.39	1.82	0.69	13.11	9.94	2.05	0.00	0.00	4.42	3.18	0.02	17.11	6.31

Table F-11 Tons of N20 by County 1991, 1992, 1993 (continued)
N20-N * 44/28

Fertilizer Types	Piute	Rich	Salt Lake	San Juan	Sanpete	Sevier	Summit	Tooele	Uintah	Utah	Wasatch	Washington	Wayne	Weber	State Total 1990
Nitrogen															
Ammonium Nitrate	0.12	0.00	17.07	0.00	3.55	2.53	7.41	5.42	3.87	26.41	0.90	3.83	0.96	10.38	179.66
Ammonium Sulfate	0.00	0.00	11.29	0.01	0.02	0.01	0.01	15.86	2.79	22.57	0.38	0.23	0.00	0.38	61.70
Anhydrous Ammonia	0.00	0.00	1.41	0.00	0.00	0.00	0.00	0.00	5.68	0.83	0.00	0.00	0.00	0.00	31.99
Calcium Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 28%	0.00	0.00	0.00	0.00	.0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18
Nitrogen Solution 30%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 32%	0.00	0.00	0.55	0.00	3.67	0.00	0.00	0.00	6.02	9.18	0.00	0.04	0.00	0.00	49.30
Sodium Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
Sulfur coated Urea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Urea	0.00	0.00	41.13	0.64	0.00	0.00	0.00	0.03	0.00	2.56	0.00	0.00	0.00	0.01	57.07
Phosphate															
Superphosphate, Triple	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potash															
Murite of Potash 60%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potassium Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multiple Nutrient															
Ammonium Phosphate Sulfat	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.61
Diammonium Phosphate	0.00	0.00	4.48	0.00	0.00	0.00	0.00	0.00	0.65	0.23	0.00	0.56	0.00	0.52	6.45
Epson Salt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gypsum (Calcium Sulfate)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lime Product - Code Unk.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Monoammonium Phosphate	0.07	0.00	0.00	0.00	0.07	0.00	0.00	0.00	1.57	3.28	0.00	0.72	0.00	0.00	15.68
Potash - Not Identified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potassium Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sulfur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unknown															0.00
Ammonium Thiosulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Borax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calcium Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manure	0.00	0.00	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31
Copper Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferric Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferrous Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron compound	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Liquid Amm Polyphosphate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.25
Mangesium Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Chelate	0.00	0.00	0.00	0.00.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed Grades	0.00	0.00	7.97	0.00	0.00	0.00	0.00	0.00	0.00	0.73	0.00	0.72	0.00	0.36	15.32
Mult. Nutrient-Code/Grade U	0.00	0.00	0.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	1.01
Nitric Acid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.02
Phosphate Prod. Code Unk.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	0.35	0.00	84.80	0.65	7.31	2.54	7.44	21.31	20.59	65.81	1.29	6.49	0.96	11.99	422.49

Table F-12 Tons of N20 by County 1992, 1993, 1994
N20-N * 44/28

Fertilizer Types	Beaver	Box Elder	Cache	Carbon	Daggett	Duchesne	Davis	Emery	Garfield	Grand	Iron	Juab	Kane	Millard	Morgan
Nitrogen															
Ammonium Nitrate	1.38	43.82	26.79	1.59	0.67	9.26	4.30	2.33	0.00	0.00	1.05	3.17	0.00	11.27	6.00
Ammonium Sulfate	0.32	5.33	0.92	0.05	0.00	0.80	1.26	0.00	0.00	0.00	0.10	0.00	0.02	2.30	0.12
Anhydrous Ammonia	0.00	18.25	1.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.39	0.00	0.00	0.00	0.00
Calcium Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 28%	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 30%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 32%	0.54	19.05	1.38	0.00	0.00	0.02	0.80	0.66	0.00	0.00	0.00	0.14	0.00	4.31	0.00
Sodium Nitrate	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sulfur coated Urea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Urea	0.00	0.47	10.98	0.00	0.00	2.26	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00
Phosphate															
Superphosphate, Triple	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potash															
Murite of Potash 60%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potassium Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multiple Nutrient															
Ammonium Phosphate Sulfate	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diammonium Phosphate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Epson Salt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gypsum (Calcium Sulfate)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lime Product - Code Unk.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Monoammonium Phosphate	1.24	1.90	0.87	0.31	0.05	1.48	1.33	0.00	0.00	0.00	0.12	0.10	0.00	3.67	0.14
Potash - Not Identified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potassium Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sulfur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unknown															
Ammonium Thiosulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Borax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calcium Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manure	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Copper Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferric Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferrous Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron compound	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Liquid Amm Polyphosphate	0.00	2.09	0.79	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.00
Mangasium Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Chelate	0.00	0.00	0.00	0.00.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed Grades	0.00	0.33	0.02	0.00	0.00	0.06	1.97	0.00	0.00	0.00	1.03	0.00	0.00	0.02	0.00
Mult. Nutrient-Code/Grade Un	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitric Acid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Phosphate Prod. Code Unk.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	3.55	91.42	43.32	1.95	0.72	14.00	9.74	2.99	0.00	0.00	7.70	3.57	0.02	22.12	6.26

Table F-12 Tons of N20 by County 1992, 1993, 1994 (continued)
*N20-N * 44/28*

Fertilizer Types	Piute	Rich	Salt Lake	San Juan	Sanpete	Sevier	Summit	Tooele	Uintah	Utah	Wasatch	Washington	Wayne	Weber	State Total 1990
Nitrogen															
Ammonium Nitrate	0.33	0.00	17.43	0.00	4.38	4.27	8.35	5.44	4.98	33.11	0.88	2.56	0.87	10.88	205.12
Ammonium Sulfate	0.00	0.00	13.52	0.00	0.10	0.01	0.02	15.87	1.99	13.65	0.36	0.37	0.00	0.18	57.29
Anhydrous Ammonia	0.00	0.00	3.69	0.00	0.00	0.00	0.00	0.00	5.73	0.00	0.00	0.00	0.00	0.00	34.64
Calcium Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Solution 28%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.22
Nitrogen Solution 30%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.05
Nitrogen Solution 32%	0.00	0.00	0.48	0.00	3.67	0.50	0.00	0.00	4.34	11.89	0.00	0.27	0.00	0.00	48.06
Sodium Nitrate	0.00	0.00	0.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.93
Sulfur coated Urea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Urea	0.00	0.00	37.25	0.94	0.00	0.00	0.01	0.00	0.00	2.60	0.00	0.04	0.00	0.11	54.82
Phosphate															
Superphosphate, Triple	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potash															
Murite of Potash 60%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potassium Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multiple Nutrient															
Ammonium Phosphate Sulfat	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.34
Diammonium Phosphate	0.00	0.00	6.46	0.00	0.00	0.00	0.00	0.00	1.30	0.29	0.00	1.12	0.00	0.26	9.44
Epson Salt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gypsum (Calcium Sulfate)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lime Product - Code Unk.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Monoammonium Phosphate	0.13	0.00	0.00	0.00	0.13	0.00	0.00	0.00	1.29	5.17	0.00	0.62	0.00	0.00	18.55
Potash - Not Identified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potassium Nitrate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sulfur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unknown															
Ammonium Thiosulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Borax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calcium Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manure	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24
Copper Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferric Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ferrous Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron compound	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Liquid Amm Polyphosphate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.50
Mangesium Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manganese Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mixed Grades	0.00	0.00	8.73	0.32	0.00	0.00	1.16	0.00	0.00	0.72	0.00	0.76	0.00	0.38	15.50
Mult. Nutrient-Code/Grade U	0.00	0.00	1.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.69	2.01
Nitric Acid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01
Phosphate Prod. Code Unk.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc Chelate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc Sulfate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	0.54	0.00	89.90	1.26	8.29	4.78	9.53	21.31	19.63	67.50	1.25	5.94	0.96	12.50	450.73

Appendix G

Forest Management and Land Use Change

Table G-1 Changes in Forests and Woody Biomass Stock

Forest ID		Predominant Forest Type	Total Forest Acres	Column A	Column B	Column C	Column D	Column E
			(1994 USFS approximation and approximation from state forester, Chas Chandler of Richfield, Utah 896-6494)	Adjusted Area of Biomass/ Forest Stocks in thousands of acres (from forest stocks)	Annual Growth Rate (t dm/acre/yr) (Douglas fir)	(AxB) Annual Biomass Increment (10^3 t dm/yr)	Carbon Fraction of Dry Matter (t C/t dm)	(CxD) Total Carbon Uptake Increment (10^3 t C/yr)
Ashley	1993	evergreen (lodgepole pines)	1,373,200	835	13.5	11278.6	0.512	5774.6
	1992			833	13.5	11249.7	0.512	5759.8
	1991			832	13.5	11231.7	0.512	5750.6
	1990			830	13.5	11210.1	0.512	5739.6
Dixie	1993	evergreen (spruce and pines)	1,883,896	675	13.5	9109.7	0.512	4664.1
	1992			670	13.5	9041.2	0.512	4629.1
	1991			665	13.5	8973.8	0.512	4594.6
	1990			659	13.5	8897.3	0.512	4555.4
Fishlake	1993	evergreen (spruce and pines)	1,424,480	727	13.5	9817.8	0.512	5026.7
	1992			727	13.5	9812.4	0.512	5024.0
	1991			727	13.5	9810.8	0.512	5023.1
	1990			726	13.5	9795.4	0.512	5015.2
Manti-LaSal	1993	evergreen (spruce and pines)	1,334,500	690	13.5	9309.0	0.512	4766.2
	1992			689	13.5	9301.3	0.512	4762.3
	1991			689	13.5	9301.3	0.512	4762.3
	1990			689	13.5	9299.4	0.512	4761.3
Uinta 1993	1993	evergreen (spruce and pines)	836,500	323	13.5	4362.8	0.512	2233.8
	1992			323	13.5	4358.2	0.512	2231.4
	1991			322	13.5	4352.4	0.512	2228.4
	1990			322	13.5	4341.5	0.512	2222.9
Wasatch-Cache	1993	evergreen (spruce and pines)	1,219,700	742	13.5	10019.7	0.512	5130.1
	1992			742	13.5	10014.0	0.512	5127.2
	1991			741	13.5	10008.2	0.512	5124.2
	1990			741	13.5	10007.5	0.512	5123.8
					(may use default values from table 10-1 of USEPA)		(see table 1.2 of Birdsey, 1992 or use default value 0.5)	

Note: 60% of all lumber cut in Utah is spruce. The remaining 40% is dispersed through other woods including: aspen (for Pallets), lodgepole pine, and some ponderosa pine.
Source: Rollie Sayler of Forest Management Intermountain Region USFS.
Future Reference: Utah Aspen Mills of Sigurd, Utah, began heavy processing of Aspens for pallets for years 1994 foward. (1-801-896-6402)

non-forest trees	*Column A*	*Column B*			
	Acreage in urban forest for cities with population > 20,000	Annual Growth Rate (see page 10-4) (Loblolly Pine)			
	(10^3 acres)	(t dm/acre/yr)			
1993	48	9	433.5	0.512	222.0
1992	48	9	433.5	0.512	222.0
1991	48	9	433.5	0.512	222.0
1990	48	9	433.5	0.512	222.0

Column E Totals

Total for 27817.5 thousand tons C/yr
Total for 27755.7 thousand tons C/yr
Total for 27705.1 thousand tons C/yr
Total for 27640.2 thousand tons C/yr
(these values are used in column P of Worksheet 10-1, sheet 2.)

Table G-1 Changes in Forests and Woody Biomass Stock

Forest ID		Predominant Forest Type	Total Forest Acres	Column A	Column B	Column C	Column D	Column E
			(1994 USFS approximation and approximation from state forester, Chas Chandler of Richfield, Utah 896-6494)	Adjusted Area of Biomass/ Forest Stocks in thousands of acres (from forest stocks)	Annual Growth Rate (t dm/acre/yr) (Douglas fir)	(AxB) Annual Biomass Increment (10^3 t dm/yr)	Carbon Fraction of Dry Matter (t C/t dm)	(CxD) Total Carbon Uptake Increment (10^3 t C/yr)
Ashley	1993	evergreen (lodgepole pines)	1,373,200	835	13.5	11,278.6	0.512	5,774.6
	1992			833	13.5	11,249.7	0.512	5,759.8
	1991			832	13.5	11,231.7	0.512	5,750.6
	1990			830	13.5	11,210.1	0.512	5,739.6
Dixie	1993	evergreen (spruce and pines)	1,883,896	675	13.5	9,109.7	0.512	4,664.1
	1992			670	13.5	9,041.2	0.512	4,629.1
	1991			665	13.5	8,973.8	0.512	4,594.6
	1990			659	13.5	8,897.3	0.512	4,555.4
Fishlake	1993	evergreen (spruce and pines)	1,424,480	727	13.5	9,817.8	0.512	5,026.7
	1992			727	13.5	9,812.4	0.512	5,024.0
	1991			727	13.5	9,810.8	0.512	5,023.1
	1990			726	13.5	9,795.4	0.512	5,015.2
Manti-LaSal	1993	evergreen (spruce and pines)	1,334,500	690	13.5	9,309.0	0.512	4,766.2
	1992			689	13.5	9,301.3	0.512	4,762.3
	1991			689	13.5	9,301.3	0.512	4,762.3
	1990			689	13.5	9,299.4	0.512	4,761.3
Uinta 1993	1993	evergreen (spruce and pines)	836,500	323	13.5	4,362.8	0.512	2,233.8
	1992			323	13.5	4,358.2	0.512	2,231.4
	1991			322	13.5	4,352.4	0.512	2,228.4
	1990			322	13.5	4,341.5	0.512	2,222.9
Wasatch-Cache	1993	evergreen (spruce and pines)	1,219,700	742	13.5	10,019.7	0.512	5,130.1
	1992			742	13.5	10,014.0	0.512	5,127.2
	1991			741	13.5	10,008.2	0.512	5,124.2
	1990			741	13.5	10,007.5	0.512	5,123.8
					(may use default values from table 10-1 of USEPA)		(see table 1.2 of Birdsey, 1992 or use default value 0.5)	

Note: 60% of all lumber cut in Utah is spruce. The remaining 40% is dispersed through other woods including: aspen (for Pallets), lodgepole pine, and some ponderosa pine.
Source: Rollie Sayler of Forest Management Intermountain Region USFS.
Future Reference: Utah Aspen Mills of Sigurd, Utah, began heavy processing of Aspens for pallets for years 1994 foward. (1-801-896-6402)

non-forest trees		Column A	Column B			
		Acreage in urban forest for cities with population > 20,000	Annual Growth Rate (see page 10-4) (Loblolly Pine)			
		(10^3 acres)	(t dm/acre/yr)			
	1993	48	9	433.5	0.512	222.0
	1992	48	9	433.5	0.512	222.0
	1991	48	9	433.5	0.512	222.0
	1990	48	9	433.5	0.512	222.0

Column E Totals

Total for 27817.5 thousand tons C/yr
Total for 27755.7 thousand tons C/yr
Total for 27705.1 thousand tons C/yr
Total for 27640.2 thousand tons C/yr
(these values are used in column P of Worksheet 10-1, sheet 2.)

Table G-2 Approximations of Biomass/Forest Stocks

Information provided by Rollie Saylor of Forest Management Intermountain Region gives total forest acres and forest land acres for 1994. These values may be used to approximate forest acreage for 1990 and 1993.

Use equation below (i.e. where for the 1993 year):

(total forest land acres 1994) - (acres planted in 1993 - acres harvested in 1993) = (total forest land in acres for 1993)

year	forest name	Approximation of area of biomass/forest stocks for column A of worksheet 10-1 from Utah USFS office (10^3 acres)	acres planted previous year (10^3 acres)	acres harvested (10^3 acres)	total of previous year (10^3 acres)	net change this year (10^3 acres)
1994	Ashley	836.8	1.350	0.000	835.5	1.350
1993	Ashley	835.5	2.141	0.000	833.3	2.141
1992	Ashley	833.3	1.331	0.000	832.0	1.331
1991	Ashley	832.0	1.601	0.000	830.4	1.601
1990	Ashley	830.4	0.000	0.000	830.4	0.000
1994	Dixie	678.8	5.042	1.032	674.8	4.010
1993	Dixie	674.8	5.903	0.834	669.7	5.069
1992	Dixie	669.7	5.450	0.452	664.7	4.998
1991	Dixie	664.7	6.326	0.664	659.1	5.662
1990	Dixie	659.1	7.354	0.687	652.4	6.667
1994	Fishlake	727.8	0.592	0.056	727.2	0.536
1993	Fishlake	727.2	0.411	0.015	726.8	0.396
1992	Fishlake	726.8	0.247	0.122	726.7	0.125
1991	Fishlake	726.7	1.219	0.078	725.6	1.141
1990	Fishlake	725.6	0.710	0.086	725.0	0.624
1994	Manti-LaSal	689.8	0.316	0.071	689.6	0.245
1993	Manti-LaSal	689.6	0.572	0.000	689.0	0.572
1992	Manti-LaSal	689.0	0.000	0.000	689.0	0.000
1991	Manti-LaSal	689.0	0.167	0.032	688.8	0.135
1990	Manti-LaSal	688.8	0.000	0.000	688.8	0.000
1994	Uinta	323.3	0.155	0.028	323.2	0.127
1993	Uinta	323.2	0.340	0.000	322.8	0.340
1992	Uinta	322.8	0.436	0.000	322.4	0.436
1991	Uinta	322.4	0.802	0.000	321.6	0.802
1990	Uinta	321.6	0.000	0.000	321.6	0.000
1994	Wasatch-Cache	742.3	0.384	0.284	742.2	0.100
1993	Wasatch-Cache	742.2	0.420	0.000	741.8	0.420
1992	Wasatch-Cache	741.8	0.435	0.000	741.3	0.435
1991	Wasatch-Cache	741.3	0.050	0.000	741.3	0.050
1990	Wasatch-Cache	741.3	0.000	0.204	741.5	-0.204

Approximations of Biomass/Forest Stocks linked to Column A of Worksheet 10-1, Sheet 1

	1990	1991	1992	1993
Ashley	830	832	833	835
Dixie	659	665	670	675
Fishlake	726	727	727	727
Manti-LaSal	689	689	689	690
Uinta	322	322	323	323
Wasatch-Cache	741	741	742	742
Totals	3966.758	3976.149	3983.474	3992.412
Annual increase		9	7	9

Table G-3 Greenhouse Gas from Forest Changes (Urban Forest)

City	Square Kilometer	Acres	Percent Acres Forest (18.5%)	Number of Trees	
Logan	37.05	9,155	1,694	707,951	
Bountiful	27.17	6,714	1,242	519,164	
Clearfield	18.96	4,685	867	362,287	
Layton	47.7	11,787	2,181	911,451	
Salt Lake City	287.23	70,974	13,130	5,488,385	
Murray	25.24	6,237	1,154	482,285	
Sandy	52.89	13,069	2,418	1,010,621	
West Jordan	69.5	17,173	3,177	1,328,005	
W Valley City	89.1	22,016	4,073	1,702,521	
Orem	46.32	11,446	2,117	885,082	
Provo	108.4	26,785	4,955	2,071,305	
St George	157.21	38,846	7,187	3,003,966	
Ogden	68.59	16,948	3,135	1,310,616	
Roy	18.4	4,547	841	351,587	
Total			48,170	20,135,226	
		1,000 Acres	48	20,135	**1,000 Trees**

Notes:

1. Percent tree cover for: SLC = 26%, Logan = 11%, Average = 18.5%.
   Percent acres of Forest for each city = 18.5% of total acres in the corporate boundary.
2. Tree density converted from trees/hectare to trees/acre from data provided by Greg McPherson.
3. Number of trees = 418 trees/acre across all urban land uses.

State of Utah
Department of Environmental Quality
Division of Air Quality
(801) 536-4000