Geochemical Database of Feed Coal and Coal Combustion Products (CCPs) from Five Power Plants in the United States

Selected Coal Utilization References

By Kelly L. Conrad and Ronald H. Affolter

Pamphlet to accompany
Data Series 635

U.S. Department of the Interior
U.S. Geological Survey
About USGS Products

For product and ordering information:
World Wide Web: http://www.usgs.gov/pubprod
Telephone: 1-888-ASK-USGS

For more information on the USGS—the Federal source for science about the Earth, its natural and living resources, natural hazards, and the environment:
Telephone: 1-888-ASK-USGS

About this Product

Publishing support provided by
Denver Science Publishing Network

For more information concerning this publication, contact:
Center Director, USGS Central Energy Resources Science Center
Box 25046, Mail stop 939
Denver, CO 80225
(303) 236-7775

or visit the Central Energy Resources Science Center Web site at:
http://energy.cr.usgs.gov

Suggested citation:


Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Although this report is in the public domain, permission must be secured from the individual copyright owners to reproduce any copyrighted materials contained within this report.


Cover: Photograph of a coal-fired power plant in the northwestern United States. Photograph by Ronald H. Affolter.
Contents

Selected Coal Utilization References ................................................................. 1
Geochemical Database of Feed Coal and Coal Combustion Products (CCPs) from Five Power Plants in the United States

By Kelly L. Conrad and Ronald H. Affolter

Selected Coal Utilization References

[Bracketed numbers indicate total page counts. These are provided to aid identification for the work.]

The purpose of this bibliography is to provide a source of information to assist decision makers, land and resource managers, other Federal and State agencies, the domestic energy industry, foreign governments, nongovernmental groups, academia, and other scientists making decisions in the face of rapid energy development in the U.S. This document attempts to encompass the most relevant literature that will help serve as a foundation on which to appropriately understand the complexities of coal utilization. Since the early 1970s, the U.S. Geological Survey has been involved in evaluations of data collected from various coal utilization and power plant-related studies. The publications in this bibliography cover the last 50+ years and include many past, unique, and current studies involving coal utilization. Subject material ranges from utilization of coal to disposal of coal combustion products (CCPs) with topics on new technology and regulations. These references were compiled as a source of associated material for this Data Series—Geochemical database of feed coal and coal combustion products (CCPs) from five power plants in the United States: consisting of major-, minor-, and trace-element contents, proximate and ultimate analyses, forms of sulfur, calorific values, ash fusion temperatures, mineralogy, petrological data, and selected coal utilization references.


Air Pollution Work Sub-group, 1972, Appendix A, Southwest Energy Study, air pollution aspects of Southwest Energy Study, southwest power plant air pollutant emissions: Research Triangle Park, N.C., U.S. Environmental Protection Agency, Office of Air and Water Programs, Office of Air Programs, Stationary Source Pollution Control Programs, Applied Technology Division, Air Quality Management Branch, National Source Inventory Section, 89 p.


Arroyo, Fátima, 2007, Recovery of germanium present in the fly ash produced in an IGCC plant that uses coal from ENCASUR (Puertollano): Seville, University of Seville, Spain, School of Engineering, Chemical and Environmental Engineering Department, Ph.D. Dissertation [in Spanish].


Babcock and Wilcox Company, 1969, Guide specifications; cyclone furnace fuel systems; Coal 1A5; 9P4; 2A1111: Alliance, Ohio, Babcock and Wilcox Company, 7 p.


Bakharev, T., 2006, Thermal behavior of geopolymers prepared using Class F fly ash and elevated temperature curing: Cement and Concrete Research, v. 36, no. 6, p. 1134–1147.


Selected Coal Utilization References 23


Brown, N., 2001, Modifications to pf burners to reduce NOx emissions: Stanwell Power Station: Palo Alto, Calif., Electric Power Research Institute, 1 vol., variously paged.


California Air Resources Board, Stationary Source Control, and Regional Programs Divisions, 1981, Proposed guidelines for the control of emissions from coal-fired power plants: Sacramento, California, Air Resources Board, Stationary Source Control and Regional Programs Divisions, State document no. A1173 C62, 1 v., variously paged.


Carlton, R., Chu, P., Levin, L., Offen, G., and Yager, J., 2005, EPRI Comments on U.S. Environmental Protection Agency Notice of Data Availability (NODA) regarding a proposed Clean Air Mercury Rule (CAMR); proposed national emission standards for hazardous air pollutants; and, in the alternative, proposed standards of performance for new and existing stationary sources, Electric Utility Steam Generating Units: Palo Alto, Calif., Electric Power Research Institute [EPRI], 91 p., plus appendices.


Cliff, D.I., and Young, B.C., 1985, NOx generation from the combustion of Australian brown and subbituminous coals: Fuel, v. 64, no. 11, p. 1521–1524.


Davis, D.D., 1977, Laser induced fluorescence to study power plant plume chemistry: Atlanta, Georgia, Georgia Institute of Technology, Engineering Experiment Station, Final Reports 1 and 2 for project A-1933, 2 vols. in 1, separately paged.


De Santis, V., and Longo, I., 1984, Coal energy vs. nuclear energy – a comparison of the radiological risks: Health Physics, v. 46, p. 73–84.


Deeson, D.R., Gladney, E.S., Owens, J.W., Perkins, B.L., Wience, C.L., and Wangen, L.E., 1977, Comparison of levels of trace elements extracted from fly ash and levels found in effluent waters from a coal-fired power plant: Environmental Science and Technology, v. 11, no. 10, p. 1017–1019.


Dressen, D.R., Gladney, E.S., Owens, J.W., Perkins, B.L., Weinke, C.L., and Wangen, L.E., 1977, Comparison of levels of trace elements extracted from fly ash and levels found in effluent waters from a coal-fired power plant: Environmental Science and Technology, v. 11, p. 1017–1019.


Ellsworth, K., 1975, Electrification – two new Texas coal lines are coming in under the wire: Railway Age, v. 176, no. 24, p. 22.


Emmel, Thomas E., 1990, Retrofit costs for SO$_2$ and NOx control options at 200 coal-fired plants – v. 3 – site specific studies for Indiana, Kentucky, Massachusetts, Maryland, Michigan, Minnesota: Research Triangle Park, N.C., U.S. Environmental Protection Agency [EPA], Air and Energy Engineering Research Laboratory, Report no. EPA/600/S7-90/021C, 425 p.


Energy and Environmental Research Center [EERC], University of North Dakota, 2006, Mercury in coal and transformations in combustion flue gases, mercury control short course, 18 p.
Selected Coal Utilization References


Ensor, D.S., 1979, Ceilcote ionizing wet scrubber evaluation: Meteorology Research, Inc. and U.S. Environmental Protection Agency [EPA], Industrial Environmental Research Laboratory, Report no. EPA-600/7-79-246, 1 vol., variously paged.


Flanders, P.J., 1999, Identifying fly ash at a distance from fossil fuel power stations: Environmental Science and Technology, v. 33, no. 4, p. 528–532.


Freiberg, J., 1976, The application of an isotopic ratio technique to a study of the atmospheric oxidation of sulfur dioxide in the plumes from an oil-fired and a coal-fired power plant – I and II: *Atmospheric Environment*, v. 10, no. 8, p. 672.


Garty, J., 1987, Metal amounts in the lichen Ramalina duriae (De Not.) Bagl. transplanted at biomonitoring sites around a new coal-fired power station after 1 year of operation: Environmental Research, v. 43, no. 1, p. 104–116.


Goren, A. I., Hellmann, S., and Glaser E.D., 1997. Use of outpatient clinics as a health indicator for communities around a coal-fired power plant – Institute for Environmental Research, Sackler School of Medicine, Tel-Aviv University, Tel-Aviv, Israel: Environmental Health Perspectives, v. 103, no. 12, p. 1110–1115 [English summary].

Goren, A. I., Hellmann, S., and Glaser E.D., 1997, Use of outpatient clinics as a health indicator for communities around a coal-fired power plant – Institute for Environmental Research, Sackler School of Medicine, Tel-Aviv University, Tel-Aviv, Israel: Environmental Pollution, v. 97, no. 1-2, p. 193.

Goss, D., 2006, New mercury controls challenge reuse of utility ash: Natural Gas and Electricity, v. 22, no. 6, p. 8–12.


Gruhl, J., 1973, Quantification of aquatic environmental impact of electric power generation: Cambridge, Massachusetts Institute of Technology [MIT], Energy Laboratory Report MIT-EL 73-004, 176 p.


Habelt, W.W., and Selker, A.P., 1974, Operating procedures and prediction for NOx control in steam power plants, in Combustion Institute, Central States Section, Spring technical meeting, March 26–27, 1974, Madison, Wisconsin: Pittsburgh, Pa., Combustion Institute, 17 p.


Han, M., 1992, Coal- and oil-fired power plant contributions to the atmosphere of Maryland: College Park, University of Maryland, Ph.D. dissertation, 255 p.


Hayward, T.J., and Burgher, K.E., 1989, Coal quality market modeling with pooled data: an example that traces the spot market purchases of Dayton Power and Light: Mining Science and Technology, v. 8, no. 1, p. 73–84.


Selected Coal Utilization References


Huang, C.P., and Hsu, M.-C., 1997, Recovery of EDTA from power plant boiler chemical cleaning wastewater: Maryland Department of Natural Resources Report CBWP-MANTA-TR-97-7, 100 p.


James, K.W., and Foster, P.M., 1976, The application of an isotopic ratio technique to studies of the atmospheric oxidation of sulfur dioxide in the plumes from an oil-fired and a coal-fired power plant – I and II: Atmospheric Environment, v. 10, no. 8., p. 671.


Kapička, A., Petrovský, E., Ustjak, S., and Macháčková, K., 1999, Proxy mapping of fly-
ash pollution of soils around a coal-burning power plant – a case study in the Czech

Kaplan, L.J., 1982, Cost-saving process recovers CO from power-plant flue gas:

Kaplan, N., 1985, Status of commercial utility FGD (flue gas desulfurization) technol-
ogy: Research Triangle Park, N.C., U.S. Environmental Protection Agency [EPA], Air

Karamanis, D., Ioannides, K., and Stamoulis, K., 2009, Environmental assessment of
natural radionuclides and heavy metals in waters discharged from a lignite-fired power

plume-in-grid model: Palo Alto, Calif., Electric Power Research Institute [EPRI]
Report no. TR-113097, variously paged.

Karamchandani, P., and Seigneur, C., 1999, Simulation of sulfate and nitrate chemistry in
power plant plumes: Journal of the Air and Waste Management Association, v. 49, no.
1 supplement, p. PM175–PM181.

in the Mojave Power Plant Plume: San Ramon, Calif., Atmospheric and Environ-
mental Research, Inc., report prepared for Electric Power Research Institute [EPR], last
accessed July 2010 at http://www.energy.ca.gov/Reports/2002-01-10_600-00-015/
APPENDICES/600-00-015-AD.pdf, [62 p.].

Karamdoust, N.A., and Durrani, S.A., 1990, Determination of radon emanation power of
fly ash produced in coal-combustion power stations: International Journal of Radia-
tion Applications and Instrumentation [United Kingdom], Part D, v. 19, no. 1-4, p.
339–342.

Karangelos, D.J., Petropoulos, N.P., Anagnostakis, M.J., Hinis, E.P., and Simopoulos,
S.E., 2004, Radiological characteristics and investigation of the radioactive equilib-
rium in the ashes produced in lignite-fired power plants: Journal of Environmental

Biogeochemistry of Trace Elements in Coal and Coal Combustion Byproducts: New

Karayığıt, Ali I., Bulut, Y., Karayığıt, G., Querol, X., Alastuey, A., Vassilev, S., and Vas-
sileva, C., 2006, Mass balance of major and trace elements in a coal-fired power plant:
Energy Sources, Part A: Recovery, Utilization, and Environmental Effects, 1556-7230,
v. 28, no. 14, p. 1311–1320.

fly ash composition from the Soma Power Plant, Turkey: Energy Sources, v. 27, no.
15, p. 1473–1481.

Karayığıt, Ali I., and Gayer, Rod A., 2001, Characterisation of fly ash from the Kangal
Power Plant, eastern Turkey, in International Ash Utilization Symposium, 2001: Lex-
ington, University of Kentucky Center for Applied Energy Research [CAER], [8] p.,


Kennedy, F.M., Schroeder, A.C., and Veitch, J.D., 1981, Economics of ash disposal at coal-fired power plants: U.S. Environmental Protection Agency [EPA] and Tennessee Valley Authority [TVA], Report no. EPA-600/7-81-170; TVA/OP/EDT-81/34, 204 p.


Lee, R.E., Crist, H.L., Riley, A.E., and MacLeod, K.E., 1975, Concentration and size of trace metal emissions from a power plant, a steel plant, and a cotton gin: Environmental Science and Technology, v. 9, no. 7, p. 643–647.


Lim, K.J., 1980, Environmental assessment of utility boiler combustion modification NOx controls: U.S. Environmental Protection Agency Report EPA-600/7-80-075 a-b, 2 vol.


Lindsay, D., 2000, Power-Plant Control and Instrumentation – the control of boilers and HRSG systems: London, United Kingdom, Institution of Electrical Engineers [IEE], v. 58.


Lockwood, F.C., and Syed, S.A., 1977, Prediction of coal-fired furnaces: London, United Kingdom, Imperial College of Science, Technology and Medicine, Mechanical Engineering Department, Report to CEGB, Technical Note FS/78/1, [pagination not found].


Geochemical Database of Feed Coal and Coal Combustion Products


Malte, P.C., 1978, Inorganic pollutants from pulverized coal combustion (a review), in Combustion Institute, Fall meeting of the Western States Section of the Combustion Institute, October 17, 1977, Palo Alto, California: Pittsburgh, Pa., Combustion Institute, 26 p.


Marović, G., 1985, Enhanced natural radioactivity around a coal-fired power plant [in Croatian]: Zagreb, Croatia, University of Zagreb, Technological Faculty, Master of Science thesis.


Mastradone, P.J., 1979, Trace metal deposition on agricultural crops near the Chalk Point Generating Station: College Park, University of Maryland, Master of Science thesis, 158 p.


Mayland, B.J., and Heinze, R.C., 1973, Continuous catalytic absorption for NOx emission control: Chemical Engineering Progress, v. 69, p. 75–76.


McCrea, P.R., 1986, An assessment of the effects on horticultural production of fugitive dust and ash from the proposed Waikato coal-fired power station activities: Lincoln, New Zealand, Lincoln College Agricultural Economics Research Unit Report no. 185, 86 p.


Mejstrík, V., and Švácha, J., 1988, Concentrations of $^{232}$Th, $^{228}$Ra, $^{137}$Cs, and $^{40}$K in soils, and radioactivity in areas of coal-fired power plants: The Science of The Total Environment, v. 71, no. 1, p. 69–79.


Merz, E., Kroth, K., Scholz, W., and Holzapfel, T., 1989, Measuring the radioactivity of gypsum from flue gas desulphurisation plants and drawing up a radioactivity balance for the flue gas desulphurisation process of a large-scale power station fired with Rhenish Lignite: VGB Kraftwerkstechnik, v. 69, no. 11, p. 976–980.


Selected Coal Utilization References


National Energy Technology Laboratory [NETL], 2005, Clean coal technology; selective catalytic reduction (SCR) technology for the control of nitrogen oxide emissions from coal-fired boilers – an update of Topical Report no. 9: 10 p.


National Energy Technology Laboratory [NETL], 2005, Hydrogen from Coal Program – research, development, and demonstration plan, for the period 2005 through 2015 – external draft for review: 58 p.

National Energy Technology Laboratory [NETL], 2008, Hydrogen Coal Program – research, development, and demonstration plan, for the period 2008 through 2016 – external draft: 71 p.


North Dakota, Division of Environmental Engineering, 1974, Potential animal and human effects of trace elements resulting from coal development: Bismark, North Dakota, Division of Environmental Engineering, Environmental Control Section, North Dakota Department of Health, 32 p.

Northeast States for Coordinated Air Use Management [NESCAUM], 2003, Mercury emissions from coal-fired power plants; the case for regulatory action: Northeast States for Coordinated Air Use Management [NESCAUM], 1 vol., variously paged.


Selected Coal Utilization References


Pike, Simon, 1990, Mineral matter in coal and its influence on ash behaviour during combustion: Sheffield, United Kingdom, University of Sheffield Geology Department, Ph.D. thesis [pagination not known].

Piktel, Joseph L., 1999, Strategies to reduce nitrogen oxide formation and emissions from stationary combustion units: University Park, Pennsylvania State University, Bachelor of Science thesis, 1 vol. [pagination no known].


Pronobis, M., 1989, Further findings concerning the effect of ash deposits upon the exchange of heat in convection boiler surfaces: VGB Kraftwerkstechnik (English issue), v. 69, no. 11, p. 931–938.


logically sound ash removal technologies at reconstruction of coal-fired power plants
in Russia, in University of Kentucky Center for Applied Energy Research [CAER],
eds, World of Coal Ash [WOCA] Conference, May 7–10, 2007, Covington, Kentucky:
Lexington, University of Kentucky Center for Applied Energy Research [CAER], [9]

emissions – coal and fly ash from some eastern and western power plants in the U.S.A.
1–18.

ceramics – a case study for a large Spanish power station: Fuel, v. 76, no. 8, p.
787–791.

Querol, X., Alastuey, A., Bezares, J.C., Juan, R., López-Soler, A., Mantilla, E., Plana, F.,
térmica en la composición de material particulado atmosférico [Effect of emissions
from a large thermal power station on atmospheric particulate material composition]:

Sources of natural and anthropogenic sulphur around the Teruel Power Station, NE
34, p. 333–345.

composition of atmospheric particulates around a large coal-fired power station:
Atmospheric Environment, v. 30, no. 21, p. 3557–3572.

Querol, X., Alastuey, A., López-Soler, A., Plana, F., Mantilla, E., Juan, R., Ruiz, C.R.,
and La Orden, A., 1999, Characterisation of atmospheric particulates around a coal-

Querol, X., Alastuey, A., Puicercus, J.A., Mantilla, E., Miro, J.V., López-Soler, A., Plana,
F., and Artiñano, B., 1998, Seasonal evolution of suspended particles around a large

Querol, X., Alastuey, A., Puicercus, J.A., Mantilla, E., Ruiz, C.R., López-Soler, A.,
Plana, F., and Juan, R., 1998, Seasonal evolution of suspended particles around a large
coal-fired power station: Chemical characterization: Atmospheric Environment, v. 32,
no. 4, p. 719–731.

and their behaviour during combustion in a large power station: Fuel, v. 74, no. 3, p.
331–343.

Querol, X., Fernández-Turiel, J.L., López-Soler, A., and Duran, M.E., 1992, Trace ele-
ments in high-S subbituminous coals from Teruel Mining District, northeast Spain:

Querol, X., Juan, R., López-Soler, A., Fernández-Turiel, J.L., and Ruiz, C.R., 1996,
Mobility of trace elements from coal and combustion wastes: Fuel, v. 75, no. 7, p.
821–838.

Querol, X., Moreno, N., Alastuey, A., Juan, R., Andrés, J.M., López-Soler, A., Ayora,
C., Medinaceli, A., and Valero, A., 2007, Synthesis of high ion exchange zeolites from


Ragaini, R.C., and Ondov, J.M., 1975, Trace contaminants from coal-fired power plants: Livermore, University of California, Lawrence Livermore Laboratory Report UCRL-76794, 18 p.


Randall, A.J., Ives, B.C., and Eastman, C., 1974, Benefits of abating aesthetic environmental damage from the Four Corners Power Plant, Fuitland, New Mexico: New Mexico State University, Agricultural Experiment Station, 40 p.


Repić, B., Radulović, P., Šikmanović, S., and Grubor, B., 1988, Boilers start-up with pul- 
verized Coal [abs.], in XX Kraftwerkstechnisches Kolloquium [Power Plant Technical 
Colloquium], Einsatz schwieriger brennstoffe in dampferzengern und industriellen 
feuerungen, October 11–12, 1988, Dresden, Deutsch Democratic Republic: Dresden, 
Technische Universität Dresden, p. 89.

ies of fly ash and bottom ash, in Breit, G.N., and Finkelman, R.B., eds., Characteriza-
tion of coal and coal combustion products from a coal-burning power plant—prelimi-

Rezek, J.P., and Campbella, R.C., 2007, Cost estimates for multiple pollutants – a maxi-

Ribeiro, J., 1995, Techno-economic analysis of the SCR plant for NOx abatement – 
investigation into the optimisation potential of catalyst renewal strategies in SCR 

Rice, C.A., 1998, Preliminary geochemical model results of water leachates, in Breit, 
G.N., and Finkelman, R.B., eds., Characterization of coal and coal combustion prod-
ucts from a coal-burning power plant—preliminary report and results of analyses: 

Rice, C.A., 2007, Leaching studies by batch, sequential, toxicity characteristic leach-
ing protocol (TCLP), and synthetic precipitation leaching protocol (SPLP), in Ellis, 
Margaret, and Affolter, R.H., eds., From Cradle to Grave, The Power of Coal, Interna-
tional Technical Conference on Coal Utilization and Fuel Systems, June 10–15, 2007, 

coal-fired gas turbine conditions: surface and combustion temperature effects: Journal 

Richards, L.W., 1985, Nitrogen dioxide from a coal-fired power plant: Atmospheric 

Waters, N., Macias, E.S., and Bhardwaja, P.S., 1981, The chemistry, aerosol physics, 
and optical properties of a western coal-fired power plant plume: Atmospheric Envi-
ronment, v. 15, no. 10/11, p. 2111–2134.

and sulfur chemistry and aerosol formation in a western coal-fired power plant plume, 
in Mathai, C.V., ed., Transactions, Visibility and Fine Particles: Pittsburgh, Pennsylva-

Richards, L.W., Anderson, J.A., Blumenthal, D.L., McDonald, J.A., Macias, E.S., Her-
ing, S.V., and Wilson, W.E.J., 1985, Chemical, aerosol and optical measurements in 
the plumes of three midwestern coal-fired power plants: Atmospheric Environment, v. 
19, no. 10, p. 1685–1704.

Richardson, C., Machalek, T., Miller, S., Dene, C., and Chang, R., 2002, Effect of NOx 
control processes on mercury speciation in utility flue gas: Journal of the Air and 
Waste Management Association, v. 52, no. 8, p. 941–947.


Rogozen, M.B., 1978, Coal slurry pipelines; the water issues: Los Angeles, University of California, 284 p.


Selected Coal Utilization References


Schumacher, B., 1988, Bisherige erfahrungen mit SCR-deNOx-anlagen zur stickoxidminderung [Previous experience with SCR-deNOx plants for nitrogen oxide reduction]: EVT-Register, v. 47, p. 27–38.


Schwitzgebel, K., Magee, R.A., Meserole, F.B., Oldham, R.G., Mann, R.M., Wilkin, G.E., and Thompson, C.M., 1975, Coal fired power plant trace element study; Station I; Station II; Station III: Denver, Colo., Environmental Protection Agency [EPA], Rocky Mountain-Prairie Region [Region VIII], 4 v. [v. II-IV under single cover].


Sharma, R., and Pervez, S., 2004, A case study of spatial variation and enrichment of selected elements in ambient particulate matter around a large coal-fired power station in central India: Environmental Geochemistry and Health, v. 26, no. 3-4, p. 373–381.


Sheridan, R.P., 1979, Impact of emissions from coal-fired electricity generating facilities on N2-fixing lichens: Bryologist, v. 82, p. 54–58.


Showman, R.E., 1975, Lichens as indicators of air quality around a coal-fired power generating plant: The Bryologist, v. 78, no. 1, p. 1–6.


Southern Research Institute, 1977, Environmental control implications of generating electric power from coal, technology status Report, appendix E: a review of technology for control of fly ash emissions from coal in electric power generation: Argonne, Illinois, Argonne National Laboratory Report, ANL/ECT-3, Appendix E.


Stevens, T.H., and Ives, B.C., 1976, Distribution and concentration of air pollution from the Four Corners Power Plant at Fruitland: New Mexico State University, Agricultural Experiment Station, 16 p.


Strauss, K., and Thelen, F., 1989, Brennstoffaufbereitung als beitrag zur NOx-minderung [Fuel preparation as a contribution to the lowering of NOx levels]: VGB Kraftwerkstechnik, v. 69, no. 2, p. 207–211.


Tolvanen, M., 2004, Mass balance determination for trace elements at coal-, peat- and bark-fired power plants, Department of Physical Sciences, Faculty of Science, University of Finland: Helsinki, Finland, VTT Technical Research Centre of Finland, Espoo, Finland, VTT Publication no. 524, 139 p., 190 p. appendix.


Turner, F.B., and others, 1975, Preliminary analyses of soils and vegetation in the vicinity of the Mojave Generating Station in southern Nevada: Los Angeles, University of California, Laboratory of Nuclear Medicine and Radiation Biology, UCLA Report no. 12-990, 102 p.


Utah Power and Light Company, and Utah State University Agricultural Experiment Station, 1987, Evaluation of health effects on animals and defining a cattle reproductive problem in the vicinity of a coal-fired power generation plant: Logan, Utah, Utah State University Agricultural Experiment Station, 145 p.


Vassilev, S., 1994, Trace elements in solid waste products from coal burning at some Bulgarian thermoelectric power stations: Fuel, v. 73, p. 367–374.


Wall, T.F., 1985, Combustion of coal chars, an intensive course on the characterization of steaming coals; May 20–22, 1985, Newcastle: Newcastle, New South Wales, Australia, University of Newcastle, Institute of Coal Research, p. 5.1–5.29.


Wilde, M., 2008, Best available techniques (BAT) and coal-fired power stations – can the energy gap be plugged without increasing emissions?: Journal of Environmental Law, v. 20, no. 1, p. 87–114.

Williams, Lawrence G., 1977, The demand for steam coal used for electric power generation in the four corners area of Arizona, Colorado, New Mexico and Utah: Las Cruces, New Mexico State University, Master of Science thesis, 64 p.


