

Definitions of parameters in the
U.S. Geological Survey Coal Quality database.

U.S. GEOLOGICAL SURVEY OPEN-FILE REPORT 97-134

U.S. GEOLOGICAL SURVEY COAL QUALITY (COALQUAL) DATABASE: VERSION 2.0

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Since the middle 1970's, the U.S. Geological Survey (USGS) has maintained a coal quality database of national scope. The USGS generated data on more than 13,000 samples on samples collected by the USGS and cooperative state geological surveys. For each sample, 136 parameters are recorded, including data on location and sample description, analytical data from ASTM tests, and USGS tests for major-, minor-, and trace elements. Many of these data have been published in various USGS Open-File Reports or other publications. This CD-ROM contains coal quality data for 7,430 coal samples that represent complete-bed thicknesses at various localities. The CD contains the coal quality data in the COALQUAL database; Landview III™ (data management software) which is integrated with MARPLOT™ (mapping software); documentation on the software and data; documents pertaining to the collection and analysis of coal samples, as well as to terminology and calculation of coal resources; and various software help files. Help files are on the CD as .pdf files (See list in [PDFLIST.PDF](#)) and can be accessed with the Adobe Acrobat Reader software, which is also included on the CD.

It is strongly recommended that the user spend 30 minutes to go through the [Quick-Start Tutorial](#) to become familiar with the software to access the COALQUAL data. As the user gains expertise, the longer tutorial covers most of the other functions, in particular mapping functions, that are useful in looking at the data. One of the advantages of this software is that the user can add new data and map sets to the data already on the CD. The next version of the CD, available after the completion of the National Coal Resource Assessment, will contain new analyses, as well as the data collected as part of the assessment.

The data are presented on a whole-coal basis, in addition the oxides are also shown as a percentage of the total ash on an ash-basis for specific elements. The standard analyses, American Society for Testing and Materials (ASTM) data are provided on an as-received basis, whereas USGS data are provided on a remnant-moisture basis (using USGS test methods, moisture contents of samples were not adequately determined prior to analysis. Therefore some samples, particularly low-rank coal samples, contained significant amounts of unmeasured moisture which would manifest an effect by reducing the amount of ash, trace- major-, and minor- elements.). Some fields may not contain data and will be represented as NO DATA ENTERED in the text fields or NULL values in the numeric fields. In the .dbf file (dBase data file) on the CD-ROM, NULL values will be represented as negative zeros (-0) in the numeric fields.

Samples have been selected from the USCHEM (USgeoCHEMical) database using the following criteria:

1. GSASH data must have a positive value, not 0, in order to convert data on an ash-basis to a whole-coal basis.
2. GSASH and STDASH data must be less than or equal to 33 percent (as-determined basis).
3. All data must represent complete-bed channel or drill core (SEE list of SAMPTYPE and VALREP values in TECHINFO.PDF. For some localities, data are represented by one sample obtained either by channel or core ([Swanson & Huffman, 1976](#); [Stanton, 1989](#)). In other localities, data were calculated from weighted averages of samples taken sequentially to represent the bed thickness. (Weighted averages are calculated by normalizing the data to the total "bed thickness" using the individual sample thicknesses.)

4. Samples must have an ESTRANK (apparent rank) value which is not a rock type. (SEE list of ESTRANK values in TECHINFO.PDF)

The following section provides a description of each data field in the COALQUAL database and an explanation of all codes that are used. The analytical method(s) is noted for each field of coal quality data.

The following list contains the number of significant figures for analytical methods, when known. The user is cautioned to utilize only the correct number of significant figures as noted below for any final results of calculations or summaries of values in the database. For American Society for Testing and Materials (ASTM) analytical methods ([ASTM Annual Book of Standards, 1992](#)) we list the precision differences for reproducibility, in lieu of the known number of significant figures. **All ASTM data are reported to two decimal places unless otherwise noted.**

ASTM Property	Comments
Gross Calorific Value	100 Btu/lb on a DRY basis (reported with no decimal places)
Proximate Analysis	
Moisture	0.3 percent for < 5 percent moisture; 0.5 percent for > 5 percent moisture
Ash yield	0.3 percent no carbonates present 0.5 percent carbonates present; 1.0 percent coals with > 12 percent ash containing carbonates and pyrite
Volatile matter [based on rank]	anthracite 0.6 percent; semianthracite and bituminous 1.0 percent; subbituminous 1.4 percent; lignite and peat 2.0 percent
Fixed carbon	calculated by difference {100-volatile matter (dry, ash-free basis)}
Ultimate Analysis	
Total Sulfur	0.1 percent for < 2 percent sulfur; 0.2 percent for > 2 percent sulfur; 0.05 percent for coke
Carbon	0.3 percent
Hydrogen	0.07 percent
Nitrogen	not yet available
Forms of sulfur	
Sulfate	0.04 percent by weight
Pyritic sulfur	95 percent confidence interval of multiple analyses
Organic sulfur	calculated by difference {total sulfur-pyritic sulfur-sulfate sulfur}
Grindability of coal by Hardgrove-Machine (Reported to 1 decimal place)	3 points
Ash Fusion temperatures	Normally reported to the nearest 10 degrees Fahrenheit

THE USGS MAKES NO CLAIMS AS TO THE ACCURACY OF COAL RANK CALCULATED FROM PARAMETERS OF PROXIMATE AND ULTIMATE ANALYSES. CALCULATED RANK MAY BE HIGHER FOR SOME SAMPLES DUE TO AIR-DRYING OF SAMPLES BEFORE ANALYSIS.

USGS ANALYTICAL METHODS SIGNIFICANT FIGURES: ALL USGS ANALYTICAL DATA ARE REPORTED TO TWO SIGNIFICANT FIGURES, EXCEPT FOR GSASH WHICH IS REPORTED TO 1 DECIMAL PLACE EVEN THOUGH THE VALUES ARE SHOWN TO THREE DECIMAL PLACES IN THE DATABASE TO MEET CONDITIONS OF THE SOFTWARE TO PROPERLY PLACE THE DECIMAL POINT. ALL ELEMENTAL DATA ARE REPORTED IN PARTS-PER-MILLION (PPM). DATA FIELDS ARE LABELED BY THE TWO LETTER SYMBOL FOR THE ELEMENT AND HAVE A SUFFIX OF _E SUCH AS AS_E, WHICH REPRESENTS ELEMENTAL ARSENIC. SEE THE FOLLOWING TABLE FOR THE DEFINITIONS OF OTHER FIELDS IN THE DATABASE AND THE MANNER IN WHICH THE DATA ARE REPORTED.

Query operations may be performed on all fields.

Qualified data are included in the database in the following manner: greater than values have been treated as the value, reported less than values have been treated by multiplying the reported less than value by 0.7 (SEE [CONNOR, 1976](#) in

[REFERENC.PDF](#)) and dropping the qualifier, and NULL values (represented by -0 in the database) represent zero values which were qualified. (Qualified zero values are obtained when a sample was not analyzed for an element (no data available), when the element had interference in its analysis, or when an element was not detected during an analysis.) The percentage of qualified values for each element was calculated using the original as-received/as-determined database (USCHEM). This percentage calculation did not include qualifiers which resulted in NULL values. See each element in [TECHINFO.PDF](#) or in the HELP files in Landview III™ Query option.

Data for elements having more than 25 percent qualified values (Au, Bi, Cd, Cl, Dy, Er, Gd, Ge, Ho, In, Ir, Nd, Os, Pd, Pr, Pt, Rb, Re, Rh, Ru, Sn, Te, Tl, and Tm) should not be used comparison purposes (statistical or otherwise) and elements with 10 to 25 percent qualified values (Ashdef, Ashsof, Ashfld, Slfate, Slfpyr, Slforg, P₂O₅, Ag, Ce, Hf, La, Lu, Nb, P, Ta, Tb, and W) should be used with EXTREME caution for statistical comparison purposes. There is no easy way to separate the qualified values from the non-qualified values in this database. The database structure will be revised in the next version of this CD to resolve this problem. If working with these elements, please contact the authors (See [CONTACTS.PDF](#)) to obtain the original qualified data.

Column definitions

#	Name	## Type	###	Definition
#	COLUMN INDICATES ITEM NUMBER IN DATABASE AND NAME			
##	COLUMN INDICATES TYPE OF DATA FIELD: TEXT IS A CHARACTER FIELD INTEGER IS AN INTEGER NUMERIC FIELD REAL IS A REAL NUMBER FIELD			
###	COLUMN INDICATES TEXT FIELD LENGTH			
1.	LABID	TEXT	1	Analysis Identification Number (Alphabetic)
2.	SAMPLENO	TEXT	6	Analysis Identification Number (Alphabetic) Note: The combination of LABID and SAMPLENO form a unique sample identification number
3.	STATE	TEXT	30	Name of State where sample was collected
4.	COUNTY	TEXT	30	Name of county in state (or borough name in Alaska) where sample was collected
5.	LATITUDE	REAL		Latitude coordinate for point source location of coal sample (decimal degrees)
6.	NS	TEXT	1	Hemisphere of Latitude (N OR S). All values are N in this data set.
7.	LONGITUD	REAL		Longitude coordinate for point source location of coal sample (decimal degrees)
8.	EW	TEXT	1	Hemisphere of Longitude (E OR W). All values are E in this data set.
9.	CPROVINC	TEXT	40	Coal Province Name-See Wood and others (1983), US Geological Survey Circular 891, page 16
10.	CREGION	TEXT	48	Coal Region Name-See Wood and others (1983), US Geological Survey Circular 891, page 15

11.	CFIELD	TEXT	40	Coal Field Name--See Barnes, F. F., 1961, Coal fields of the United States--Sheet 2, Alaska: U.S. Geological Survey, scale 1:5,000,000 See Trumball, J. V. A., 1960, Coal fields of the United States--Sheet 1: U.S. Geological Survey, scale 1:5,000,000
12.	DISTRICT	TEXT	48	District Name--Depending on the state, this field may be mining districts, political divisions (such as townships or boroughs), or other subdivisions of the state
13.	CFORMATN	TEXT	40	Formation Name--Stratigraphic formation name specified by the collector of the sample, usually a state geologist; or if collected by USGS personnel (SEE Stratigraphic Nomenclature Databases for the United States, its possessions and territories)
14.	CGROUP	TEXT	40	Group Name--Stratigraphic group name specified by the collector of the sample, usually a state geologist; or if collected by USGS personnel (SEE Stratigraphic Nomenclature Databases for the United States, its possessions and territories)
15.	CBED	TEXT	40	Bed Name--Stratigraphic bed name specified by the collector of the sample, usually a state geologist; or if collected by USGS personnel (SEE Stratigraphic Nomenclature Databases for the United States, its possessions and territories)
16.	CMEMBER	TEXT	40	Member Name--Stratigraphic member name specified by the collector of the sample, usually a state geologist; or if collected by USGS personnel (SEE Stratigraphic Nomenclature Databases for the United States, its possessions and territories)
17.	CZONE	TEXT	40	Relationship between non-coal material and the coal bed (e.g., parting, roof, floor--not a coal zone name)
18.	DEPTH	REAL		Depth from the surface of the earth to the top of the sample if the sample is part of a drill core. If samples are not drill cores, but samples are benched, then depth is a measure from the top of the uppermost bench to the top of the next sample in the benched series. (Depth is measured in inches)
19.	SAMPTHK	REAL		Thickness of the sample, measured in inches
20.	SYSTEM	TEXT	40	System designates a fundamental unit of the sample's geologic age (SEE Stratigraphic Nomenclature Databases for the United States, its possessions and territories)
21.	SER_EPOC	TEXT	40	Designates a fundamental unit of the sample's geologic age, either series or epoch (SEE Stratigraphic Nomenclature Databases for the United States, its possessions and territories)

22.	COMMENTS	TEXT	100	Used as a comment field to describe the mine name, the drill hole identified, or other miscellaneous information about the sample
23.	MAP	TEXT	40	Usually the topographic quadrangle map name and series. For some areas of the U.S. where there are no topographic maps, another type of map name may be used along with the scale of the map.
24.	COLLECTR	TEXT	60	The agency and name of the person collecting or submitting the sample
25.	POINTID	TEXT	160	The field number assigned by the collector or submitter of the sample. For composited samples, pointid contains a list of the LABID and SAMPLENO for all samples combined.
26.	SUBDATE	DATE		The date the sample was confirmed by the USGS analytical labs as having been submitted for analysis (methods of analyses are determined by this date). (MM/DD/YY)
27.	ESTRANK	TEXT	30	<p>Estimated rank of coal (also includes lithology for coal-related rock samples, which are not included in the database and are not listed here). --See Barnes, F. F., 1961, Coal fields of the United States--Sheet 2, Alaska: U.S. Geological Survey Map, scale 1:5,000,000 --See Trumball, J. V. A., 1960, Coal fields of the United States--Sheet 1: U.S. Geological Survey Map, scale 1:5,000,000</p> <p>Note:.</p> <p>THE USGS MAKES NO CLAIMS AS TO THE ACCURACY OF COAL RANK CALCULATED FROM PARAMETERS OF PROXIMATE AND ULTIMATE ANALYSES. WITH SOME SAMPLES CALCULATED RANK MAY BE HIGHER DUE TO AIR-DRYING OF SAMPLES BEFORE ANALYSIS</p> <p>ANTHRACITE SEMI-ANTHRACITE BITUMINOUS SUBBITUMINOUS LIGNITE COAL</p>
28.	LABCODE	INTEGER		<p>Code for laboratory performing analyses</p> <p>5 =U.S. Geological Survey (USGS) 15 =USBM and USGS 35 =State agency and USGS 65 =USGS and Geochemical Testing Co., Somerset, PA 75 =USGS and Dickinson Laboratories, Inc., El Paso, TX 765 =USGS, Dickinson Laboratories, Inc., and Geochemical Testing Co.</p>
29.	SAMPTYPE	INTEGER		<p>Sample type</p> <p>1 =Channel 3 =Drill core 11 =Weathered channel</p>

30.	ANALTYPE	INTEGER		Analysis type 1 =As-received/As-determined
31.	VALREP	INTEGER	NOTE:	Values represent 1 =Single Sample (Most common) 2 =Average of more than one sample (composite) A composite sample may be made by either A) physically combining samples on the basis of their thicknesses B) or, mathematically weighting data from individual samples on the basis of bed thickness. 4 =Composite samples for ASTM analyses and samples for individual USGS analyses 5 =Composite samples for USGS analyses and individual samples for ASTM analyses 20 =Upper split (incremental sample, not a bench) 21 =Lower split (incremental sample, not a bench) 22 =Middle split (incremental sample, not a bench) DEFINITIONS: A) Splits = Herein defined as incremental samples of beds separated by 1 foot or more of non-coal material
32.	BTU	REAL		Gross calorific value of the coal sample expressed in British Thermal Units (BTU/lb) as determined by ASTM method D-2015. There are no qualified non-zero values for BTU in USCHEM.
33.	ASHDEF	REAL		Ash Deformation temperature in degrees Fahrenheit as determined by ASTM method D1857 in reducing atmosphere. Approximately 12 percent of the non-zero values for ASHDEF in USCHEM are qualified.
34.	ASHSOF	REAL		Ash Softening temperature in degrees Fahrenheit as determined by ASTM method D1857 in reducing atmosphere. Approximately 19 percent of the non-zero values for ASHSOF in USCHEM are qualified.
35.	ASHFLD	REAL		Ash Fluid temperature in degrees Fahrenheit as determined by ASTM method D1857- in reducing atmosphere. Approximately 23 percent of the non-zero values for ASHFLD in USCHEM are qualified.
36.	FRESWL	REAL		Free-Swelling index as determined by ASTM method D-720. There are no qualified non-zero values for FRESWL in USCHEM.
37.	MOISTR	REAL		Moisture content (as-received basis) in percent as determined by ASTM method D-3173. There are no qualified non-zero values for MOISTR in USCHEM.
38.	VOLMAT	REAL		Volatile Matter content in percent as determined by ASTM method D-3175. There are no qualified non-zero values for VOLMAT in USCHEM.

39.	FIXEDC	REAL	Fixed Carbon content in percent as determined by ASTM method D-3172. There are no qualified non-zero values for FIXEDC in USCHEM.
40.	STDASH	REAL	Ash yield in percent as determined by ASTM method D-3174 (ash obtained at 750 degrees C). There are no qualified non-zero values for STDASH in USCHEM.
41.	HYDRGN	REAL	Hydrogen content in percent as determined by ASTM method D-3178. Hydrogen as reported includes hydrogen in water. There are no qualified non-zero values for HYDRGN in USCHEM.
42.	CARBON	REAL	Carbon content in percent as determined by ASTM method D-3178 in USGS or other labs (see LABCODE). There is one qualified non-zero value for CARBON in USCHEM.
43.	NITRGN	REAL	Nitrogen content in percent as determined by ASTM method D-3179. There are no qualified non-zero values for NITRGN in USCHEM.
44.	OXYGEN	REAL	Oxygen content in percent as determined by ASTM method D-3176. Oxygen as reported includes oxygen in water. There are no qualified non-zero values for OXYGEN in USCHEM.
45.	SULFUR	REAL	Sulfur content in percent as determined by ASTM method D-3177 in USGS or other labs (see LABCODE). Less than 1 percent of the non-zero values for SULFUR in USCHEM are qualified.
46.	SLFATE	REAL	Sulfate Sulfur content in percent as determined by ASTM method D-2492 in other labs or similar method in USGS labs (see LABCODE). Approximately 22 percent of the non-zero values for SLFATE in USCHEM are qualified.
47.	SLFPYR	REAL	Pyritic Sulfur content in percent as determined by ASTM method D-2492 in other labs or similar method in USGS labs (see LABCODE). Approximately 17 percent of the non-zero values for SLFPYR in USCHEM are qualified.
48.	SLFORG	REAL	Organic Sulfur content in percent as determined by ASTM method D-2492 in USGS or other labs (see LABCODE). Approximately 18 percent of the non-zero values for SLFORG in USCHEM are qualified.
49.	ADLOSS	REAL	Air-Dry Loss in percent as determined by ASTM method D-2013. Less than 1 percent of the non-zero values for ADLOSS in USCHEM are qualified.
50.	HGI	REAL	Hardgrove Grindability Index as determined by ASTM method D-409. There are no qualified non-zero values for HGI in USCHEM.
51.	EQMOIS	REAL	Equilibrium Moisture content in percent as determined by ASTM method D-1412. There are no qualified non-zero

values for EQMOIS in USCHEM.

52.	GSASH	REAL	Ash yield in percent as determined by USGS laboratories (ash obtained at 525 degrees C). There is one qualified non-zero value for GSASH in USCHEM.
53.	SIO2	REAL	Silicon dioxide (SiO ₂) value in percent as determined on the coal ash by USGS laboratories using X-ray fluorescence analysis (ash obtained at 525 degrees C)--May be converted from SI_E value in parts-per-million which was determined by the same method. There are no qualified non-zero values for SIO2 in USCHEM.
54.	AL2O3	REAL	Aluminum oxide (Al ₂ O ₃) value in percent as determined on the coal ash by USGS laboratories using X-ray fluorescence analysis (ash obtained at 525 degrees C)--May be converted from AL_E value in parts-per-million which was determined by the same method. There are no qualified non-zero values for AL2O3 in USCHEM.
55.	CAO	REAL	Calcium oxide (CaO) value in percent as determined on the coal ash by USGS laboratories using X-ray fluorescence analysis (ash obtained at 525 degrees C)--May be converted from CA_E value in parts-per-million which was determined by the same method. There are no qualified non-zero values for CAO in USCHEM.
56.	MGO	REAL	Magnesium oxide (MgO) value in percent as determined on the coal ash by USGS laboratories using wet chemistry analysis (atomic absorption: ash obtained at 525 degrees C)--May be converted from MG_E value in parts-per-million or percent which was determined by the same method. Less than 1 percent of the non-zero values for MGO in USCHEM are qualified.
57.	MNO	REAL	Manganese oxide (MnO) value in percent. Converted from MN_E as determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C) and later using wet chemistry analysis on the ash to analyze for Mn. Less than 1 percent of the non-zero values for MNO in USCHEM are qualified.
58.	NA2O	REAL	Sodium oxide (Na ₂ O) value in percent as determined on the coal ash by USGS laboratories using wet chemistry analysis (atomic absorption: ash obtained at 525 degrees C)--May be converted from NA_E value in parts-per-million or percent which was determined by the same method. Less than 1 percent of the non-zero values for NA2O in USCHEM are qualified.
59.	K2O	REAL	Potassium oxide (K ₂ O) value in percent as determined on the coal ash by USGS laboratories using X-ray fluorescence analysis (ash obtained at 525 degrees C)--May be converted

			from K_E value in parts-per-million which was determined by the same method. Less than 1 percent of the non-zero values for K2O in USCHEM are qualified.
60.	FE2O3	REAL	Ferric oxide (Fe ₂ O ₃) value in percent as determined on the coal ash by USGS laboratories using X-ray fluorescence analysis (ash obtained at 525 degrees C)--May be converted from FE_E value in parts-per-million which was determined by the same method. Less than 1 percent of the non-zero values for FE2O3 in USCHEM are qualified.
61.	TIO2	REAL	Titanium oxide (TiO ₂) value in percent as determined on the coal ash by USGS laboratories using X-ray fluorescence analysis (ash obtained at 525 degrees C)--May be converted from TI_E value in parts-per-million which was determined by the same method. Less than 1 percent of the non-zero values for TIO2 in USCHEM are qualified.
62.	P2O5	REAL	Phosphorous pentoxide (P ₂ O ₅) value in percent as determined on the coal ash by USGS laboratories using X-ray fluorescence analysis (ash obtained at 525 degrees C)--May be converted from P (P_E) value in parts-per-million which was determined by the same method. Approximately 19 percent of the non-zero values for P2O5 in USCHEM are qualified.
63.	SO3	REAL	Sulfur trioxide (SO ₃) value in percent as determined on the coal ash by USGS laboratories using X-ray fluorescence analysis (ash obtained at 525 degrees C)--May be converted from S_E value in parts-per-million which was determined by the same method. Approximately 1 percent of the non-zero values for SO3 in USCHEM are qualified.
64.	SI_E	REAL	Silicon (Si) value in parts-per-million on whole-coal basis, converted from value as determined on coal ash by USGS laboratories using X-ray fluorescence analysis (ash obtained at 525 degrees C)--May be converted from SIO2 value in percent which was determined by the same method. There are no qualified non-zero values for SI_E in USCHEM.
65.	AL_E	REAL	Aluminum (Al) value in parts-per-million on whole-coal basis, converted from value as determined on coal ash by USGS laboratories using X-ray fluorescence analysis (ash obtained at 525 degrees C)--May be converted from AL2O3 value in percent which was determined by the same method. There are no qualified non-zero values for AL_E in USCHEM.
66.	CA_E	REAL	Calcium (Ca) value in parts-per-million on whole-coal basis, converted from value as determined on coal ash by USGS laboratories using X-ray fluorescence analysis (ash obtained at 525 degrees C)--May be converted from CAO value in percent which was determined by the same method. There are no qualified non-zero values for CA_E in USCHEM.

67.	MG_E	REAL	Magnesium (Mg) value in parts-per-million on whole-coal basis, converted from value as determined on coal ash by USGS laboratories using wet chemistry analysis (atomic absorption: ash obtained at 525 degrees C)--May be converted from MGO value in percent which was determined by the same method. Less than 1 percent of the non-zero values for MG_E in USCHEM are qualified.
68.	NA_E	REAL	Sodium (Na) value in parts-per-million on whole-coal basis, converted from value as determined on coal ash by USGS laboratories using wet chemistry analysis (atomic absorption: ash obtained at 525 degrees C)--May be converted from NA2O value in percent which was determined by the same method. Less than 1 percent of the non-zero values for NA_E in USCHEM are qualified.
69.	K_E	REAL	Potassium (K) value in parts-per-million on whole-coal basis, converted from value as determined on coal ash by USGS laboratories using X-ray fluorescence analysis (ash obtained at 525 degrees C)--May be converted from K2O value in percent which was determined by the same method. Less than 1 percent of the non-zero values for K_E in USCHEM are qualified.
70.	FE_E	REAL	Iron (Fe) value in parts-per-million on whole-coal basis, converted from value as determined on coal ash by USGS laboratories using X-ray fluorescence analysis (ash obtained at 525 degrees C)--May be converted from FE2O3 value in percent which was determined by the same method. Less than 1 percent of the non-zero values for FE_E in USCHEM are qualified.
71.	TI_E	REAL	Titanium (Ti) value in parts-per-million on whole-coal basis, converted from value as determined on coal ash by USGS laboratories using X-ray fluorescence analysis (ash obtained at 525 degrees C)--May be converted from TIO2 value in percent which was determined by the same method. Less than 1 percent of the non-zero values for TI_E in USCHEM are qualified.
72.	S_E	REAL	Sulfur (S) value in parts-per-million on whole-coal basis, converted from value as determined on coal ash by USGS laboratories using X-ray fluorescence analysis (ash obtained at 525 degrees C)--May be converted from SO3 value in percent which was determined by the same method. Approximately 1 percent of the non-zero values for S_E in USCHEM are qualified. THIS IS NOT STANDARD ASTM SULFUR.
73.	AG_E	REAL	Silver (Ag) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Approximately 20 percent of the

non-zero values for AG_E in USCHEM are qualified.

74.	AS_E	REAL	Arsenic (As) value in parts-per-million as determined on whole-coal by USGS laboratories using either wet chemistry analysis for samples analyzed in Denver (D for LABID) before 1976 or Instrumental Neutron Activation Analysis (INAA) for samples analyzed in Reston (W for LABID) and for samples analyzed after 1976 in Denver. Less than 1 percent of the non-zero values for AS_E in USCHEM are qualified.
75.	AU_E	REAL	Gold (Au) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Approximately 100 percent of the non-zero values for AU_E in USCHEM are qualified.
76.	B_E	REAL	Boron (B) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Approximately 5 percent of the non-zero values for B_E in USCHEM are qualified.
77.	BA_E	REAL	Barium (Ba) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Approximately 0.5 percent of the non-zero values for BA_E in USCHEM are qualified.
78.	BE_E	REAL	Beryllium (Be) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Approximately 2 percent of the non-zero values for BE_E in USCHEM are qualified.
79.	BI_E	REAL	Bismuth (Bi) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Approximately 98 percent of the non-zero values for BI_E in USCHEM are qualified.
80.	BR_E	REAL	Bromine (Br) value in parts-per-million as determined on whole-coal by USGS laboratories for samples having a LABID=W using Instrumental Neutron Activation Analysis (INAA). Approximately 7 percent of the non-zero values for

BR_E in USCHEM are qualified.

81.	CD_E	REAL	Cadmium (Cd) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using wet chemistry analysis (atomic absorption-ash obtained at 525 degrees C). Approximately 29 percent of the non-zero values for CD_E in USCHEM are qualified.
82.	CE_E	REAL	Cerium (Ce) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either semi-quantitative 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C) for all samples with LABID = D or all samples with LABID = W and SUBDATE less than or equal to 75/05/27. Samples with LABID = W and SUBDATE greater than 75/05/27 were analyzed on a whole-coal basis using Instrumental Neutron Activation Analysis (INAA). Approximately 10 percent of the non-zero values for CE_E in USCHEM are qualified.
83.	CL_E	REAL	Chlorine (Cl) value in parts-per-million as determined on whole-coal by USGS laboratories using X-ray fluorescence analysis. Approximately 29 percent of the non-zero values for CL_E in USCHEM are qualified.
84.	CO_E	REAL	Cobalt (Co) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either semi-quantitative 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C) for all samples with LABID = D with SUBDATE less than or equal to 76/08/19 or all samples with LABID = W and SUBDATE less than or equal to 75/05/27. Samples with LABID = W and SUBDATE greater than 75/05/27 or LABID = D and SUBDATE greater than 76/08/19 were analyzed on a whole-coal basis using Instrumental Neutron Activation Analysis (INAA). Approximately 2 percent of the non-zero values for CO_E in USCHEM are qualified.
85.	CR_E	REAL	Chromium (Cr) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either semi-quantitative 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C) for all samples with LABID = D with SUBDATE less than or equal to 76/08/19 or all samples with LABID = W and SUBDATE less than or equal to 75/05/27. Samples with LABID = W and SUBDATE greater than 75/05/27 or LABID = D and SUBDATE greater than 76/08/19 were analyzed on a whole-coal basis using Instrumental Neutron Activation Analysis. Approximately 1 percent of the non-zero values for CR_E in USCHEM are qualified.

86.	CS_E	REAL	Cesium (Cs) value in parts-per-million on whole coal basis, converted from value determined on coal ash by USGS laboratories using either semi-quantitative 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C) for all samples with LABID = D or all samples with LABID = W and SUBDATE less than or equal to 75/05/27. Samples with LABID = W and SUBDATE greater than 75/05/27 were analyzed on a whole-coal basis using Instrumental Neutron Activation Analysis (INAA). Approximately 8 percent of the non-zero values for CS_E in USCHEM are qualified.
87.	CU_E	REAL	Copper (Cu) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using wet chemistry analysis (atomic absorption-ash obtained at 525 degrees C). Less than 1 percent of the non-zero values for CU_E in USCHEM are qualified.
88.	DY_E	REAL	Dysprosium (Dy) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Approximately 89 percent of the non-zero values for DY_E in USCHEM are qualified.
89.	ER_E	REAL	Erbium (Er) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Approximately 82 percent of the non-zero values for ER_E in USCHEM are qualified.
90.	EU_E	REAL	Europium (Eu) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C) for all samples with LABID = D or all samples with LABID = W and SUBDATE less than or equal to 75/05/27. Samples with LABID = W and SUBDATE greater than 75/05/27 were analyzed on a whole-coal basis using Instrumental Neutron Activation Analysis (INAA). Approximately 6 percent of the non-zero values for EU_E in USCHEM are qualified.
91.	F_E	REAL	Fluorine (F) value in parts-per-million as determined on whole-coal by USGS laboratories using wet chemistry analysis (ion-selective electrode). Approximately 7 percent of the non-zero values for F_E in USCHEM are qualified.
92.	GA_E	REAL	Gallium (Ga) value in parts-per-million on whole-coal basis,

			converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Less than 1 percent of the non-zero values for GA_E in USCHEM are qualified.
93.	GD_E	REAL	Gadolinium (Gd) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Approximately 73 percent of the non-zero values for GD_E in USCHEM are qualified.
94.	GE_E	REAL	Germanium (Ge) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Approximately 26 percent of the non-zero values for GE_E in USCHEM are qualified.
95.	HF_E	REAL	Hafnium (Hf) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C) for all samples with LABID = D or all samples with LABID = W and SUBDATE less than or equal to 75/05/27. Samples with LABID = W and SUBDATE greater than 75/05/27 were analyzed on a whole-coal basis using Instrumental Neutron Activation Analysis (INAA). Approximately 10 percent of the non-zero values for HF_E in USCHEM are qualified.
96.	HG_E	REAL	Mercury (Hg) value in parts-per-million as determined on whole-coal by USGS laboratories using wet chemistry analysis (cold-vapor atomic absorption). Approximately 7 percent of the non-zero values for HG_E in USCHEM are qualified.
97.	HO_E	REAL	Holmium (Ho) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Approximately 93 percent of the non-zero values for HO_E in USCHEM are qualified.
98.	IN_E	REAL	Indium (In) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash

obtained at 525 degrees C). Approximately 100 percent of the non-zero values for IN_E in USCHEM are qualified.

99.	IR_E	REAL	Iridium (Ir) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). One hundred percent of the non-zero values for IR_E in USCHEM are qualified.
100.	LA_E	REAL	Lanthanum (La) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C) for all samples with LABID = D or all samples with LABID = W and SUBDATE less than or equal to 75/05/27. Samples with LABID = W and SUBDATE greater than 75/05/27 were analyzed on a whole-coal basis using Instrumental Neutron Activation Analysis (INAA). Approximately 10 percent of the non-zero values for LA_E in USCHEM are qualified.
101.	LI_E	REAL	Lithium (Li) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using wet chemistry analysis (atomic absorption-ash obtained at 525 degrees C). Approximately 1 percent of the non-zero values for LI_E in USCHEM are qualified.
102.	LU_E	REAL	Lutetium (Lu) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C) for all samples with LABID = D or all samples with LABID = W and SUBDATE less than or equal to 75/05/27. Samples with LABID = W and SUBDATE greater than 75/05/27 were analyzed on a whole-coal basis using Instrumental Neutron Activation Analysis (INAA). Approximately 12 percent of the non-zero values for LU_E in USCHEM are qualified.
103.	MN_E	REAL	Manganese (Mn) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C) and later using wet chemistry analysis (atomic absorption on the ash). Less than 1 percent of the non-zero values for MN_E in USCHEM are qualified.
104.	MO_E	REAL	Molybdenum (Mo) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic

analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Approximately 7 percent of the non-zero values for MO_E in USCHEM are qualified.

105.	NB_E	REAL	Niobium (Nb) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Approximately 11 percent of the non-zero values for NB_E in USCHEM are qualified.
106.	ND_E	REAL	Neodymium (Nd) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Approximately 31 percent of the non-zero values for ND_E in USCHEM are qualified.
107.	NI_E	REAL	Nickel (Ni) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Approximately 1 percent of the non-zero values for NI_E in USCHEM are qualified.
108.	OS_E	REAL	Osmium (Os) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Approximately 100 percent of the non-zero values for OS_E in USCHEM are qualified.
109.	P_E	REAL	Phosphorus (P) value in parts-per-million as determined on the coal ash by USGS laboratories using X-ray fluorescence analysis (ash obtained at 525 degrees C)--May be converted from P2O5 value in percent which was determined by the same method. Approximately 19 percent of the non-zero values for P_E in USCHEM are qualified.
110.	PB_E	REAL	Lead (Pb) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using wet chemistry analysis (atomic absorption—ash obtained at 525 degrees C). Approximately 9 percent of the non-zero values for PB_E in USCHEM are qualified.
111.	PD_E	REAL	Palladium (Pd) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading

computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Approximately 100 percent of the non-zero values for PD_E in USCHEM are qualified.

112.	PR_E	REAL	Praseodymium (Pr) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Approximately 82 percent of the non-zero values for PR_E in USCHEM are qualified.
113.	PT_E	REAL	Platinum (Pt) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Approximately 100 percent of the non-zero values for PT_E in USCHEM are qualified.
114.	RB_E	REAL	Rubidium (Rb) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C) for all samples with LABID = D or all samples with LABID = W and SUBDATE less than or equal to 75/05/27. Samples with LABID = W and SUBDATE greater than 75/05/27 were analyzed on a whole-coal basis using Instrumental Neutron Activation Analysis (INAA). Approximately 54 percent of the non-zero values for RB_E in USCHEM are qualified.
115.	RE_E	REAL	Rhenium (Re) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Approximately 100 percent of the non-zero values for RE_E in USCHEM are qualified.
116.	RH_E	REAL	Rhodium (Rh) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Approximately 100 percent of the non-zero values for RH_E in USCHEM are qualified.
117.	RU_E	REAL	Ruthenium (Ru) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Approximately 100 percent of

non-zero values for RU_E in USCHEM are qualified.

118.	SB_E	REAL	Antimony (Sb) value in parts-per-million as determined on whole-coal by USGS laboratories using wet chemistry analysis (Rhodamine B) for with LABID = D and SUBDATE less than or equal to 76/08/19. Samples with LABID = D and subdate greater than 76/08/19 and samples with LABID = W were analyzed using Instrumental Neutron Activation Analysis (INAA). Approximately 5 percent of the non-zero values for SB_E in USCHEM are qualified.
119.	SC_E	REAL	Scandium (Sc) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C) for all samples with LABID = D or all samples with LABID = W and SUBDATE less than or equal to 75/05/27. Samples with LABID = W and SUBDATE greater than 75/05/27 were analyzed on a whole-coal basis using Instrumental Neutron Activation Analysis (INAA). Approximately 1 percent of the non-zero values for SC_E in USCHEM are qualified.
120.	SE_E	REAL	Selenium (Se) value in parts-per-million as determined on whole-coal basis by USGS laboratories using X-ray fluorescence on all older samples with LABID = D and SUBDATE less than or equal to 78/01/05 and all samples with LABID = W and SUBDATE less than or equal to 75/06/01. Samples with LABID = D and SUBDATE greater than 78/01/05 and all samples with LABID = W and SUBDATE greater than 75/06/01 were analyzed on a whole-coal basis using Instrumental Neutron Activation Analysis (INAA). Approximately 6 percent of the non-zero values for SE_E in USCHEM are qualified.
121.	SM_E	REAL	Samarium (Sm) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C) for all samples with LABID = D or all samples with LABID = W and SUBDATE less than or equal to 75/07/01. Samples with LABID = W and SUBDATE greater than 75/07/01 were analyzed on a whole-coal basis using Instrumental Neutron Activation Analysis (INAA). Approximately 8 percent of the non-zero values for SM_E in USCHEM are qualified.
122.	SN_E	REAL	Tin (Sn) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Approximately 50 percent of the

non-zero values for SN_E in USCHEM are qualified.

123.	SR_E	REAL	Strontium (Sr) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Less than 1 percent of the non-zero values for SR_E in USCHEM are qualified.
124.	TA_E	REAL	Tantalum (Ta) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C) for all samples with LABID = D. Samples with LABID = W were analyzed on a whole-coal basis using Instrumental Neutron Activation Analysis (INAA). Approximately 18 percent of the non-zero values for TA_E in USCHEM are qualified.
125.	TB_E	REAL	Terbium (Tb) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C) for all samples with LABID = D or all samples with LABID = W and SUBDATE less than or equal to 75/05/27. Samples with LABID = W and SUBDATE greater than 75/05/27 were analyzed on a whole-coal basis using Instrumental Neutron Activation Analysis (INAA). Approximately 12 percent of the non-zero values for TB_E in USCHEM are qualified.
126.	TE_E	REAL	Tellurium (Te) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Approximately 99 percent of the non-zero values for TE_E in USCHEM are qualified.
127.	TH_E	REAL	Thorium (Th) value in parts-per-million as determined on whole-coal basis by USGS laboratories using Delayed Neutron Analysis (DNA) for older samples and Instrumental Neutron Activation analysis (INAA). Approximately 2 percent of the non-zero values for TH_E in USCHEM are qualified.
128.	TL_E	REAL	Thallium (Tl) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Approximately 95 percent of the

non-zero values for TL_E in USCHEM are qualified.

129.	TM_E	REAL	Thulium (Tm) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Approximately 99 percent of the non-zero values for TM_E in USCHEM are qualified.
130.	U_E	REAL	Uranium (U) value in parts-per-million as determined on whole-coal basis by USGS laboratories using Delayed Neutron Analysis (DNA). Approximately 6 percent of the non-zero values for U_E in USCHEM are qualified.
131.	V_E	REAL	Vanadium (V) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Less than 1 percent of the non-zero values for V_E in USCHEM are qualified.
132.	W_E	REAL	Tungsten (W) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C) for all samples with LABID = D. Samples with LABID = W were analyzed on a whole-coal basis using Instrumental Neutron Activation Analysis (INAA). Approximately 21 percent of the non-zero values for W_E in USCHEM are qualified.
133.	Y_E	REAL	Yttrium (Y) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Approximately 1 percent of the non-zero values for Y_E in USCHEM are qualified.
134.	YB_E	REAL	Ytterbium (Yb) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C) for all samples with LABID = D or all samples with LABID = W and SUBDATE less than or equal to 75/05/27. Samples with LABID = W and SUBDATE greater than 75/05/27 were analyzed on a whole-coal basis using Instrumental Neutron Activation Analysis (INAA). Approximately 2 percent of the non-zero values for YB_E in USCHEM are qualified.

135.	ZN_E	REAL	Zinc (Zn) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using wet chemistry analysis (atomic absorption-ash obtained at 525 degrees C). Less than 1 percent of the non-zero values for ZN_E in USCHEM are qualified.
136.	ZR_E	REAL	Zirconium (Zr) value in parts-per-million on whole-coal basis, converted from value determined on coal ash by USGS laboratories using either 6-Step emission spectrographic analysis for older samples or automatic plate reading computer-assisted emission spectrographic analysis (ash obtained at 525 degrees C). Less than 1 percent of the non-zero values for ZR_E in USCHEM are qualified.