

**COMBUSTION AREA SOURCES: DATA SOURCES**

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## ABSTRACT

Area source emissions of particulate matter (TSP), sulfur dioxide (SO<sub>2</sub>), oxides of nitrogen (NO<sub>x</sub>), reactive volatile organic compounds (VOCs) and carbon monoxide (CO) are estimated annually by the U.S. Environmental Protection Agency's (EPA's) National Air Data Branch (NADB). Area sources include all mobile sources and any stationary sources that are too small, difficult or numerous to be inventoried as point sources. The original National Emissions Data System (NEDS) area source methodology and algorithms were developed in 1973 and 1974, using 1960 census data. The NEDS methodology has remained relatively unchanged over the past 15 years. Current methods may be improved by updating referenced technology or revised using more recent data. Due to the recent groundswell of interest in obtaining better emissions inventory data, efforts are underway to update or revise these "old" NEDS methodologies. The work discussed in this report relates to the combustion category of emissions. Information presented in this report is intended to identify, document, and evaluate data sources for stationary area sources, including solid waste burning, agricultural burning, and other burning categories.

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## LIST OF ACRONYMS

AGA	American Gas Association
CBECs	Commercial Buildings Energy Consumption Survey
CO	Carbon Monoxide
DOE	Department of Energy
DTM	Digital Terrain Modeling
EIA	Energy Information Administration
EOSAT	Earth Observation Satellite Company
EPA	Environmental Protection Agency
EROS	Earth Resources Observation System
GAA	Governmental Advisory Associates
GIS	Geographic Information Systems
GPO	Government Printing Office
JEIOG	Joint Emissions Inventory Oversight Group
MSW	Municipal Solid Waste
MWC	Municipal Waste Combustion
NA	Not Available
NADB	National Air Data Branch
NASA	National Aeronautics and Space Administration
NEDS	National Emissions Data System
NFPA	National Fire Protection Association
NFS	National (U. S. ) Forest Service
NOAA	National Oceanic and Atmospheric Administration
NO <sub>x</sub>	Oxides of Nitrogen
NSWMA	National Solid Waste Management Association
NTIS	National Technical Information Service
SIC	Standard Industrial Classification
SIP	State Implementation Plan
SO <sub>2</sub>	Sulfur Dioxide
SPOT	Système Probatoire de la Observation de la Terre
STAR	Scientific and Technical Aerospace Reports
TSP	Total Suspended Particulates
VOC	Volatile Organic Compounds

## SECTION 1

### INTRODUCTION

#### BACKGROUND

Area source emissions of total suspended particulate (TSP), sulfur dioxide (SO<sub>2</sub>), oxides of nitrogen (NO<sub>x</sub>), volatile organic compounds (VOC) and carbon monoxide (CO) are estimated annually by the U.S. Environmental Protection Agency's (EPA's) National Air Data Branch (NADB). Area sources include all mobile sources and any stationary sources that are too small, difficult, or numerous to be inventoried as point sources. The original National Emissions Data System (NEDS) area source methodology and algorithms were developed in 1973 and 1974, using 1960 census data. The NEDS methodology has remained relatively unchanged over the past fifteen years. Current methods need to be updated or revised using more recent data.

As part of the EPA's atmospheric ozone and CO control program, State and local control agencies responsible for ozone and CO nonattainment areas must estimate emissions from point, area, and mobile sources to serve as a basis for State implementation plans (SIPs). SIP guidance for estimating stationary and mobile source emissions is found in *Procedures for the Preparation of Emission Inventories for Carbon Monoxide and Precursors of Ozone, Volume I: General Guidance for Stationary Sources* (EPA-450/4-91-016; NTIS PB92-112168) and *Procedures for the Emission Inventory Preparation, Volume IV: Mobile Sources* (EPA-450/4-81-26d (Revised)), respectively. Stationary area source guidance and data sources are, in some cases, more than fifteen years old, despite recent (1992) updates to the original guidance documentation.

The Joint Emissions Inventory Oversight Group (JEIOG) has placed a high priority on evaluating the stationary area source categories and recognizes that the emissions inventory methodologies currently applied to these sources are outdated and need to be revised. This report is one of the initial steps of the revision process.



## **PURPOSE**

The purpose of this project was to identify, document, and evaluate data sources for stationary combustion area sources, including fuel burning, solid waste burning, and other burning.

## **CONTENTS**

Section 2 of this report describes the methodology used in the data source identification, documentation, and evaluation process. Section 3 contains a summary chart of the fuel combustion data sources, and a description of the most promising data sources. Section 4 contains the same information for solid waste combustion, and Section 5 covers the category of other burning. Section 6 is a brief evaluation of satellite data and potential sources.

This report also includes two appendices. Appendix A contains the complete information data sheets for each data source. Appendix B contains a summary chart of trade and professional associations.

## SECTION 2

### DATA SOURCE DISCOVERY AND RECORDING METHODOLOGY

Data sources were identified for three major categories of area source emissions: fuel combustion, solid waste combustion, and other combustion. In the other combustion category, the search focused on two primary subcategories: forest fires and agricultural burning. The same basic technique was used for searching, evaluating, recording, and storing the data sources for each major category.

Data sources were identified in the following ways:

- reviewing the EPA library holdings and Triangle universities' collections
- contacting the U.S. Departments of Commerce, Energy, Agriculture and Transportation
- searching the National Technical Information Service (NTIS) and Government Printing Office (GPO) databases
- contacting trade, business, and manufacturing associations

The following characteristics were identified and recorded, to the extent possible, for each source reviewed: title, author, date published, frequency of update, document number, type of data, timeliness of data, available data media, resolution of data, comprehensiveness and accuracy of the data, and a brief description of the contents of the document. A template developed under EPA Contract No. 68-D9-0173, Work Assignment No. 0/106 was used to record the information. A separate template was maintained for each data source identified for this work assignment.

The completed templates were stored in computer files and are included in Appendix A.

### SECTION 3

#### FUEL COMBUSTION DATA SOURCES

Eighteen area source fuel combustion data sources were identified under this project. The data sources listed below contain the most useful information from those sources reviewed. Data source numbers refer to sources in Table 3-1 only.

- Data source 1, *State Energy Data Report* - data on energy consumption at the State and national levels
- Data source 2, *Annual Energy Review* - energy data on the census and national levels
- Data source 3, *Gas Facts* - natural gas consumption data on the national and State levels
- Data source 4, *Gas Househeating Survey* - fuel consumption and costs for natural gas househeating
- Data source 5, *Petroleum Supply Annual 1989*, Volumes I and II - data on petroleum products consumption
- Data source 6, *Fuel Oil and Kerosene Sales* - data on sales (consumption) of fuel oil and kerosene products
- Data source 7, *Natural Gas Annual* - data on regional, State and national levels

Additional combustion data sources were reviewed and may provide some useful information on one or more fuel consumption areas. However, the sources may be inadequate because they have been published only one time. These sources are represented as data sources 8 through 18 in Table 3-1.

TABLE 3-1. FUEL DATA SOURCES FOR STATIONARY AREA SOURCE COMBUSTION

Document Title	Frequency of Update	Issuing Agency	Type of Information	Document Number
<i>State Energy Data Report 1990</i>	Annual	DOE/EIA	Provides estimates of annual energy consumption at the state and national levels by principal energy type and by major economic sector from 1960 forward.	DOE/EIA-0214(90) NTIS DE991010971
<i>Annual Energy Review 1990</i>	Annual	DOE/EIA	Presents energy data summaries as well as complete data coverage of the principle energy commodities on the national and census region. Contains world production data in the major fuel categories.	DOE/EIA-0384(90) NTIS DE86010432
<i>Gas Facts</i>	Annual	AGA	Data specific to natural gas on consumption, cost, production, and revenues.	AGA catalog #F10187
<i>Gas Househeating Survey</i>	Annual	AGA	Data based on annual survey of gas utility companies.	NA
<i>Petroleum Supply Annual 1989, Volumes I and II</i>	Annual	DOE/EIA	Data on the supply and disposition of crude oil and petroleum products. The data presented are yearly and monthly.	DOE/EIA-0340(89)/1, 2 (1) NTIS DE90012613 (2) NTIS DE90016012
<i>Fuel Oil and Kerosene Sales 1989</i>	Annual	DOE/EIA	Presents sales and adjusted sales for fuel oil and kerosene.	DOE/EIA-0535(89)

(continued)

Document Title	Frequency of Update	Issuing Agency	Type of Information	Document Number
<i>Natural Gas Annual 1989</i>	Annual	DOE/EIA	Contains national, state and regional statistics on natural gas reserves, production, imports, exports, transportation, storage, consumption, and prices.	DOE/EIA-0131(89) NTIS DE90002646
<i>Quarterly Coal Report - October-December 1990</i>	Quarterly	DOE/EIA	Coal consumption is listed by census region, state, end-use sectors, and Standard Industrial Classification (SIC) codes.	DOE/EIA-0121 (90/4Q)
<i>Household Energy Consumption and Expenditures 1987, Part 1</i>	Triennial	DOE/EIA	Consumption and expenditures of energy used in all types of housing. Data are based on national and census region.	DOE/EIA-0321(87)/1 NTIS DE87010362
<i>Housing Characteristics 1987</i>	Triennial	DOE/EIA	Data on residential fuels and their use in homes, appliances, and other home characteristics.	DOE/EIA-0314(87) NTIS DE89014621
<i>Manufacturing Energy Consumption Survey 1985</i>	Triennial	DOE/EIA	Data on energy consumption, manufacturing acquisitions and disposition of energy.	DOE/EIA-0512(85) DE89003384

(continued)

TABLE 3-1. FUEL DATA SOURCES FOR STATIONARY AREA SOURCE COMBUSTION (continued)

Document Title	Frequency of Update	Issuing Agency	Type of Information	Document Number
<i>Commercial Buildings Characteristics 1989</i>	Triennial	DOE/EIA	Data on the consumption of and the expenditures for energy used in commercial buildings. Data are based on national and census region.	DOE/EIA-0246(86) NTIS DE89000448
<i>Commercial Buildings Consumption and Expenditures 1986</i>	Triennial	DOE/EIA	Reports national- and regional-level consumption estimates on coal for commercial buildings. Data are listed under several commercial building characteristics.	DOE/EIA-0318(86) NTIS DE89011843
<i>Nonresidential Building Energy Consumption Survey: Fuel Characteristics and Conservation Practices</i>	One-time (1981)	DOE/EIA	Data on energy uses and conservation practices employed in nonresidential buildings.	DOE/EIA-0278 NTIS DE81027671
<i>Energy Expenditures for Space Heating By Fuel, State, Region, and Income Class</i>	One-time (1979)	DOE/EIA	Provides estimates of median expenditures on home fuels for space heating by low income households, and do not include fuels used for other purposes such as water heating.	DOE/EIA-SR/EUA/79-16

(continued)

**TABLE 3-1. FUEL DATA SOURCES FOR STATIONARY AREA SOURCE COMBUSTION (continued)**

<b>Document Title</b>	<b>Frequency of Update</b>	<b>Issuing Agency</b>	<b>Type of Information</b>	<b>Document Number</b>
<i>Estimated U.S. Wood Energy Consumption from 1949 to 1981</i>	One-time (1984)	DOE/EIA	Reports the results that determine wood energy consumption on the residential, commercial and industrial sectors.	DOE/EIA-0341 NTIS DE82020578
<i>Regression Analysis of Energy Consumption by End Use</i>	One-time (1983)	DOE/EIA	Covers residential sector end-use consumption of energy by regression analysis.	DOE/EIA-0431 NTIS DE84001290
<i>An Assessment of the Quality of Selected EIA Data Series</i>	Triennial	DOE/EIA	Presents coal data on production, direct labor hours, recoverable reserves, and prices from 1983 to 1988.	DOE/EIA-0292(89) NTIS DE89010969

## SECTION 4

### SOLID WASTE DATA SOURCES

The solid waste data source summary table is divided into two sections for ease of reference: a census bureau data source section and a section for other sources. Seventeen solid waste data sources were identified during this project.

Seven census data sources were identified under this project. The data sources listed below contain the most useful information from those census sources reviewed. Data source numbers refer to sources in Table 4-1 only.

- Data source 1, *Census of Retail Trade* - the quantity and types of retail establishments resolved to metropolitan areas
- Data source 2, *Summary of Population and Housing Characteristics, 1991* - data resolved to county and most current data
- Data source 3, *The County and City Data Book, 1988* - comprehensive data resolved to cities
- Data source 4, *Statistical Abstract of the U.S.* - data on the social, political, and economic organization of the United States

The following useful census data sources will be available in 1992 and 1993:

- General population characteristics for metropolitan statistical areas
- Social and economic characteristics
- Detailed housing characteristics

In addition, the *Guide to the 1987 Economic Censuses and Related Statistics* is a very useful tool for locating any sources of economic activity data for retail and wholesale trade, service industries, transportation, manufacturers, mineral industries, and construction industries.



TABLE 4-1. SOLID WASTE DATA SOURCE SUMMARY-CENSUS

Document Title	Frequency of Update	Issuing Agency	Type of Information	Document Number
<i>Census of Retail Trade in the U.S. 1989</i>	Every five years	U.S. Department of Commerce - Bureau of the Census	Summary of establishments engaged in selling merchandise for personal or household consumption and rendering services incidental to the sale of the goods	RC87-A-1-52
<i>Summary of Population and Housing Characteristics 1991</i>	Decennial	U.S. Department of Commerce - Bureau of the Census	Population and housing unit counts and summary statistics	CPH-1-52 (1990)
<i>The County and City Data Book 1988</i>	Every five years	U.S. Department of Commerce - Bureau of the Census	The 238 census items are covered for State, County, 2,500 cities and 2,500 places	PB003-024-06709-9
<i>Statistical Abstract of the U.S. 1991</i>	Annual	U.S. Department of Commerce - Bureau of the Census	Data on the social, political, and economic organization of the U.S.	Library of Congress card # 4-18089
<i>State Population and Household Estimates, with Age, Sex, and Components of Change: 1981-1988</i>	Annual	U.S. Department of Commerce - Bureau of the Census	Estimates and projections of resident and civilian populations and households, and components of population change for 1980-88	P25, No. 1044
<i>State and Metropolitan Area Data Book 1986</i>	Every five years	U.S. Department of Commerce - Bureau of the Census	Covers 298 items of census data from population to community components	PB003-024-06334-4
<i>Population 1988 and 1987 Per Capita Income Estimates for Counties and Incorporated Places 1990</i>	Every two years	U.S. Department of Commerce - Bureau of the Census	Review of population and per capita income and their percent change for each State and county	P-26, No. 88-W-SC

Ten non-census data sources were reviewed for this work assignment. The data sources listed below contain the most useful information from those non-census sources reviewed. Data source numbers refer to sources in Table 4-2 only.

- Data source 1, *Characterization of Municipal Solid Waste in the United States: 1990 Update* - national MSW data
- Data source 2, *The 1991 Resource Recovery Yearbook, Directory & Guide* - all waste-to-energy projects in the United States, broken down by region and State
- Data source 3, *Municipal Waste Combustion (MWC) Study* - MWC characterization by technology and emission control systems
- Data source 4, *Estimates of U.S. Biofuels Consumption* - energy produced from solid waste by industrial sector and region
- Data source 5, *A Comprehensive Report on the status of Municipal Waste Combustion* - MSW annual status update

Additional solid waste data may be available from the waste management sections of individual states. Contact with the Governmental Advisory Associates (GAA) indicates that a small amount of unpublished data about incineration without resource recovery systems is available only upon purchase of the 1991 Resource Recovery Yearbook. Initial contacts with Franklin Associates, LTD indicated that they are able to provide data sources on solid waste.

Searching the publications of the Paper Manufacturing Group, the American Hospital Association, and National Restaurant News, *Waste Solutions* (McGraw-Hill, 1990 supplement), and the Society of the Plastics Industry may yield solid waste generation and disposal data.

TABLE 4-2. SOLID WASTE DATA SOURCE SUMMARY-OTHER SOURCES

Document Title	Frequency of Update	Issuing Agency	Type of Information	Document Number
<i>Characterization of Municipal Solid Waste in the United States: 1990 Update</i>	Every two years	EPA	Estimate and projection of MSW generation, recovery for recycling, composition from 1960-2000	EPA 530-SW-90-042
<i>The 1991 Resource Recovery Yearbook, Directory &amp; Guide</i>	Every two years	GAA	All waste-to-energy projects in U.S. in various stages for the past 10 years	None
<i>Municipal Waste Combustion Study</i>	Once	EPA	Survey of MWC in U.S. by type of technologies: mass burn, modular, and RDF	EPA 530-SW-87-021A
<i>Estimates of U.S. Biofuels Consumption</i>	Irregularly	DOE/EIA	Energy derived from solid waste in the U.S.	DOE/EIA-0548(90)
<i>A Comprehensive Report on the Status of Municipal Waste Combustion 1991</i>	Annual	NSWMA	Municipal solid waste status update in U.S.	ISSN00431001
<i>Best Management Practices Analysis for Solid Waste: 1987 Recycling and Waste Stream Survey-Vol. 1</i>	Once	Washington State Department of Ecology, Office of Waste Reduction and Recycling	Definition of waste generation areas, quantity and composition of waste disposal, current recycling levels for all sources of potential MSW	PB88-33A

(continued)

TABLE 4-2. SOLID WASTE DATA SOURCE SUMMARY-OTHER SOURCES (continued)

Document Title	Frequency of Update	Issuing Agency	Type of Information	Document Number
<i>Disposal Cost Fee Study - Final Report</i>	Once	Tellus Institute	MSW quantitative characterization of the state of California	PB90-131
<i>Basic Data: Solid Waste Amounts, Composition and Management Systems</i>	Once	NSWMA	National level data of solid waste flow: generation, annual volume, composition of MSW, densities of refuse components	TB#85-6
<i>Available Disposal Capacity for Solid Waste in Illinois 1990</i>	Annual	EPA	Statistical data of solid waste handling in Illinois	IEPA/LPC/90-173
<i>Solid Waste Data: A Compilation of Statistics on Solid Waste Management Within the U.S.</i>	Once		Solid waste statistics of generation composition, collecting, disposal, processing, resource recovery, and hazardous waste	PB82-1073-1

## SECTION 5

### OTHER COMBUSTION DATA SOURCES

Thirty-two area source other combustion data sources were identified for this work assignment. Three types of data sources were recorded: documents, organizations, and computer databases. The organizations and computer databases are listed in Section 6. The document sources of other combustion data are listed below. Most of the data sources concentrate on satellite information that is relevant to forest acreage burning and potential agricultural burning.

Of the data sources reviewed, those listed below contain the most promising data. Data source numbers refer to sources in Table 5-1 only.

- Data source 1, *Wildfire Statistics* - state and geographic area data for state and privately owned lands
- Data source 2, *1990 Annual Fire Report* - compilation of southeastern U.S. forest fire data
- Data source 3, *Structural Fire Statistics* - data on housing fires
- Data source 4, *Estimates of U.S. Biofuels Consumption* - energy produced from wood and alcohol by industrial sector and region
- Data source 5, *Global Biomass Burning* - compilation of satellite data on biomass burning
- Data source 6, *Local Climatological Data: Monthly Summary* - climatological data from weather stations around the United States
- Data source 7, *Climatic Averages and Extremes for U.S. Cities* - annual compilation of monthly climatological data
- Data source 8, *Keyguide to Information Sources in Remote Sensing* - summary of institutions and individuals involved with satellites and remote sensing
- Data source 9, *Remote Sensing Yearbook* - Annual update of satellite and satellite related industries

TABLE 5-1. SATELLITE DATA SOURCES

Document Title	Frequency of Update	Issuing Agency	Type of Information	Document Number
<i>Wildfire Statistics</i>	Data collected annually but not published; year last published 1977	NFS	State-level public and private wildfire data	NA
<i>1990 Annual Fire Report</i>	Annual	NFS	Acreage burned in forest fires by States	NA
<i>Structural Fire Statistics</i>	Annual	NFPA	Statistics on housing fires	NA
<i>Estimates of U.S. Biofuels Consumption</i>	Irregularly	DOE/EIA	Energy produced from wood and alcohol	DOE/EIA-0548(90)
<i>Global Biomass Burning</i>	One time	NA	Biomass burning throughout the world and its environmental implications	NA
<i>Local Climatological Data: Monthly Summary 1991</i>	Monthly	NOAA	Various climatological data from national weather service stations	NA
<i>Climatic Averages and Extremes for U.S. Cities 1991</i>	Annual	NOAA	Temperature, extremes, normal degree days, % of possible sunshine, other climatological factors	HCS6-3
<i>Keyguide to Information Sources in Remote Sensing</i>	One time	Mansell Publishing	Listings of institutions involved with the satellite industry and peripheral industries	ISBN 0-7201-1854-9

(continued)

TABLE 5-1. SATELLITE DATA SOURCES (continued)

Document Title	Frequency of Update	Issuing Agency	Type of Information	Document Number
<i>Remote Sensing Yearbook 1990</i>	Annual	Taylor and Francis Ltd.	Listings of institutions involved with the satellite industry and peripheral industries	ISBN 0-85066-808-5 ISSN 0267-6133
<i>Selected Annotated Bibliography on Application of Satellite Images to Thematic Mapping</i>	One time	Department of Geography Publication Series, University of Waterloo	Listings of organizations/ individuals involved with satellite mapping techniques	NA
<i>Remote Sensing of Earth Resources: A Guide to Information Sources</i>	One time	Gale Research Company	Listings of documents on remote sensing	ISBN 0-8103-1413-4
<i>Radar Remote Sensing for Geosciences, an Annotated and Tutorial Bibliography</i>	One time	Environmental Research Institute of Michigan	Lists and indexes of satellite related information	NSF GI-340 89X
<i>Canadian Journal of Remote Sensing 1991</i>	Bimonthly	Canadian Aeronautics and Space Institute	Recent advances in and information on remote sensing	ISSN 0008-2821
<i>Journal of Geophysical Research 1990</i>	Trimonthly	American Geophysical Union	Varied uses of remote sensing data	ISSN 0022-1406
<i>Photogrammetria 1990</i>	Bimonthly	Elsevier Scientific Publishing	Information on remote sensing data interpretation	ISSN 0031-8663
<i>Scientific and Technical Aerospace Reports 1991</i>	Biweekly	NASA	Abstracts of documents relating to space science and technology	ISSN 0036-8741

(continued)

TABLE 5-1. SATELLITE DATA SOURCES (continued)

Document Title	Frequency of Update	Issuing Agency	Type of Information	Document Number
<i>Physical Fundamentals of Remote Sensing</i>	One time	Springer-Verlag Publishing	Information on how remote sensing might be used to detect gases in the atmosphere	ISBN 1-387-16236-4
<i>International Journal of Remote Sensing 1991</i>	Monthly	Taylor and Francis Ltd.	Scientific papers on remote sensing	ISSN 0143-1161
<i>International Symposium on Remote Sensing of the Environment: Proceedings</i>	Yearly	Environmental Research Institute of Michigan	Scientific papers on remote sensing delivered at symposium	NA
<i>Space-Based Remote Sensing of the Earth: A Report to the Congresses</i>	Biennial	NOAA	Information on the status of remote sensing	NTIS 1-825,725
<i>User's Guide to ENDEX/OASIS: Environmental Data Index and the Oceanic and Atmospheric Scientific Information System</i>	Irregularly	NOAA	Information on NOAA data distribution service	NA
<i>Theory and Applications of Optical Remote Sensing</i>	One time	Asrar and Ghassem Authors	Thorough assessment of remote sensing technology	ISBN 0-471-62895-6



Data source 2, *The 1990 Annual Fire Report*, covers only the southeastern region of the United States. Fire reports for different regions may also be available from the National Forest Service (NFS).

Thirteen other documents are listed in Table 5-1. Some of these may be useful for further research, but most have been evaluated as having little value as data sources. A further discussion of satellite data is presented in Section 6, along with details on satellite information services.

## SECTION 6

### REMOTE SENSING AND IMAGE PROCESSING

#### INTRODUCTION

With the development of satellite technology and image processing computer systems, remote sensing has become a viable source of land cover, topographic, and interpretive data. Remote sensing is the process of deriving information through systems not in direct contact with the objects or phenomena of interest, whereas image processing describes the manipulation of this raw data yielded by remote sensing systems. The combination of these technologies can yield a variety of spatial data.

#### REMOTE SENSING

Remote sensing can address a range of spatial and temporal scales. Aerial photography can record detailed information over a limited area when flight conditions and visibility permit. Weather satellites provide virtually continuous data over a limited geographic extent; this is a geosynchronous orbit, where the satellite platform remains essentially stationary over the earth's surface. Sun-synchronous orbits pass over locations at the same time on each pass. Commercial satellites systematically circle the earth: providing data with pixel sizes as small as 10m x 10m for the entire planet on approximately weekly cycles. Satellite paths are typically polar or equatorial orbits. Polar orbits indicated a ground track which ranges from pole to pole; the rotation of the earth prevents a satellite path is restricted to a single longitude line, providing a spiralling orbit and, consequently, global coverage over a regular period of time. Equatorial orbits provide coverage of a band of the earth's surface near the equator and whose extent is defined by the height of the orbit: a low-inclination orbit having a ground track restricted to the latitudes near the equator.

Remote sensing systems can be classified as passive or active systems. Passive systems read energy emitted by or reflected from other sources, whereas active systems provide their own energy source for reflectance and recording, similar to using a flash attachment for snapshots.

Remote Sensing systems can be further classified as photographic and non-photographic systems. Photographic systems use cameras: with lenses, shutters, and energy sensitive

emulsions. The photographs are made when electromagnetic radiation--often reflected visible light--passes through the lens, strikes the emulsion, and creates a latent image. The non-photographic systems typically read other portions of the electromagnetic spectrum. Non-photographic recordings of infrared, ultraviolet, and radio frequencies can be recorded with a radiation detector or antenna system and a recording medium for the electronic signal. The near-infrared portion of the spectrum is sensitive to vegetation, by virtue of its reading the reflectance of plant pigments and water. Near- and middle-infrared spectra have significant geological applications due to their sensitivity to mineral reflectance. Far-infrared radiation can be used to sense temperature. This data is applicable to map surface currents in water; temperature variance of soil temperature of time can also imply water content. Active systems are used in the microwave spectrum. Short bursts are transmitted and the reflectance is measured: smooth, flat surfaces will reflect a strong signal, whereas rough surfaces will scatter the reflection.

There are two methods of scanning a wide band of information on a single pass over a site, these methods have been given the illustrative classifications of whisk-broom and push-broom scanners. The whisk-broom scanner uses a rotating mirror to reflect the series of individual pixels from across each row to a single sensor which encodes the data for reading as a larger image. The push-broom scanner uses a row of sensors to simultaneously detect the series of pixels across the band for each row of information. The push-broom scanner offers the advantages of higher speed and the lack of moving parts. This lateral scanning--by virtue of both whisk-broom and push-broom scanning--allows multiple views of the same area from different angles, providing stereoscopic, three-dimensional viewing of terrain. This scanning can allow a satellite to "revisit" the same site several times per week by scanning from different angles as it slowly spirals around the earth.

There are a variety of distortions that can affect remote sensing data. If a photograph is composed so that the nadir (point directly below the sensor) is at the image's principal point (center), objects will appear larger when they are near the principal point, since the principal point is the nearest point to the camera. Variations in topography can cause images of the same size appear dissimilar because of the differing distances from the sensor and, further, cause some areas to be recorded out of focus. Lens aberrations and unanticipated movements of the satellite platform can cause further complications. A type of *de facto* distortion is

cloud cover, obstructing portions of the desired study area. Cloud cover obstructs reflectance of all remote sensing spectra excepting radar frequencies, complicating thorough data collection.

## IMAGE PROCESSING

There are a variety of digital image processing techniques applicable to remote sensing data. Computer interpretation of digital data can significantly increase the information it provides. While the human eye can only distinguish between sixteen or seventeen gray tones, an image recorded with 8-bit quantization will have 256 gray levels, which can be analyzed by computer. Mathematical or statistical operations can be performed on single images to derive land cover, land use, and other descriptive information, as shown in Table 6-1. Comparison and overlay of different images of the same space can model change over

**TABLE 6-1. INFORMATION FROM PROCESSED REMOTE SENSING DATA**

<b>GEOLOGY</b>	<b>FORESTRY</b>
Oil and gas exploration	Harvest logistics
Structural mapping	Stand density
Engineering studies	Yield estimate verification
Hazard analysis	Disease and fire damage assessment
Tectonic studies	
<b>URBAN PLANNING</b>	<b>CARTOGRAPHY</b>
Land use mapping	Topographic mapping
Impervious surface modelling	Terrain simulations
Siting studies	Terrain modeling
Demographic and cultural change detection	Thematic mapping
	Map updating
<b>AGRICULTURE</b>	<b>WATER AND ENVIRONMENT</b>
Crop forecasting	Wetlands and habitat mapping
Productivity modelling	Pollution monitoring
Soil moisture assessments	Resource assessment
Crop damage assessments	Hydrologic and coastal studies

Data from Digitally Processed Remote Sensing Data [SPOT Image Corp.]

time. This information can be read into Geographic Information Systems [GIS] and be analyzed individually or be overlaid and compared with other data. Through computer interpretation and analysis, remote sensing data can yield significant information individually or in combination with other data.

## DATA SOURCES

There are two main providers of primary remote sensing data. The Earth Observation Satellite Company (EOSAT) is the operator of the Landsat remote sensing satellite system and the distributors of the primary data (and some interpreted data) from this system. The information from this system is read with a pixel size of 30m x 30m. The French company Système Probatoire de la Observation de la Terre [SPOT] has a satellite in orbit and a distribution office in the United States. SPOT data is available with a 20m x 20m pixel size for color data and a 10m x 10m black and white pixel size. SPOT is also the only supplier of global Digital Terrain Modeling information. Both companies offer data for a variety of sizes of databases and a variety of media (digital/tape, paper, or film/transparency). The cost for digital system corrected map sheet information is \$0.49 per square km for EOSAT data and \$0.68 per square km for SPOT data.

The National Oceanic and Atmospheric Administration (NOAA) has used the Nimbus series of satellites to gather Advanced Very High Resolution Radiometer (AVHRR) data since 1978. AVHRR data is only sensed at 1.1 kilometer resolution, but offers the advantage of semidiurnal readings. The private vendor handling public access to AVHRR data notes that this information is not archived and contains encoded meteorological data; no land cover/land use information is available through AVHRR.

Remote sensing data can directly provide information on land use and land cover.

Digital processing can enhance the satellite data to interpret this physical evidence to describe physical and cultural processes.

See Table 6-2 for a synopsis of remote sensing data sources, their sponsoring organizations, and phone numbers.

**TABLE 6-2. REMOTE SENSING ORGANIZATIONS/DATABASES WITH POSSIBLE INFORMATION ON FUEL AND WASTE COMBUSTION BURNING SOURCES**

Remote Sensing Organization/Database	Type of Information Available	Phone Number/ Online Access
Earth Observation Satellite Company (EOSAT)	Operators of Landsat remote sensing satellite system and distributors of all data from these satellites. Primary products include photographic images and tapes from MSS and TM sensors. Provide earth resource data to a worldwide customer base.	(301) 552-0500
Système Probatoire de la Observation de la Terre (SPOT)	Operators of the SPOT remote sensing satellite system and distributors of data from the satellite. Only world suppliers of DTM information.	(703) 620-2200
Earth Resources Observation System (EROS)	Responsible for research and development in applications of remotely sensed data and GIS to resource management problems. Applications of aerial photography and Landsat data to resource problems.	(605) 594-6511
Technology Application Center	Technology transfer in the field of remote sensing of natural resources. Image processing, GIS training, information retrieval and dissemination.	(505) 277-3622
Directory of Online Databases	The most current directory available of information concerning online databases. Very useful for checking the current status of and developments in the computerization of information on remote sensing and related subjects.	DIALOG (in print at UNC)
American Institute of Aeronautics and Astronautics, Technical Information Service and National Aeronautics and Space Administration, Scientific and Technical Information Branch	Access to this bibliographic reference file is restricted. It is available as the NASA file to member states of the European Space Agency through ESA-IRS. The database concentrates on aeronautics, astronautics, space sciences, and geosciences. It is particularly useful for satellite technology and remote sensing.	DIALOG; MDC
AGRIS	AGRIS provides access to agricultural science and technology literature. Remote sensing records are available.	DIMDI; ESA-IRS
GEOLINE	GEOLINE covers geoscience literature from journals, monographs, and government reports. Surveying, mapping, photogrammetry, and remote sensing are included subjects.	INKA
LEDA	This database catalogues the imagery archived from Landsats 1, 2, 3, 4, and 5 available at ESA/Earthnet/Eurimage following acquisition.	ESA-IRS
American Society for Photogrammetry and Remote Sensing	The purpose of this organization is to advance knowledge on remote sensing.	(301) 493-0290

**APPENDIX A**  
**AREA EMISSIONS DATA SOURCE SHEETS**



## AREA EMISSIONS DATA SOURCE SHEET

**Title:** 1977 Wildfire Statistics

**Author:** U.S. Department of Agriculture, NFS

**Date Published:** April 1979

**Frequency of Update:** Annual

**Document Number:** NA

**Type of Data in Document:** Wildfire statistics, including acreage burned, for forest land and nonforested watershed lands federally owned lands, and for some state and privately owned lands

**Timeliness of Data:** Current

**Available Data Media:** Paper

**Cost of Data:** NA

**Format of Data:** Tables, bar graphs, pie charts, maps

**Resolution of Data in Document:** Data available at the state and regional levels

**Comprehensiveness and Accuracy of Data:** Accuracy is dependent on the quality of the nine districts of the forest service that report. Data are national and comprehensive, but not very specific.

**Abstract of Document:** Wildfire statistics for forest land and nonforested watershed lands in federal ownership and for state and privately owned lands which are included in the Cooperative Forest Fire Control Program. Statistical data for each individual state and totals for geographical groups of states are included.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** 1990 Annual Fire Report; Southern Region: State and Private

**Author:** Southern Region

**Date Published:** 1990

**Frequency of Update:** Annual, from 1970 at latest

**Document Number:** None

**Type of Data in Document:** Forested acreage burned by state forest and state

**Timeliness of Data:** Current

**Available Data Media:** Paper

**Cost of Data:** Free

**Format of Data:** Tables and text

**Resolution of Data in Document:** State level and individual forests

**Comprehensiveness and Accuracy of Data:** Data appear accurate, but may miss private burning. Only the Southeast is covered.

**Abstract of Document:** This document covers the southern region of the NFS. Other similar documents may be available from the seven other regions of the NFS.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Annual Energy Review 1990

**Author:** DOE/EIA

**Date Published:** May 1991

**Frequency of Update:** Annually

**Document Number:** DOE/EIA-0384(90)

**Type of Data in Document:** The data in the document are consumption figures represented on the national and census region basis.

**Timeliness of Data:** The data are one year old.

**Available Data Media:** Paper and microfiche

**Cost of Data:** \$8.00 microfiche, \$39.00 paper

**Format of Data:** Tables, text, and graphs

**Resolution of Data in Document:** The data are based on the national and census region areas with world production figures for the major fuel categories.

**Comprehensiveness and Accuracy of Data:** The document is very comprehensive and accurate.

**Abstract of Document:** The document presents energy data summaries as well as complete data coverage of the principle energy commodities. The review also contains world production data of the major fuel categories. All data are represented on a national or census region basis for the United States.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** An Assessment of the Quality of Selected EIA Data Series

**Author:** DOE/EIA

**Date Published:** November 1991

**Frequency of Update:** NA

**Document Number:** DOE/EIA-0292(89).

**Type of Data in Document:** Data are presented on production, direct labor hours, recoverable reserves, and prices from 1983 to 1988.

**Timeliness of Data:** The data range from three to eight years old.

**Available Data Media:** Paper and microfiche

**Cost of Data:** \$8.00 microfiche

**Format of Data:** Text, graphs, and tables.

**Resolution of Data in Document:** The data are on the state level and are listed yearly.

**Comprehensiveness and Accuracy of Data:** The data are only as accurate and comprehensive as the *Coal Distribution Report*, *Quarterly Coal Consumption Report--Manufacturing Plants*, *Coke Plant Report--Quarterly*, *Financial Reporting System*, *Monthly Power Plant Report* and *Manufacturing Energy Consumption Survey* from which the data are taken.

**Abstract of Document:** This document contains data from several other DOE sources. The data list coal production, direct labor hours, recoverable reserves, and prices from 1983 to 1988.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Available Disposal Capacity for Solid Waste in Illinois

**Author:** Illinois Environmental Protection Agency, Division of Land Pollution Control, Solid Waste Management Section

**Data Published:** October 1990

**Frequency of Update:** Annual since 1987

**Document Number:** IEPA/LPC/90-173

**Type of Data in Document:** The report contains solid waste data from Illinois such as amount of non-hazardous solid waste disposed of by landfill, recycling, and incineration; amount of solid waste generated, handled, exported, and imported; number and location of landfills and incinerators; number of landfills that accept out-of-state waste, their locations and volumes received; waste generation rate in pounds per capita per day by resident, commercial/institutional, industries, and construction/demolition information; active and inactive landfills in each county, and their total and remaining capacities.

**Timeliness of Data:** The data cover April 1, 1989 to March 1, 1990. April 1 to March 1 is the time period for the annual report.

**Available Data Media:** Print

**Cost of Data:** Free

**Format of Data:** Tables and Figures

**Resolution of Data in Document:** Data are at the County and Regional level for the State of Illinois only.

**Comprehensiveness and Accuracy of Data:** The data are comprehensive but they are a rough estimate from the landfill operators.

**Abstract of Document:** Under the Illinois Solid Waste Management Act, IEPA is required to publish an annual report on the remaining landfill capacity in Illinois. This is the fourth annual report published by the IEPA. It details data on volumes of waste accepted at landfills in each county, as well as the reported remaining landfill capacity by county and region. The number of active solid waste landfills in Illinois has gone from 147 in 1987, to 133 in 1988, to 126 in 1989 to 117 in 1990. Solid waste accepted at these facilities in 1990 totalled 45.2 million cubic yards. The reported remaining landfill capacity was 351 million cubic yards. At current disposal volumes and capacities, Illinois has between six and eight years of remaining landfill capacity if no further capacity is added.

## **AREA EMISSIONS DATA SOURCE SHEET**

**Title:** Basic Data: Solid Waste Amounts, Composition and Management Systems

**Author:** National Solid Waste Management Association

**Data Published:** October 1, 1985

**Frequency of Update:** Once

**Document Number:** Technical Bulletin #85-6

**Type of Data in Document:** Solid waste flow data

**Timeliness of Data:** Current

**Available Data Media:** Print

**Cost of Data:** \$3.50

**Format of Data:** Tables and figures

**Resolution of Data in Document:** Data are at the national level only.

**Comprehensiveness and Accuracy of Data:** The data are not very comprehensive. There is no way to judge the accuracy of the data.

**Abstract of Document:** Technical bulletin is NSWMA's regular publication. This contains annual volume of solid waste flow, solid waste generation rates of lbs. per day by building type, solid waste generation rates of lbs. per day by community type, quantities of waste generated by category of tourists, national average composition of municipal solid waste by material type; densities of municipal solid wastes by material type, densities of pure refuse components, energy values of municipal solid waste and conventional fuels; disposition of municipal solid waste.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Best Management Practices Analysis for Solid Waste: 1987 Recycling and Waste Stream Survey - Volume I

**Author:** Office of Waste Reduction and Recycling, Washington State Department of Ecology

**Data Published:** December 1988

**Frequency of Update:** Once

**Document Number:** 88-33A

**Type of Data in Document:** The report contains definition of waste generation areas, quantity of waste hauled and disposed, waste-stream composition, current recycling levels, WGA waste generation and composition, and comparison of primary and secondary data sources for waste stream volumes.

**Timeliness of Data:** Not available

**Available Data Media:** Print and microfiche

**Cost of Data:** \$26.00 print, \$9.00 microfiche

**Format of Data:** Tables and figures

**Resolution of Data in Document:** Data are only for the State of Washington.

**Comprehensiveness and Accuracy of Data:** The data are comprehensive. It is impossible to judge the accuracy of the data.

**Abstract of Document:** The Best Management Practices bill passed by the Washington State Legislature directed the Department of Ecology to determine Best Management Practices for these waste categories: waste reduction, recycling, energy recovery and incineration, and landfilling. The department was also to develop information on solid waste generation rates for each category of the waste stream, and the rate of recycling being achieved for each category of solid waste. This volume addresses the definition of waste generation areas, the quantity and composition of waste disposed, and current recycling levels.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Canadian Journal of Remote Sensing

**Author:** Canadian Aeronautics and Space Institute

**Date Published:** 1975 to present

**Frequency of Update:** Bi-monthly

**Document Number:** ISSN 0008-2821

**Type of Data in Document:** Recent advances in and information on remote sensing

**Timeliness of Data:** Current

**Available Data Media:** Paper

**Cost of Data:** \$30.00/yr

**Format of Data:** Papers, articles, and technical notes

**Resolution of Data in Document:** NA, possibly by subject or acceptance date.

**Comprehensiveness and Accuracy of Data:** The scientific papers are accurate but cover a very narrow scope.

**Abstract of Document:** This journal, a part of the Canadian Remote Sensing Society (a constituent society of the Canadian Aeronautics and Space Institute), publishes papers, articles, and technical notes dealing with remote-sensing applications, instrumentation, and theory. Also included are remote sensing news and notices of upcoming events.



## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Census of Retail Trade-United States

**Author:** U.S. Department of Commerce, Bureau of Census

**Data Published:** August 1989

**Frequency of Update:** Every five years

**Document Number:** RC87-A-52

**Type of Data in Document:** A separate report is issued for the United States, each state, and the District of Columbia. Each report enumerates retail business listed in the following categories; building materials, garden supplies and garden merchandise, food, automotive dealers, gasoline service, apparel and accessory, furniture and homefurnishing, food and beverage, drug and proprietary, miscellaneous retail, and miscellaneous. They are grouped by establishments, sales, annual payroll, and unincorporated businesses.

**Timeliness of Data:** 1982 and 1987 data are published in 1989.

**Available Data Media:** Print, microfiche, computer tape, and CD ROM

**Cost of Data:** \$8.00 print for each series, \$10.00 microfiche for each series, \$175.00 computer tape, \$150.00 CD ROM

**Format of Data:** Tables

**Resolution of Data in Document:** Data are at the national, State and metropolitan area levels.

**Comprehensiveness and Accuracy of Data:** All data are compiled from either census questionnaires or administrative records. They are comprehensive.

**Abstract of Document:** No abstract

## **AREA EMISSIONS DATA SOURCE SHEET**

**Title:** Characterization of Municipal Solid Waste in the United States: 1990 Update

**Author:** U.S. EPA, Solid Waste and Emergency Response

**Data Published:** June 1990

**Frequency of Update:** Every two years

**Document Number:** EPA/530-SW-90-042

**Type of Data in Document:** This report characterizes the national waste stream including municipal waste generation by weight; recovery for recycling, composting, and combustion; characterizing MSW by volume and weight; projection for MSW generation to the year 2000; projection for MSW combustion and recovery and recycling; MSW generated per person per day.

**Timeliness of Data:** 1960 to 1988 data are published in 1990. Projection data are from 1990 to 2000.

**Available Data Media:** Print and microfiche

**Cost of Data:** \$26.00 print, \$9.00 microfiche

**Format of Data:** Tables and Graphs

**Resolution of Data in Document:** Data are at the national level.

**Comprehensiveness and Accuracy of Data:** The data are comprehensive though they are mostly estimated and are based on the national level only.

**Abstract of Document:** This report is the most recent in a 20-year series of reports to characterize municipal solid waste in the United States. This report provides an updated database for a 50 year characterization (by weight) of the materials and products in MSW.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Climatic Averages and Extremes for U.S. Cities

**Author:** U.S. Department of Commerce; National Oceanic and Atmospheric Administration, National Climatic Data Center

**Data Published:** May 1991

**Frequency of Update:** Annual

**Document Number:** HCS6-3

**Type of Data in Document:** The report contains data such as temperature, extremes, normal degree days, percent of possible sunshine, sky cover, average station pressure, relative humidity, precipitation, wind speed, and direction.

**Timeliness of Data:** The normals cover the period of 1951-1980, all the long-term averages and extremes are collected from the beginning of station operation through December of 1990.

**Available Data Media:** Print

**Cost of Data:** \$20.00

**Format of Data:** Tables

**Resolution of Data in Document:** Data are at the city and State level and address data from each weather station throughout the country.

**Comprehensiveness and Accuracy of Data:** The data are comprehensive and relatively accurate.

**Abstract of Document:** This is a yearly summary of climatic data from the principal climatological stations of the National Weather Service. The source of the information is the "Normals, Means, and Extremes" page of the *Local Climatological Data Bulletin: Annual Summary*, which is published yearly by the National Climatic Data Center.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Commercial Buildings Characteristics 1989

**Author:** DOE/EIA

**Date Published:** June 1991

**Frequency of Update:** Triennial

**Document Number:** DOE/EIA-0246(89)

**Type of Data in Document:** The data contain analyses of buildings at the national and regional census levels in terms of building variables (e.g., use and size, location and floor space).

**Timeliness of Data:** Data are two years old.

**Available Data Media:** The data are available in paper and microfiche.

**Cost of Data:** \$8.00 microfiche, \$39.00 paper

**Format of Data:** text, graphs and tables

**Resolution of Data in Document:** Buildings used for commercial and industrial use at the national and regional census levels.

**Comprehensiveness and Accuracy of Data:** The document is relatively comprehensive and accurate. The document lists data for some characteristics which may be helpful in some cases.

**Abstract of Document:** The data from this document come from the Commercial Buildings Energy Consumption Survey (CBECS). The data analyze buildings with different characteristics including building use and size, location, energy sources, energy end-uses, conservation features, heating, cooling, lighting equipment, and percent of floor space at the national and regional levels. The survey is the only source of national-level data for this kind of information.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Commercial Buildings Consumption and Expenditures 1986

**Author:** DOE/EIA

**Date Published:** May 1989

**Frequency of Update:** Triennial

**Document Number:** DOE/EIA-0318(86)

**Type of Data in Document:** This document includes data estimates on coal consumption from commercial buildings.

**Timeliness of Data:** The data are over five years old.

**Available Data Media:** Paper and microfiche

**Cost of Data:** \$8.00 microfiche, \$39.00 paper

**Format of Data:** Tables and text

**Resolution of Data in Document:** The report presents national- and regional-level estimates for consumption and expenditures of fuels used in commercial buildings.

**Comprehensiveness and Accuracy of Data:** The data are somewhat comprehensive and accurate. However, not all the fuel categories are consistent with other documents.

**Abstract of Document:** The document reports national- and regional-level consumption estimates on coal for commercial buildings. The data are listed under the following categories: building use, location, energy source and end uses, heating and costing equipment practices, lighting equipment and practices, and building structure.

## **AREA EMISSIONS DATA SOURCE SHEET**

**Title:** A Comprehensive Report on the Status of Municipal Waste Combustion

**Author:** Waste Age, National Solid Waste Management Association

**Data Published:** November 1991

**Frequency of Update:** Once

**Document Number:** ISSN00431001

**Type of Data in Document:** Statistics on State MWC capabilities

**Timeliness of Data:** The data from 1975 to 1990 are published in 1990.

**Available Data Media:** Print

**Cost of Data:** \$7.00

**Format of Data:** Tables

**Resolution of Data in Document:** Data are at the State and national level.

**Comprehensiveness and Accuracy of Data:** The data are not comprehensive. It is impossible to judge the accuracy.

**Abstract of Document:** The report details municipal waste combustion (MWC) status in each state such as status of municipal waste combustion in operation, construction and planning; MWC capacity, technology, and energy production; air pollution control system; MWC ownership/operations trends; MWC project cost data; and ash management and recycling endeavors.

## **AREA EMISSIONS DATA SOURCE SHEET**

**Title:** The County and City Data Book

**Author:** U.S. Department of Commerce, Bureau of Census

**Data Published:** May 1988

**Frequency of Update:** Every five years

**Document Number:** # 003-024-06709-9

**Type of Data in Document:** Data are covered by type of area including land area, population, population density, vital statistics, health, social insurance and health services, education, income, poverty, housing, labor force, agriculture, manufacturing, construction, wholesale trade, retail trade, service industries, government, elections, climate, and electric bills, etc.

**Timeliness of Data:** Data are based on 1982, 1984, and 1985.

**Available Data Media:** Print, magnetic tape, diskette

**Cost of Data:** \$36.00 print, \$175.00 tape, \$144.00 diskette

**Format of Data:** Tables and maps

**Resolution of Data in Document:** Data are at the regional, State, city, and county levels.

**Comprehensiveness and Accuracy of Data:** All data are from census surveys and administrative records. They are comprehensive and accurate.

**Abstract of Document:** No abstract

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Data Report 1987

**Author:** DOE/EIA

**Date Published:** May 1989

**Frequency of Update:** Annual

**Document Number:** DOE/EIA-0214(87)

**Type of Data in Document:** The data contain annual energy consumption of principle energy type and by major economic sector.

**Timeliness of Data:** The data are from 4 to 31 years old.

**Available Data Media:** Paper and microfiche

**Cost of Data:** \$45.00 paper, \$8.00 microfiche.

**Format of Data:** Tables, text, algorithms, and graphs.

**Resolution of Data in Document:** The data present in this document are on the national and state levels.

**Comprehensiveness and Accuracy of Data:** The data are accurate and comprehensive. Many of the categories are based on other compiled DOE sources, which are relatively reliable data sources.

**Abstract of Document:** This document presents estimates of annual energy consumption at the State and national levels by principal energy type and by major economic sector from 1960 forward. Data are presented in both physical and British thermal units for the current year. Included in the report is documentation describing how the estimates are made for each energy source, sources of all input data, and a summary of changes from the previous report.



## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Disposal Cost Fee Study - Final Report

**Author:** Tellus Institute, Boston, MA

**Data Published:** February 15, 1991

**Frequency of Update:** Once

**Document Number:** 90-131

**Type of Data in Document:** Tonnages and percentages of components in the California waste stream.

**Timeliness of Data:** Timeframe is not clear in this report, but it includes the latest available data from each county solid waste management plan.

**Available Data Media:** Print

**Cost of Data:** \$50.00

**Format of Data:** Tables

**Resolution of Data in Document:** Data are on a county basis for the State of California only.

**Comprehensiveness and Accuracy of Data:** The data are quite comprehensive and most are probably estimated or projected.

**Abstract of Document:** The report contains California waste stream analysis data such as: composition of the residential and commercial waste streams; quantities of waste generated by the residential and commercial sectors; total annual waste generation for California; levels of recycling for all materials in the waste stream; existing and planned disposal facilities and their capacities; the amount of the waste disposed of by landfill, recycling, and incineration; the percentage of each material being recycled, landfilled, and incinerated.

## **AREA EMISSIONS DATA SOURCE SHEET**

**Title:** Energy Expenditures for Space Heating By Fuel, State, Region, and Income Class

**Author:** DOE/EIA

**Date Published:** November 1979

**Frequency of Update:** Service Report

**Document Number:** DOE/EIA-SR/EUA/79-16

**Type of Data in Document:** Estimates of median expenditures on home fuels for space heating by low income households. Estimates are made for all homes including those below the poverty line. Estimates are listed on the level of consumption.

**Timeliness of Data:** The data are more than 12 years old.

**Available Data Media:** Data are available through the National Energy Information Center.

**Cost of Data:** NA

**Format of Data:** Tables and text

**Resolution of Data in Document:** The data are based on the Department of Energy regions and by State.

**Comprehensiveness and Accuracy of Data:** NA

**Abstract of Document:** The tables in this report provide estimates of median expenditures on home fuels for space heating by low income households, and do not include fuels used for other purposes such as water heating. Estimates are made for all homes including those below the poverty line. Estimates are also listed on the level of consumption. The data from the report are based on the Department of Energy regions and by State.

## **AREA EMISSIONS DATA SOURCE SHEET**

**Title:** Estimated U.S. Wood Energy Consumption from 1949 to 1981

**Author:** DOE/EIA

**Date Published:** November 1984

**Frequency of Update:** One-time

**Document Number:** DOE/EIA-0341

**Type of Data in Document:** The document contains wood consumption data for the industrial, residential, and commercial sectors.

**Timeliness of Data:** The data range from 10 years to 50 years old.

**Available Data Media:** Paper and microfiche

**Cost of Data:** \$8.00 microfiche, \$23.00 paper

**Format of Data:** The data are in text, tables and algorithms.

**Resolution of Data in Document:** The wood consumption data are at the national and regional levels for the industrial, residential, commercial, and utility sectors.

**Comprehensiveness and Accuracy of Data:** The accuracy of the data is unknown because there is no uniform source of data on wood consumption in the different sectors of the economy.

**Abstract of Document:** The document reports the results of a project done for DOE to determine wood energy consumption from 1949 to 1981. Methodologies were developed to estimate wood consumption at the state level. Residential wood fuel use is based on the number of wood stoves and an estimated activity level for wood stoves. Data include wood stove sales, housing characteristics, and heating degree-days. Commercial wood fuel use is based on residential wood fuel use. Industrial wood fuel use is based on statistics from the American Forest Products Association and the American Paper Institute.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Estimates of U.S. Biofuels Consumption 1990

**Author:** DOE/EIA

**Date Published:** 1990

**Frequency of Update:** Irregularly, every few years

**Document Number:** DOE/EIA-0548(90)

**Type of Data in Document:** Energy on wood, solid waste, and alcohol for industrial and residential sectors

**Timeliness of Data:** Current

**Available Data Media:** Paper

**Cost of Data:** NA

**Format of Data:** Tables, charts, text

**Resolution of Data in Document:** Data are on regional level, and are specific to 2-digit SIC code

**Comprehensiveness and Accuracy of Data:** Data cover only energy consumed, amount consumed not included. Some data are based on studies up to 10 years old, and some are survey-based.

**Abstract of Document:** This report is the sixth in a series of publications developed by the EIA to quantify the amount of biofuel-derived primary energy used by the U.S. economy. It provides preliminary estimates of 1990 U.S. biofuels energy consumption by sector and by biofuels energy resource type. The objective of this report is to provide updated annual estimates of biofuels energy consumption for use by Congress, Federal and State agencies, and other groups involved in activities related to the use of biofuels.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Fuel Oil and Kerosene Sales 1989

**Author:** DOE/EIA

**Date Published:** 1990

**Frequency of Update:** Annual

**Document Number:** DOE/EIA-0535(89)

**Type of Data in Document:** This document contains kerosene and fuel oil sales obtained from EIA-821 survey.

**Timeliness of Data:** The data are two years old.

**Available Data Media:** The report is available in paperback and microfiche forms.

**Cost of Data:** \$8.00 microfiche

**Format of Data:** Text and graphs

**Resolution of Data in Document:** The survey is reported at the state level.

**Comprehensiveness and Accuracy of Data:** The data are comprehensive and relatively accurate. There is an adjustment made on the figures in the report to equal the volumes found in the Petroleum Supply Annual.

**Abstract of Document:** This document lists data for the sale of kerosene and fuel oil. The data are from a survey of 5,500 distributors throughout the United States. The data have been adjusted by the Petroleum Administration for Defense to equal the data which are in the Petroleum Supply Annual.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Gas Facts

**Author:** AGA

**Date Published:** 1988

**Frequency of Update:** Annual

**Document Number:** AGA Catalog #F10187

**Type of Data in Document:** Data on natural gas consumption, production, and price

**Timeliness of Data:** Current

**Available Data Media:** Paper

**Cost of Data:** \$10.88

**Format of Data:** Tables

**Resolution of Data in Document:** Data are broken down to state and regional level; statistics go back to 1965.

**Comprehensiveness and Accuracy of Data:** Data are based on a number of surveys and survey-based publications. Data cover many aspects of natural gas statistics.

**Abstract of Document:** This publication contains detailed statistics for 1987 and summary statistics for 1965-1986 for the gas utility industry, which, by definition, consists of the companies engaged in natural gas distribution and transmission. The publication also contains relevant data on the gas producing segment of the industry and key statistics on other energy industries.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Gas Househeating Survey

**Author:** AGA

**Date Published:** 1982

**Frequency of Update:** Annual

**Document Number:** NA

**Type of Data in Document:** Data on househeating using natural gas

**Timeliness of Data:** Current

**Available Data Media:** Paper

**Cost of Data:** NA

**Format of Data:** Tables

**Resolution of Data in Document:** Data are on the national, regional and State level

**Comprehensiveness and Accuracy of Data:** Data are survey-based, approximately 86 percent of national natural gas used for househeating is covered. However, data cover only househeating gas.

**Abstract of Document:** This survey presents the results of the 33rd annual gas househeating survey conducted by the American Gas Association. Data for the residential gas market are presented by state and region, including customers, fuel prices, anticipated inventory additions from new homes and conversions, and existing restrictions on new customer hookups.

A total of 154 gas utility companies, serving 86 percent of the nation's residential gas customers, responded to this year's survey. The information provided by these utilities was expanded to obtain the state and national totals shown in Tables 4 and 6. Individual company data are listed by region and State in Appendices 1 and 2.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Household Energy Consumption and Expenditures 1987, Part 1

**Author:** DOE/EIA

**Date Published:** October 1989

**Frequency of Update:** Triennial

**Document Number:** DOE/EIA-0321(87)/1

**Type of Data in Document:** This document contains data on household energy consumption by census region, structure type, degree-day category, number of rooms, etc. It also contains expenditures and consumption on the national level.

**Timeliness of Data:** The data are more than four years old.

**Available Data Media:** Paper and microfiche

**Cost of Data:** \$8.00 microfiche, \$31.00 paper

**Format of Data:** Tables and text

**Resolution of Data in Document:** The data are reported on the national and census region level.

**Comprehensiveness and Accuracy of Data:** The data appear relatively comprehensive and accurate. However, the data may be difficult to work with because the raw data have been collected under different ranges (i.e., three ranges of heating- or cooling-degree days).

**Abstract of Document:** This is a two-part report which presents data from the Residential Energy Consumption Survey on the consumption and expenditures of energy in all types of housing. Part 1 contains national-level household energy consumption, expenditures, and prices of household fuels. Part 2 contains household consumption and expenditures for census regions involving several key variables. The document includes estimates of end-use consumption and expenditures for space heating, water heating, air conditioning, and appliances.



## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Housing Characteristics 1987

**Author:** DOE/EIA

**Date Published:** June 1989 <sup>90</sup><sub>5</sub>

**Frequency of Update:** Triennial

**Document Number:** DOE/EIA-0314(87)

**Type of Data in Document:** This document contains data on fuels used in the primary and secondary heating sources of residential housing.

**Timeliness of Data:** The data are more than four years old.

**Available Data Media:** Paper, microfiche

**Cost of Data:** \$8.00 microfiche, \$31.00 paper

**Format of Data:** Tables, graphs, and text.

**Resolution of Data in Document:** The data are given on the national and census region level.

**Comprehensiveness and Accuracy of Data:** The data are not comprehensive or accurate. There are other DOE sources which have more specific breakdowns of fuels and categories.

**Abstract of Document:** This report provides a summary and analysis of the data collected in the 1987 Residential Energy Consumption Survey. The survey was distributed to all types of housing units, including single-family homes, apartments, and mobile homes. Data are provided on fuels and their use in the home, appliances, square footage of floor space, heating equipment, thermal characteristics of the housing unit, conservation activities, wood consumption, indoor temperatures, and weather. The survey lists data under census regions and on the national level.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** International Journal of Remote Sensing

**Author:** Taylor and Francis Company

**Date Published:** 1980 to present

**Frequency of Update:** Monthly

**Document Number:** ISSN 0143-1161

**Type of Data in Document:** Scientific papers on remote sensing

**Timeliness of Data:** Current

**Available Data Media:** Paper

**Cost of Data:** \$690.00/yr

**Format of Data:** Scientific papers with tables and figures

**Resolution of Data in Document:** Possibly broken down by subject or date of acceptance

**Comprehensiveness and Accuracy of Data:** Scientific papers are accurate, but are not individually comprehensive. Might be considered comprehensive as a series.

**Abstract of Document:** This is the only international journal devoted completely to remote sensing. It publishes scientific papers on remote sensing and is very technical in approach.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** International Symposium on Remote Sensing of the Environment Proceedings

**Author:** Environmental Research Institute of Michigan

**Date Published:** 1962 to present

**Frequency of Update:** Annual

**Document Number:** NA

**Type of Data in Document:** Scientific papers

**Timeliness of Data:** Current

**Available Data Media:** Paper

**Cost of Data:** NA

**Format of Data:** Papers with tables and figures

**Resolution of Data in Document:** In order of session and time of paper presentation at the symposium

**Comprehensiveness and Accuracy of Data:** The information is accurate, but the papers are very narrow in focus.

**Abstract of Document:** This series is a compilation of the scientific papers presented at the International Symposium on Remote Sensing of the Environment, which is held at the University of Michigan at Ann Arbor.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Journal of Geophysical Research

**Author:** American Geophysical Union

**Date Published:** 1896 to present

**Frequency of Update:** Three issues per month

**Document Number:** ISSN 0022-1406

**Type of Data in Document:** Varied uses of remote sensing data

**Timeliness of Data:** Current

**Available Data Media:** Paper

**Cost of Data:** NA

**Format of Data:** Articles, abstracts, illustrations, and bibliographies.

**Resolution of Data in Document:** NA

**Comprehensiveness and Accuracy of Data:** Accurate, not comprehensive

**Abstract of Document:** A rather scholarly journal which deals primarily with the more theoretical and speculative applications of remote-sensing data and interpretation techniques, along with other topics of interest to the geophysical community. An excellent way to keep abreast of the cutting edge of present research in the areas of remote-sensing studies and applications.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Keyguide to Information Sources in Remote Sensing

**Author:** Hyatt, Edward; Mansell Publishing Limited

**Date Published:** 1988

**Frequency of Update:** One time

**Document Number:** ISBN 0-7201-1854-9

**Type of Data in Document:** Listings of institutions involved with the satellite industry and peripheral industries; listings of satellite literature.

**Timeliness of Data:** Current in 1988

**Available Data Media:** Paper

**Cost of Data:** \$9.00

**Format of Data:** Lists, text

**Resolution of Data in Document:** The data are reported by country. The literature and up-to-date sources are reported by the format of the data source.

**Comprehensiveness and Accuracy of Data:** Institutional listings are not very comprehensive. Literature and up-to-date information listings are fairly comprehensive.

**Abstract of Document:** This book contains a worldwide listing of establishments involved with remote sensing, a classification of remote sensing literature, and a listing of up-to-date sources of information on remote sensing.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Local Climatological Data - Monthly Summary

**Author:** NOAA National Climatic Data Center

**Date Published:** From 1976 to present

**Frequency of Update:** Monthly

**Document Number:** NA

**Type of Data in Document:** Climatological data

**Timeliness of Data:** Current

**Available Data Media:** Paper

**Cost of Data:** NA

**Format of Data:** Tables

**Resolution of Data in Document:** Listed by climatological factor (e.g., temperature, wind, etc.) and date for each specific location.

**Comprehensiveness and Accuracy of Data:** Very accurate but only for the numerous specific locations around the United States.

**Abstract of Document:** In each state there is at least one weather center that records and compiles climatological data, which are summarized monthly and published by the NOAA. Temperature, precipitation, wind, atmospheric condition (fog, smoke, haze, etc.), degree days, minutes of sunshine, and barometric pressure are listed.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Manufacturing Energy Consumption Survey 1985

**Author:** DOE/EIA

**Date Published:** December 1988

**Frequency of Update:** Triennial

**Document Number:** DOE/EIA-0512(85)

**Type of Data in Document:** The document contains manufacturing acquisitions, consumption, and disposition of energy and their fuel switching capabilities.

**Timeliness of Data:** Data are more than six years old.

**Available Data Media:** Paper and microfiche

**Cost of Data:** \$8.00 microfiche, \$23.00 paper

**Format of Data:** Text and tables

**Resolution of Data in Document:** The data in this document are given by industry (SIC codes), nationally and by regions.

**Comprehensiveness and Accuracy of Data:** Notes in the document indicate that the fuel consumption in this document is underestimated. The data in this survey may not be consistent with that of other surveys. It would also be difficult to use the data because of the listed categories under SIC codes.

**Abstract of Document:** This document is designed to produce data concerning manufacturers' acquisition, consumption, and disposition of energy and their fuel switching capability. The report documents the history of the development of the survey system and the methodology used to implement the first cycle of the survey.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Municipal Waste Combustion Study

**Author:** Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency

**Data Published:** June 1987

**Frequency of Update:** Once

**Document Number:** EPA/530-SW-87-021A

**Type of Data in Document:** The report contains data such as existing and planned MWC facilities by combustor design type and capacity range with or without heat recovery; States with the largest existing and planned capacity of MWC; emission data measured from mass burn, modular, and RDF-fired combustors; characterization of combustion for the minimization of organic emission; and control efficiency data for toxic emissions.

**Timeliness of Data:** Unknown

**Available Data Media:** Print and microfiche

**Cost of Data:** \$26.00 print, \$9.00 microfiche

**Format of Data:** Tables and figures

**Resolution of Data in Document:** Data are at the national level only.

**Comprehensiveness and Accuracy of Data:** The data are comprehensive. There is no way to judge the accuracy of the data.

**Abstract of Document:** No abstract



## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Natural Gas Annual 1989

**Author:** DOE/EIA

**Date Published:** October 1990

**Frequency of Update:** Annually

**Document Number:** DOE/EIA-0131(89)

**Type of Data in Document:** Contains statistics on natural gas reserves, production, imports, exports, transportation, storage, consumption, and prices.

**Timeliness of Data:** The data are yearly.

**Available Data Media:** Paper and microfiche

**Cost of Data:** \$31.00 paper, \$8.00 microfiche

**Format of Data:** Tables, text, and graphs

**Resolution of Data in Document:** Data are present for the national, State and regional levels.

**Comprehensiveness and Accuracy of Data:** The data are accurate and comprehensive.

**Abstract of Document:** This document contains national, state and regional statistics on natural gas reserves, production, imports, exports, transportation, storage, consumption, and prices. Regional and state summaries are from the most recent five years. Consumption and prices are broken down by end-use sector.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Nonresidential Building Energy Consumption Survey: Fuel Characteristics and Conservation Practices

**Author:** DOE/EIA

**Date Published:** July 1981

**Frequency of Update:** One-time

**Document Number:** DOE/EIA-0278

**Type of Data in Document:** The document contains the summarized results of a 1979 survey of building characteristics.

**Timeliness of Data:** The data are over ten years old.

**Available Data Media:** Paper and microfiche

**Cost of Data:** \$8.00 microfiche, \$39.00 paper

**Format of Data:** Text and tables

**Resolution of Data in Document:** The data are reported in energy uses and on conservation practices employed in nonresidential buildings for the 48 contiguous States and the District of Columbia.

**Comprehensiveness and Accuracy of Data:** The comprehensiveness and accuracy of the data are uncertain.

**Abstract of Document:** The data are reported on energy uses and on conservation practices employed in nonresidential buildings for the 48 contiguous States and the District of Columbia. Data from a one-time 1979 survey of building characteristics are summarized and presented in this publication. Tables included summarize fuel consumption by census region, heating and cooling degree-days, building type, total square footage, number of floors in the building, year of construction, energy source, heating system, heating fuels, occupancy characteristics, number of people working in the building, and hours of typical weekly operation.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Petroleum Supply Annual 1989, Volume I and II

**Author:** DOE/EIA

**Date Published:** May (Vol. I) and June (Vol. II) 1990

**Frequency of Update:** Annual

**Document Number:** DOE/EIA-0340(89)/1, 2

**Type of Data in Document:** Data listed for the supply and disposition of crude oil and petroleum products.

**Timeliness of Data:** Data are yearly from 1973 to 1986 for supply and disposition of fuels. For the three most recent years data are presented monthly.

**Available Data Media:** Paper and microfiche

**Cost of Data:** \$8.00 (2) microfiche, paper; Volume I (\$17.00), Volume II (\$53.00)

**Format of Data:** Tables, text, and graphs

**Resolution of Data in Document:** Data are represented on national and PAD levels.

**Comprehensiveness and Accuracy of Data:** The data are relatively comprehensive and accurate.

**Abstract of Document:** The data present in this document are on the supply and disposition of crude oil and petroleum products. The data were collected from the petroleum industry during 1989 through annual and monthly surveys. The first volume contains summary statistics, detailed statistics, and refinery capacities. The second volume contains final statistics for each month of 1989, and replaces data previously published in the Petroleum Supply Monthly.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Photogrammetria

**Author:** Elsevier Scientific Publishing Company

**Date Published:** 1949 to present

**Frequency of Update:** Bimonthly

**Document Number:** ISSN 0031-8663

**Type of Data in Document:** Information on remote sensing data interpretation

**Timeliness of Data:** Current

**Available Data Media:** Paper

**Cost of Data:** NA

**Format of Data:** Articles, illustrations, charts, figures, and references

**Resolution of Data in Document:** Listed by acceptance date

**Comprehensiveness and Accuracy of Data:** The scientific papers are accurate, but the journal might only be considered comprehensive if looked at as a series.

**Abstract of Document:** The official journal of the International Society for Photogrammetry, this European journal contains articles of special interest to photogrammetrists and photo interpreters. Individual issues often contain two or three articles, many of which are quite detailed and complete.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Physical Fundamentals of Remote Sensing

**Author:** Schanda, Erwin; Springer-Verlag

**Date Published:** 1986

**Frequency of Update:** One time

**Document Number:** ISBN 0-387-16236-4

**Type of Data in Document:** Information about how remote sensing might be used to detect gases in the atmosphere.

**Timeliness of Data:** Current

**Available Data Media:** Book

**Cost of Data:** \$26.00

**Format of Data:** Text with tables and figures

**Resolution of Data in Document:** Figures and tables are included as support for the text.

**Comprehensiveness and Accuracy of Data:** Data are very accurate, however, the book primarily explains only the physical fundamentals behind remote sensing.

**Abstract of Document:** This book is an examination of the physics and mathematics behind the technology of remote sensing, particularly satellite sensing.

## **AREA EMISSIONS DATA SOURCE SHEET**

**Title:** 1988 Population and 1987 Per Capita Income Estimates for Counties and Incorporated Places-West

**Author:** U.S. Department of Commerce, Bureau of Census

**Data Published:** March 1990

**Frequency of Update:** Every two years

**Document Number:** P-26, No. 88-W-SC

**Type of Data in Document:** Regional per capita income and population

**Timeliness of Data:** 1987 and 1988 data are published in 1990.

**Available Data Media:** Print and microfiche

**Cost of Data:** \$2.75-\$7.50 depending on the region or total \$27.75 print, \$10.00 microfiche

**Format of Data:** Tables

**Resolution of Data in Document:** Data are at the national, State, county, and subcounty area levels.

**Comprehensiveness and Accuracy of Data:** All data are compiled from either census questionnaires or administrative records. It is impossible to judge the accuracy.

**Abstract of Document:** The report is one of five regional reports containing population and per capita money income data for areas including States, counties incorporated places, and active minor divisions. The report gives the methodology used for making the estimates.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Quarterly Coal Report - October-December 1990

**Author:** DOE/EIA

**Date Published:** May 1991

**Frequency of Update:** Quarterly

**Document Number:** DOE/EIA-0121(90/4Q)

**Type of Data in Document:** Coal consumption is listed by State, census region, and the United States' totals.

**Timeliness of Data:** The data are one year old.

**Available Data Media:** Paper and microfiche

**Cost of Data:** \$20.00 paper, \$8.00 microfiche

**Format of Data:** Text, graphs, and tables

**Resolution of Data in Document:** The data are reported by State, census region, end-use sector and SIC codes.

**Comprehensiveness and Accuracy of Data:** Comprehensive information about U.S. coal production, consumption, exports, imports, receipts, and stocks are provided. It is not very precise because the data for coal consumption are not disaggregated to specific types of coal.

**Abstract of Document:** Coal consumption is listed by census region, State, end-use sectors, and SIC codes. Prices are also presented for exports, imports, and receipts data. Historical trends and projections are presented for each year from 1960 to 1990 and the year 1995 to 2000. Extensive coverage of recent developments is also included in the document.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Radar Remote Sensing for Geosciences, an Annotated and Tutorial Bibliography

**Author:** Bryan, M. L.; Environmental Research Institute of Michigan

**Date Published:** December 1973

**Frequency of Update:** NA

**Document Number:** NSF grant number GI-340 89X

**Type of Data in Document:** Lists and indexes of satellite-related information

**Timeliness of Data:** 1972 back to 1960's

**Available Data Media:** Book

**Cost of Data:** \$12.50

**Format of Data:** Lists and indexes

**Resolution of Data in Document:** Alphabetically by name and by NTIS number.

**Comprehensiveness and Accuracy of Data:** Fairly short list of authors/scientific papers; information is dated.

**Abstract of Document:** This book is a tutorial bibliography of the field of remote sensing. The book reviews the history of radar remote sensing and its various applications. It contains lists of authors and scientific papers that have relevance to the field of remote sensing.



## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Regression Analysis of Energy Consumption by End Use

**Author:** DOE/EIA

**Date Published:** October 1983

**Frequency of Update:** One-time

**Document Number:** DOE/EIA-0431

**Type of Data in Document:** This document contains a regression analysis of end-use energy consumption data, obtained from the Residential Energy Consumption Survey.

**Timeliness of Data:** The data are over ten years old.

**Available Data Media:** Paper and microfiche

**Cost of Data:** \$8.00 microfiche, \$23.00 paper

**Format of Data:** Text and algorithm

**Resolution of Data in Document:** The data are based on the residential sector consumption.

**Comprehensiveness and Accuracy of Data:** The comprehensiveness and accuracy of this document is poor. There are numerous variables used in the regression equations to determine energy consumption by fuel.

**Abstract of Document:** This document covers only the residential sector end-use consumption and is a one-time analysis. The regressions presented use ten to twenty variables to create a regression equation that determines energy consumption by fuel. The document is in two parts, a technical discussion of the methodology and data transformations used in the regression analysis, and a presentation of estimates of residential energy consumption by fuel by end use.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Remote Sensing of Earth Resources: A Guide to Information Sources

**Author:** Bryan, M. Leonard; Gale Research Company

**Date Published:** 1979

**Frequency of Update:** NA

**Document Number:** ISBN 0-8103-1413-4

**Type of Data in Document:** Listings of documents on remote sensing.

**Timeliness of Data:** 1978 back to 1960's

**Available Data Media:** Book

**Cost of Data:** \$60.00

**Format of Data:** Lists

**Resolution of Data in Document:** Individual information sources are listed by author's name.

**Comprehensiveness and Accuracy of Data:** A fairly complete look at authors in the remote sensing field; information is quite dated.

**Abstract of Document:** This book contains lists of general literature, proceedings, manuals and guides, catalogs, maps, bibliographies, journals, and workshop, university, and training courses related to remote sensing. The book also contains indexes of authors, titles, subjects, NTIS accession numbers, and series.

## **AREA EMISSIONS DATA SOURCE SHEET**

**Title:** Remote Sensing Yearbook 1990

**Author:** Taylor and Francis Ltd.

**Date Published:** 1990

**Frequency of Update:** Annual

**Document Number:** ISBN 0-85066-808-5, ISSN 0267-6133

**Type of Data in Document:** Listings of institutions involved with the satellite industry and peripheral industries.

**Timeliness of Data:** Data are current.

**Available Data Media:** Paper

**Cost of Data:** £18 softcover, £40 hardcover

**Format of Data:** Text, lists

**Resolution of Data in Document:** Data are listed alphabetically by country.

**Comprehensiveness and Accuracy of Data:** Data are worldwide and very comprehensive.

**Abstract of Document:** This book contains listings of remote sensing societies, sources of satellite data, establishments receiving and supplying satellite data, hardware and software suppliers, consultants, establishments offering value-added products, and mapping, monitoring, surveillance, research, and educational establishments.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** The 1991 Resource Recovery Yearbook, Directory & Guide

**Author:** Governmental Advisory Associates, Inc.

**Data Published:** April 1991

**Frequency of Update:** Every two years

**Document Number:** None

**Type of Data in Document:** This report contains up-to-date information on all waste-to-energy projects in the United States in various stages of planning, development, and operation; capacity of resource recovery facilities; design capacity of facility by region; annual tonnage processed; tons per day, ash residue; Btu/pound of refuse; KWH/ton of refuse processed; location of resource recovery plant by state; air pollution control equipment used; and populations serviced by resource recovery facilities.

**Timeliness of Data:** Data are collected from December 1990 to March 1991.

**Available Data Media:** Print and diskette

**Cost of Data:** \$525.00 paper; \$175.00 diskette

**Format of Data:** Tables and figures

**Resolution of Data in Document:** As indicated in the outline of the book, the data are on a State and regional basis.

**Comprehensiveness and Accuracy of Data:** Unable to judge the data from the outline of the book.

**Abstract of Document:** No abstract

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Scientific and Technical Aerospace Reports (STAR)

**Author:** Scientific and Technical Information Facility, NASA

**Date Published:** 1963 to present

**Frequency of Update:** Biweekly

**Document Number:** ISSN 0036-8741

**Type of Data in Document:** Abstracts of literature on space and aeronautics science and technology.

**Timeliness of Data:** Current

**Available Data Media:** Paper, microfiche

**Cost of Data:** NA

**Format of Data:** Abstracts

**Resolution of Data in Document:** Alphabetically by subject, in order of accession number.

**Comprehensiveness and Accuracy of Data:** Very comprehensive, covering publications in many scientific and technical fields; but the abstracts have limited accuracy.

**Abstract of Document:** This publication covers reports in the literature of the science and technology of space and aeronautics. All such NASA reports, together with similar material from other government agencies, universities, corporations, and research organizations are included. The papers are grouped under a number of headings and are cross-referenced by subject, author, contract number, NASA accession number, and corporate source. Annual cumulative indexes are available. Informatics Information Systems Company presently prepares this journal for NASA.

## **AREA EMISSIONS DATA SOURCE SHEET**

**Title:** Selected Annotated Bibliography on Application of Satellite Images to Thematic Mapping

**Author:** Department of Geography Publication Series, University of Waterloo

**Date Published:** August 13, 1984

**Frequency of Update:** One-time

**Document Number:** None given

**Type of Data in Document:** Listing of organizations/individuals involved with satellite mapping techniques.

**Timeliness of Data:** Data from 1972 to 1983

**Available Data Media:** Book

**Cost of Data:** \$9.00

**Format of Data:** Lists

**Resolution of Data in Document:** Organizations/individuals listed by mapping technique

**Comprehensiveness and Accuracy of Data:** A fairly comprehensive list of mappers, but information is rather dated.

**Abstract of Document:** This book contains a listing of people and organizations that conduct satellite mapping. The listing is broken down by category of mapping (e.g., vegetation mapping, wetland mapping, etc.).

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Solid Waste Data: A Compilation of Statistics on Solid Waste Management within the United States

**Author:** JRB Associates, Inc., Mclean, VA

**Data Published:** 1981

**Frequency of Update:** Once

**Document Number:** PB82-107301

**Type of Data in Document:** The data include quantities of solid waste generated, trends in residential and commercial waste generation; net quantity and composition of post-consumer residential and commercial solid waste by type of material and detailed product category; summary of incinerator use for processing; municipal solid waste disposal by method; average disposal costs by city size; resource recovery facilities by technology; operating resource recovery facilities by capacity; waste paper utilization; total quantities of recycled materials; and recyclable materials as percent of total residential waste.

**Timeliness of Data:** Data are from various sources and cover the period from 1960 to 1980.

**Available Data Media:** Print

**Cost of Data:** \$13.00

**Format of Data:** Tables

**Resolution of Data in Document:** Data are mostly at the national level, although some are at the State level.

**Comprehensiveness and Accuracy of Data:** It is impossible to judge their comprehensiveness and accuracy because the data are at the national level only.

**Abstract of Document:** No abstract

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Space-Based Remote Sensing of the Earth: A Report to the Congress

**Author:** NOAA and NASA

**Date Published:** September 1987

**Frequency of Update:** Biennial

**Document Number:** NTIS 10-825,725

**Type of Data in Document:** Information on the status of remote sensing

**Timeliness of Data:** Fairly current

**Available Data Media:** Paper

**Cost of Data:** NA

**Format of Data:** Five sections on different topics in governmental remote sensing

**Resolution of Data in Document:** Text with tables and figures

**Comprehensiveness and Accuracy of Data:** The book gives an overview of the current status of remote-sensing in all government areas; it does not go into much depth in any one area.

**Abstract of Document:** The legislation calling for the commercialization of the Landsat Satellites, Public Law 98-365, requires that NOAA and NASA jointly prepare and submit to the Congress a biennial series of reports on remote-sensing research and development applied to the Earth and its atmosphere. This report responds to the 1985 and 1987 Congressional reporting requirements and reviews ongoing Federal research programs in the remote sensing of land, oceans, and atmosphere. The report discusses objectives, progress, and accomplishments as of May 1, 1987. It identifies major gaps in our knowledge of the Earth and its atmosphere and derives a series of space-based measurement objectives. The near-term (approximately through 1992) space observations programs of the United States and other countries are detailed. The report represents the start of the planning process to develop an integrated national program for research and development in Earth remote sensing for the remainder of this century and describes the many existing and proposed satellite and sensor systems that the program may include. NASA and NOAA have been the primary authors; other agencies have provided information on remote-sensing applications that their missions require, and they have reviewed this version of the report. In the future, an even more interactive process will be established to ensure that the national plan continues to represent agency, private sector, and academic needs. This document is designed for agency-level



planning purposes and does not represent the Administration's approval or support of any program not included in the President's budget request. Programs discussed in this document are subject to budget constraints and Administration approval.

## **AREA EMISSIONS DATA SOURCE SHEET**

**Title:** State and Metropolitan Area Data Book

**Author:** U.S. Department of Commerce, Bureau of Census

**Data Published:** April 1986

**Frequency of Update:** Every five years

**Document Number:** PB003-024-06334-4

**Type of Data in Document:** The report contains data such as land area and population; population characteristics, households, marriages, and divorces; births and deaths; physicians and nursing homes; hospitals and health insurance; social security and public aid; housing; education and money income; personal income; civilian labor force and employment; manufacturers; wholesale and retail trade; and service industries.

**Timeliness of Data:** Data from 1982 economic and government census are featured in this report. A 1983 annual survey of manufacturers and late summer/early fall 1985 population data are published in the book.

**Available Data Media:** Print and microfiche

**Cost of Data:** \$26.00 print; \$10.00 microfiche.

**Format of Data:** Tables

**Resolution of Data in Document:** Data are at the State, metropolitan area, and component county levels. Data cover 243 metropolitan statistical areas, 54 primary metropolitan statistical areas, and 6 New England county metropolitan areas.

**Comprehensiveness and Accuracy of Data:** The data are from census surveys and administrative records. They are relatively accurate and comprehensive.

**Abstract of Document:** No abstract

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** State Population and Household Estimates, with Age, Sex, and Components of Change: 1981-1988

**Author:** U.S. Department of Commerce, Bureau of the Census

**Data Published:** August 1989

**Frequency of Update:** Annual

**Document Number:** P-25, No. 1044

**Type of Data in Document:** The report contains population and household data by age, sex, and percent change in the resident population of the State.

**Timeliness of Data:** Data from 1981 to 1988

**Available Data Media:** Print

**Cost of Data:** \$3.25

**Format of Data:** Tables and charts

**Resolution of Data in Document:** Data are at the State level.

**Comprehensiveness and Accuracy of Data:** The data are relatively comprehensive and accurate.

**Abstract of Document:** The data contain the State estimates of the resident and civilian populations and of households for July 1, 1988; revised annual population and household estimates for July 1, 1981 through 1987; and components of population change for the 1980-1988 period.

## AREA EMISSIONS DATA SOURCE SHEET

**Title:** Statistical Abstract of the U.S.

**Author:** U.S. Department of Commerce, Economics and Statistics Administration, Bureau of the Census

**Date Published:** 1991

**Frequency of Update:** Annual

**Document Number:** Library of Congress card #4-18089

**Type of Data in Document:** Data on the social, political, and economic organization of the United States.

**Timeliness of Data:** Current

**Available Data Media:** Paper

**Cost of Data:** NA

**Format of Data:** Tables, charts

**Resolution of Data in Document:** Data are broken down to the state level, with selected metropolitan statistics

**Comprehensiveness and Accuracy of Data:** Data are very comprehensive, covering numerous facets of U.S. civilization. Accuracy should parallel other census bureau data.

**Abstract of Document:** Published since 1878, this book is the standard summary of statistics on the social, political, and economic organization of the United States. It is designed to serve as a convenient volume for statistical reference and as a guide to other statistical publications and sources. This volume includes a selection of data from other statistical publications, both government and private. The entire tabular portion of the abstract was put in separate Lotus 123 spreadsheet files.

## **AREA EMISSIONS DATA SOURCE SHEET**

**Title:** Structural Fire Statistics

**Author:** National Fire Protection Association

**Date Published:** NA

**Frequency of Update:** NA

**Document Number:** NA

**Type of Data in Document:** Statistics on fires in housing units

**Timeliness of Data:** NA

**Available Data Media:** Paper

**Cost of Data:** NA

**Format of Data:** NA

**Resolution of Data in Document:** NA

**Comprehensiveness and Accuracy of Data:** NA

**Abstract of Document:** NA

## **AREA EMISSIONS DATA SOURCE SHEET**

**Title:** Summary of Population and Housing Characteristics

**Author:** U.S. Department of Commerce, Bureau of the Census

**Data Published:** August 1991

**Frequency of Update:** Decennial

**Document Number:** 1990CPH-1

**Type of Data in Document:** Total population and housing unit counts, summary statistics on age, sex, race, Hispanic origin, household relationship, units in structure, value and rent, number of rooms tenure, and vacancy characteristics for local governments.

**Timeliness of Data:** The data contain March - August 1990 census of population and housing published in 1991.

**Available Data Media:** Print, computer tape, microfiche, and CD ROM

**Cost of Data:** \$4.75-\$30.00 depending on the State, or total for \$717.25 print; \$175.00 - \$625.00 or total for \$10,000 computer tape; \$150.00/each CD or total for \$1,700.00.

**Format of Data:** Tables

**Resolution of Data in Document:** Data are available at the national, regional, State, and county levels.

**Comprehensiveness and Accuracy of Data:** The data are comprehensive and relatively accurate.

**Abstract of Document:** A separate report is issued for the United States, each State, Puerto Rico, and the Virgin Islands. Each report contains census data such as land area and population density; occupied housing units by race, occupancy and financial characteristics for renter and owner; structural and vacancy characteristics; household, family and group quarters characteristics by age, sex, and race.

## **AREA EMISSIONS DATA SOURCE SHEET**

**Title:** Theory and Applications of Optical Remote Sensing

**Author:** Asrar, Ghassem

**Date Published:** 1989

**Frequency of Update:** One time

**Document Number:** ISBN 0-471-62895-6

**Type of Data in Document:** Thorough assessment of remote sensing technology.

**Timeliness of Data:** The most recent textbook on remote sensing found for this search.

**Available Data Media:** Paper

**Cost of Data:** \$56.00

**Format of Data:** Text with figures and tables

**Resolution of Data in Document:** Textbook chapters

**Comprehensiveness and Accuracy of Data:** Very comprehensive in scope, but not a data source on remote sensing.

**Abstract of Document:** This book is a comprehensive overview on remote sensing. It contains sections which give an overview of space-based remote sensing, and specifically, detection of atmospheric conditions.

## **AREA EMISSIONS DATA SOURCE SHEET**

**Title:** User's Guide to ENDEX/OASIS: Environmental Data Index and The Oceanic and Atmospheric Scientific System

**Author:** NOAA Environmental Data Service

**Date Published:** January 1976

**Frequency of Update:** Every several years

**Document Number:** NA

**Type of Data in Document:** Information on NOAA data distribution source

**Timeliness of Data:** Dated

**Available Data Media:** Paper

**Cost of Data:** Free upon request

**Format of Data:** Text

**Resolution of Data in Document:** Chapter format

**Comprehensiveness and Accuracy of Data:** A good guide to this data collection service, but because of age, accuracy cannot be assured, and it is probably obsolete.

**Abstract of Document:** A how-to ordering book for NOAA information.



**APPENDIX B**  
**ASSOCIATIONS CONTACTED FOR INFORMATION ON FUEL AND**  
**WASTE COMBUSTION AND OTHER BURNING SOURCES**

**TABLE B-1. TRADE AND PROFESSIONAL ASSOCIATIONS CONTACTED FOR POSSIBLE INFORMATION  
ON FUEL AND WASTE COMBUSTION AND OTHER BURNING SOURCES**

Trade/Professional Association	Type of Information Available	Phone Number
Agricultural Council of America	No information is available from the council on agricultural burning. Information is available on agricultural exports and on improving the agricultural industry.	(202) 682-9200
American Forage and Grassland Council	No information is available on agricultural burning. The council has information available on the subjects of hay and forage. It publishes four informational documents.	(717) 935-2447
National Woodland Owners Association	The association's main concern is dealing with uniting non-industrial land owners in the United States. No information is available on the forest fires, prescribed or slash burning.	(703) 255-2700
American Forest Council	The council has information available on the importance of forestry and forest products. They do not have information which would be helpful in improving an emissions inventory.	(202) 463-2455
American Forestry Association	The association has estimates on the annual number of forest fires in the United States.	(202) 667-3300
Department of Interior	The department has estimates on the amount of acreage (woods) burned per year. They do not have an estimate on the type of tree which is burned.	(202) 343-3171
Department of Agriculture	The department has estimates on the amount of crop burnings that occur per year. There are also estimates on the type of crops which are burned.	(202) 447-2791
American Petroleum Institute	Available estimates on fuel production/consumption (sales).	(202) 682-8000
Natural Gas Supply Association	Information available on natural gas consumption estimates for the nation. Mostly concerned with the new exploration of natural gas.	(202) 331-8900
National Coal Association	Estimates on the quantities of coal consumption (sales).	(202) 463-2625
Combustion Institute	Information available on combustion sources and other combustion areas and/or ideas. Most of the information is presented from technical talks given at conferences around the United States.	(412) 687-1366