U.S. DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

Listing of Geochemical Data and Assessment of Variability for Soils and Alfalfa of the Uncompahgre Project Area, Colorado

by

J.G. Crock*, K.C. Stewart*, and R.C. Severson*

Open-File Report 94-580

*U.S. Geological Survey, Box 25046, MS 973, Denver Federal Center, Denver, CO 80225

1994

CONTENTS

ILLUSTRATIONS

TABLES

LISTING OF GEOCHEMICAL DATA AND ASSESSMENT OF VARIABILITY FOR SOILS AND ALFALFA OF THE UNCOMPAHGRE PROJECT AREA, COLORADO

by

J.G. Crock, K.C. Stewart, and R.C. Severson

INTRODUCTION

The Department of Interior (DOI), in response to Congressional requests, formed a multi-agency task group in the fall of 1985, including members from the Water Resources Division (WRD) and the Geologic Division (GD) of the U.S. Geological Survey (USGS), the U.S. Fish and Wildlife Services (USFWS), the U.S. Bureau of Reclamation (USBR), and the Bureau of Indian Affairs, to investigate and examine the potential for damage to the lands affected by DOI irrigation projects in the Western U.S. The objective of this task group is to determine if irrigation practices have the potential to cause harmful effects on human health, fish, wildlife, and other water users, or to reduce the suitability of the water for beneficial uses.

In 1988, reconnaissance studies were completed at ten areas in the Western U.S. (Harms and others, 1990) where wildlife management areas received irrigation drainage water from federally managed irrigation projects. The purpose of these studies was to recognize potential problems and problem elements from a limited sampling of water, bottom sediments, and biota, but not to characterize the areas in detail.

The Uncompahgre Project Area (UPA) in west-central Colorado was one of these ten study areas. The UPA includes parts of the Gunnison River and the Uncompahgre River basin. Currently, approximately 86,000 acres in the area are under irrigation. Also included in the UPA is Sweitzer Lake, a Colorado State Park (1.3 km southeast of Delta, CO) that has been previously reported to contain high levels of selenium (Se) in biota, water, and bottom sediments (Harms and others, 1990). Preliminary results from a reconnaissance study in the UPA are given in detail by Butler and others (1991); the results indicate that the UPA is a major source of Se and molybdenum (Mo) and other dissolved and suspended loads to the Gunnison and Uncompahgre Rivers. The Gunnison River discharges into the Colorado River at Grand Junction, Colorado.

As a result of the studies by Butler and others (1991), the DOI task group recommended the lower Gunnison River and the Uncompahgre River basins for a detailed study, which was initiated in early 1991. The detailed studies were to meet the following goals: (1) determine whether irrigation-induced water-quality problems exist, and if so, (2) provide the scientific understanding to mitigate or resolve identified problems.

The USBR Uncompahgre Irrigation Project supplies water to irrigate land primarily in the Uncompahgre River basin between Colona and Delta Colorado (figure 1). Irrigation in the study area dates to the late 1800's when over 30,000 acres were irrigated with water diverted from the Uncompahgre River by 1890. Additional irrigation was possible with the completion of the Gunnison Tunnel in 1909 which brought additional water into the UPA from the Gunnison River. The diversion dam on the Gunnison River was completed in 1912. Additional canals were later completed and the UPA reached its present size. The Taylor Park Reservoir and the Ridgway Reservoir also added to the storage capacity for the UPA. Irrigated crops in the UPA include onions, broccoli, beans, potatoes, barley, sweet corn, alfalfa, feed corn, hay, various small grains, and fruit orchards.

This report describes the results of the detailed study of the UPA conducted by the USGS-GD personnel during 1991-92. The specific objectives of this report are to: (1) determine the chemical composition and variability of the irrigated, agricultural soils developed on various parent geologic units within UPA; and (2) estimate the availability of mobile element fractions and its variability among geologic units by sampling and analyzing alfalfa from each soil sampling locality. Selenium is a primary element of concern, however, other elements will also be reported and investigated. This report addresses only the total element concentrations in both the soils and alfalfa and their inter-relations. Extractable, or water-soluble, element concentrations and their relationships with the total soil and alfalfa elemental contents are addressed in Stewart and others (1993).

Studies by other scientists of the USGS, USFWS, and USBR are being conducted to: (1) determine the sources, distribution, movement, and fate of contaminants within the hydrologic and biota systems; and (2) measure contaminant concentrations, determine exposure pathways, and document effects as seen in the biota.

METHODS

A simplified geological map of the UPA (figure 2) was compiled from existing geological information (Marshall, 1959; Steven and Hail, 1989; Tweto and others, 1976; and, Williams, 1964), making inferences from the existing soil survey maps of UPA (Cline and others, 1967), and incorporating field observations. The UPA contains five predominant geological units that formed the basis of our hierarchical sampling design. These geological units are: (1) Km, Cretaceous Mancos Shale of marine origin; (2) Kd, Cretaceous Dakota Sandstone; (3) Qm, Quaternary alluvium derived from the Mancos shale; (4) Qr, Quaternary alluvium derived from recent deposits on the river flood plains;

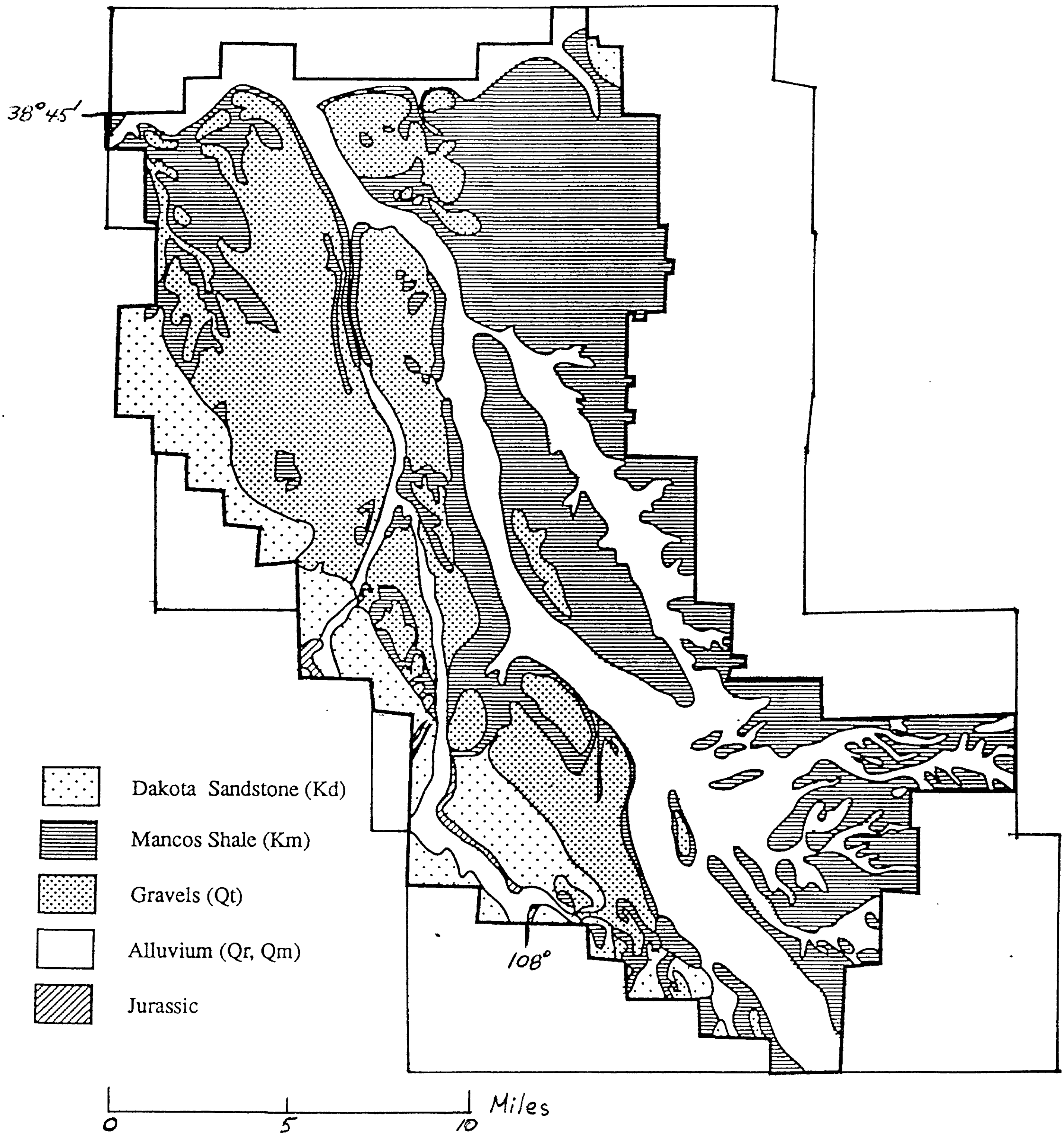

Figure 1.--Index map showing location of the Uncompahgre Project Area.

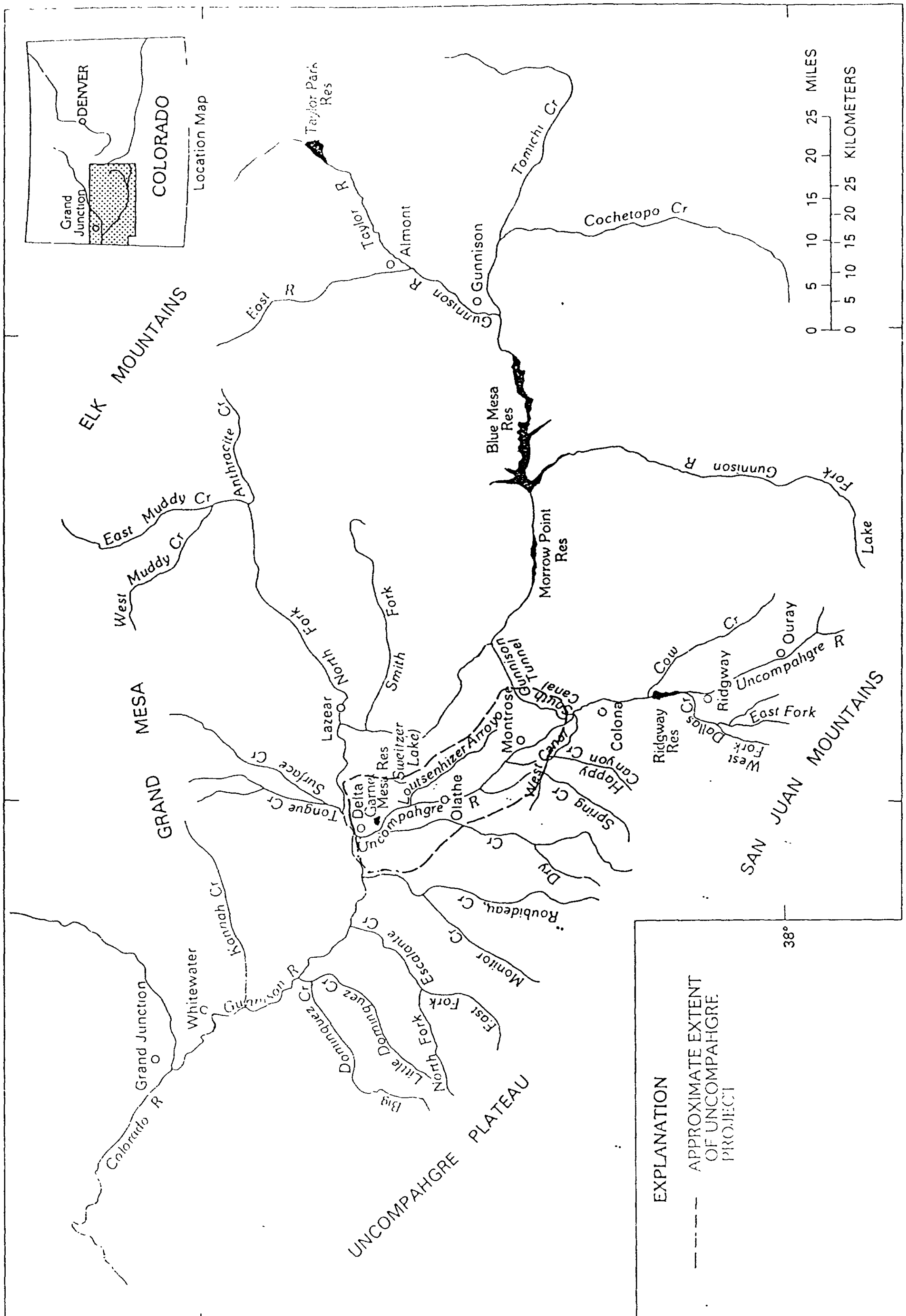

Figure 2.--Map of the Uncompahgre Project Area showing geologic units from which soil and alfalfa samples were taken.

and (5) Qt, Quaternary alluvium derived from the older Tertiary gravels on the high terraces. Units Qm and Qr are combined in figure 2, but were distinguished in the field by appearance and soil description as given in Cline and others (1967).

The Land Survey system was used as the basis to define the distance-related sampling within the UPA by overlaying a 15 township (3 by 5, East to West by North to South) grid over the study area. Table 1 gives the distribution of geological units sampled for each of the townships within the UPA. Field sampling was conducted by the authors during the first two weeks of June, 1991 and the analyses were completed by October, 1992.

Field Sampling

An unbalanced, four-level, stratified random-sampling design was used to assess variation in trace-element content of alfalfa (Medicago sativa L.) at the 10 to 30% bloom stage, and of soils among and within geologic units identified on a compiled geologic map of the UPA (figure 2). This sampling design was similar to the one used by See and others (1992) for the evaluation of non-irrigated soils of the Kendrick Reclamation Project Area in central Wyoming. Sections were selected at random within each of the 15 townships until each of the geological units in a given township had been sampled three times for both soil and, if possible, the associated alfalfa (table 1). Township 4 had four sites for the geological unit Km; township 13 was the only township where Qd (Quaternary alluvium derived from the Cretaceous Dakota sandstone formation) was sampled. In 14 randomly selected sections, soils and alfalfa from geological units were sampled at two locations about 100 m apart to assess within-section variation. After all samples of each medium were collected, dried, disaggregated, and ground, 14 samples were selected randomly and split in half with a Jones splitter in the laboratory. These were used to assess procedural error. The actual field sampling was done at the pre-selected sites where they were accessible, and as close as possible where accessibility was limited. Alfalfa fields under current irrigation were first priority in choosing the sampling sites. When unavailable, unirrigated or fallow fields were chosen and volunteer alfalfa was collected. If a site in a section proved to be unacceptable, because of inaccessibility or absence of alfalfa, the sampling site was moved to a suitable adjacent section as close as possible to the original site.

From this sampling design, variation has been segregated into components representing differences among geological units, and differences within geological units at the township, section, and within section scale. Figure 3 shows all the sampling sites for soil and alfalfa in the UPA. Quality control and quality assurance (QA/QC) were obtained by the analyses of duplicate samples and in-house reference materials. When samples of a given medium were submitted for analyses, the entire group of samples, including the duplicated samples, were arranged in a

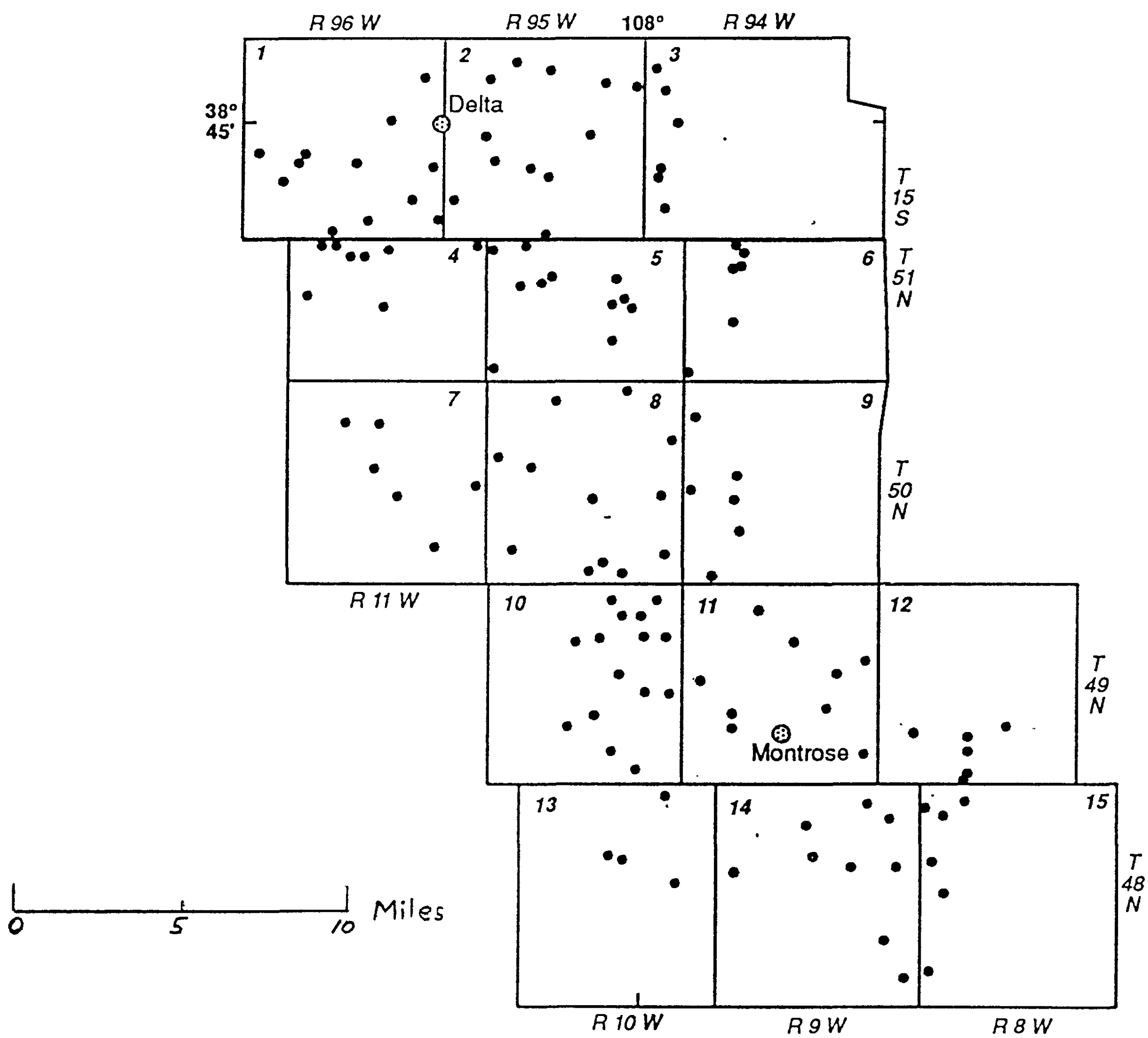

Figure 3.--Locations of soil and alfalfa samples sites within the townships of the Uncompahgre Project Area.

randomized order. This randomized group was then broken into jobs of 38 samples. Two appropriate standards were then randomly inserted to make a job of 40 samples. This randomization converts any systematic bias in the analyses to random errors.

In total, 128 sites were visited (table 1), with 142 soil samples and 129 alfalfa samples collected in the 15 township area of the UPA.

At each site, a 9-cm (3.5-inch) bucket auger was used to obtain a soil sample from the surface to a depth of approximately one meter. The one-meter section was mixed in the field and a representative 1 kg sample collected.

Alfalfa was collected, when present, within a few meters of the auger bore hole. The top 20 cm of several alfalfa plants, in the 10% to 30% bloom-stage were cut with stainless steel shears, composited, and placed into a paper bag, but not sealed to help prevent the growth of mold. The alfalfa samples were air dried in the field before transport to the Denver laboratories. Alfalfa was not available at some sample locations and only the soil core was taken.

Laboratory Methods

All samples were delivered to the U.S. Geological Survey laboratories in Denver for preparation and analysis. The soil samples were air dried under forced air at ambient temperatures. The dried soil samples were disaggregated with a mechanical mortar and pestle and the minus-10-mesh (2-mm) material saved for analyses. The plus-10-mesh material was discarded. A split of the minus-2-mm material (approximately 100 g) was made using a standard Jones splitter and then ground in a ceramic plate grinder to minus 100 mesh. This minus-100 mesh material was used for all total chemical analysis.

All alfalfa samples were washed with tap water and rinsed several times with demineralized water to remove possible surface contamination. This treatment also removes the possible differences in irrigation practices - flood or overhead sprinklers. The washed samples were dried under forced air in an aluminum colander at ambient temperature for at least 24 hours or until very dry to the touch and would easily crumble when crushed by hand. The samples were then ground in a standard Wiley mill to pass a 2-mm screen. An aliquot of each plant sample was homogenized and then ashed in an electric muffle furnace ramped to 450 ^{0}C over a 24-hour period. Both the ashed material and raw, dry material were used for total chemical analyses.

Inductively Coupled Plasma-Atomic Emission Spectroscopy

All samples were analyzed simultaneously for 40 elements using inductively coupled plasma-atomic emission spectroscopy (ICP-AES) as described by Crock and others (1983) and Arbogast

(1990, pp. 83-91). Each soil sample (0.200 g) and plant ash sample (0.100 g) was dissolved using a low-temperature digestion with concentrated hydrochloric, hydrofluoric, nitric, and perchloric acids. The acidic sample solution was taken to dryness and the residue was dissolved with 1 mL of aqua regia and then diluted to 10 g with demineralized water. Reagent blanks, reference materials, and laboratory sample replicates were all digested by the same procedure and analyzed at the same time as the samples. The elements determined and their determination limits are shown in table 2. The relative standard deviation (RSD) for replicate determinations of most elements was routinely five percent or less.

Continuous Flow Hydride Generation-Atomic Absorption Spectroscopy

Arsenic and selenium in soils were determined by continuous flow hydride generation-atomic absorption spectroscopy (HGAAS) (Crock and Lichte, 1982; Sanzolone and Chao, 1987; Arbogast, 1990. pp. 38-45). A 0.25 gram of soil sample was digested with nitric, perchloric, and hydrofluoric acids. After digestion, the sample was diluted to 50 mL with 6 N HCl. Arsenic and selenium were determined independently using specifically designed HGAAS continuous flow systems. In these procedures, the sample digest solution was reacted with sodium borohydride in order to generate the gaseous hydrides which were then swept into the heated quartz furnace of an atomic absorption spectrometer. Arsenic and selenium were determined using aqueous standard calibration curves. Determination limits for arsenic and selenium are shown in table 2. The RSD for the determination of both elements was routinely about ten percent.

Arsenic and selenium in the alfalfa was determined by HGAAS (Crock and Lichte, 1982; Sanzolone and Chao, 1987) in a similar fashion as the soils. A 1.000 g dry-weight (unashed, dried and ground material) alfalfa sample was digested with nitric and perchloric acids and 30 percent hydrogen peroxide under refluxing conditions using a 250 mL Erlenmeyer flask and a glass digestion "claw". After the digestion was complete, the clear solution was diluted to 50 mL with 6 N HCL. Determination limits for As and Se for alfalfa are given in table 2. The RSD for the determination of both elements was routinely about ten percent.

Miscellaneous Determinations

Mercury in soil and alfalfa was determined on a random subset of 40 samples of each matrix using an automated continuous-flow cold-vapor atomic absorption spectroscopic method (Kennedy and Crock, 1987; Arbogast, 1990, pp. 60-67). Only a subset of the samples of each matrix was analyzed because Hg was not indentified as a potential problem in the UPA during the reconnaissance study (Butler and others, 1991). A 0.100 g soil or 0.250 g (unashed, raw, dried and ground material) alfalfa sample was digested with nitric acid and sodium dichromate in a closed teflon bottle and then diluted to 12 mL with deionized water. The solution was reacted with a sulfuric acid-hydroxylamine hydrochloride solution and stannous chloride solution in a continuous-flow system. The gaseous mercury was separated in a phase separator and swept into a quartz cell of an atomic absorption spectrometer. Mercury was determined using an aqueous standard calibration curve. Determination limits for Hg for soil and alfalfa are given in table 2. The RSD for the determination of both samples types was routinely about ten percent.

Uranium in soils was determined using delayed neutron activation analysis (DNAA) (McKown and Millard, 1987; Arbogast, 1990, pp. 146-150). A 10.0 g soil sample is irradiated with a neutron flux to induce nuclear transformation of certain elements into radioactive nuclides. Following irradiation, beta and gamma radiations emitted from the radioactive products are measured using gamma-ray spectroscopy as an indicator of the parent-element concentration. Determination limit for U in a 10.0 g soil sample is 0.1 ppm U (table 2). The RSD for the determination of U by DNAA was usually less than five percent.

Uranium in alfalfa was not feasible by DNAA because of the large amount of ash required to produce a reasonable limit of detection. Uranium in alfalfa was determined using inductively coupled plasma-mass spectrometry (ICP-MS) (A.L. Meier, oral commun., 1992). An 0.100 g of the ashed material is dissolved using a multi-acid dissolution procedure outlined in Crock and others (1983). Uranium is quantified using the 238 mass with Lu as an internal standard with ICP-MS instrumental conditions similar to those given in Lichte and others (1986). The determination limit for U for alfalfa is given in table 2. The RSD for the determination of U by ICP-MS was less than five percent.

Quality Control

Soil Materials

Statistical techniques and reference samples were used to assess accuracy and precision of chemical analysis. Fourteen samples were selected at random to be split into two parts and analyzed separately to estimate errors associated with sample preparation and analysis. The samples and sample splits were arranged in a randomized sequence and prepared and analyzed in that sequence to convert any systematic errors in preparation and analysis to random errors and to estimate relative laboratory precision. Aliquots of the in-house standard soil (SJS-1), were inserted at random intervals into the sample sequence to estimate laboratory accuracy. Accepted values (P.H. Briggs, written commun., 1992), when compared with this study's results (table 3), show that the determinations were highly accurate and precise for most elements when they were sufficiently above the limit of determination. Only barium (Ba) showed a high standard deviation and RSD. This is probably due to a barium sulfate precipitate that occurs in the digestion procedure.

Plant Materials

Alfalfa samples were treated in a similar fashion as the soils for preparing the analytical jobs of 40 samples. Thirteen samples were selected at random to be split into two parts and analyzed separately for the estimate of analytical variation. A large sample of alfalfa was collected for the Kendrick Study (See and others, 1992) as a proposed in-house alfalfa standard. This sample was prepared in an identical fashion as described in this report, mixed, and split into approximately 50 pint glass bottles. The results of this study indicate RSD's for many elements to be less than ten percent (table 3), especially calcium (Ca), iron (Fe), magnesium (Mg), phosphorus (P), manganese (Mn), copper (Cu), zinc (Zn), and uranium (U). These results indicate that the analyses are precise and that the proposed in-house standard is sufficiently homogeneous to be used for in-house precision testing.

RESULTS

Soils

Appendix Table A1 lists all analytical results for soils collected from the Uncompahgre Project Area, except for those elements that were generally below the limit of determination for the method as given in table 2. These elements include (element symbol followed by the ratio of samples above the limit of detection to the total number of samples analyzed and the method of analysis if that element was reported by more than one method): silver (Ag) (0:164), arsenic (As) (61:164, ICP-AES), gold (Au) (0:164), bismuth (Bi) (0:164), europium (Eu) (0:164), holmium (Ho) (0:164), tin (Sn) (1:164), and U (0:164, ICP-AES). These elements will not be further discussed in this report.

Appendix Table A4 is a listing of the mercury results for a randomly chosen subset of the soils. About a third of the samples analyzed contain mercury (Hg) at or above the mean soil Hg content of 0.056 ppm Hg as reported by Rose and others (1979). This is most likely due to the large influence of the marine shales in the UPA. Rose and others (1979) report that shales range from 0.02 - 0.4 ppm Hg, but all soil samples fall within the baseline range for soils (0.0085 - 0.25 ppm Hg) from the Western United States (table 5, Shacklette and Boerngen {1984}). The mercury concentrations in this subset of soil samples support the findings of Butler and others (1991) that mercury is not a potential problem in the UPA.

Selenium was the main element of concern for this study, based on previous reports of elevated Se concentrations in biota, water, and bottom sediments (Harms and others, 1990; Butler and others, 1991). Excellent reviews of selenium soil geochemistry are given by Fisher and others (1987), Jacobs (1989), and Ihnat (1989). Severson and others (1991) present a detailed summary of Se in arid and semiarid environments of the Western United States. For comparison of Se values obtained in this study with other studies, table 4 lists geochemical baselines for Se in soils from selected studies from the Western United States and table 5 lists a calculated geochemical baseline for many elements, including Se, for soils from the Western United States. Shacklette and Boerngen (1984) report a calculated baseline range of 0.039 to 1.4 ppm Se and an observed range of <0.1 to 4.3 ppm Se based on 733 soil samples from the Western United States. Severson and Tidball (1979) list a calculated baseline range of 0.061 to 3.3 ppm Se and an observed range of <0.1 to 20 ppm Se for 136 soils from the northern Great Plains. A DOI study at the Kendrick Reclamation Project Area (KRPA) of central Wyoming, described by Erdman and others (1989) and See and others (1992), is similar to the UPA study in sample media studied, sampling design, and surface geology. The KRPA study investigated irrigated soils developed predominantly on Cretaceous Cody Shale (Kc) and alluvium derived from the Kc, and lists an observed Se concentration range of <0.1 to 3.8 ppm Se, a geometric mean of 0.37 ppm Se, and a geometric deviation of 2.85. Erdman and others (1989) also lists an observed Se concentration range of <0.1 to 2.1 ppm Se and a geometric mean of 0.64 ppm Se for the non-irrigated, native soils developed on Kc. This Kc is similar geochemically and in depositional history to the Cretaceous Mancos shale (Km) of the UPA. Table 8 lists the summary statistics for all UPA soil samples, with a geometric mean (GM) of 1.4 ppm Se and an observed range of 0.1 to 8.6 ppm Se. By comparison to the other studies given above, UPA is elevated in its Se content.

Tables 9 - 13 list summary statistics for samples of soils from the UPA by the parent geologic unit. Table 14 lists the GM for each element by parent geologic unit. The following table summarizes Se in the soils of the UPA.

Selenium in UPA Soils

Parent Geologic Unit	Geometric Mean (ppm)	Observed Range (ppm)	Detection Ratio
UPA (entire study)	1.4	0.1 - 8.6	142:142
Dakota Sandstone	0.5	0.3 - 0.6	11:11
Mancos Shale	2.2	0.3 - 7.5	43:43
Alluvium, Mancos	2.9	0.9 - 8.6	36:36
Alluvium, Recent	0.6	0.1 - 2.9	23:23
Alluvium, Tertiary	1.0	0.4 - 3.4	28:28

Two units are noticeable in this table - the Cretaceous Mancos Shale (Km) and the alluvium derived from the Mancos Shale (Qm). Their GM of 2.2 and 2.9 ppm Se, respectively, are about 10 times above the GM of 0.23 ppm Se for the Western United States and are substantially above the similar Kc unit of the KRPA. The observed ranges for these two units are also much larger that the baselines reported for all the sites studies. Since the number of samples taken from each geologic unit is proportional to the area of that unit in UPA (figure 1), the overall mean and observed range for UPA is heavily influenced by these two naturally seleniferous units. This is shown in the high overall GM of 1.4 ppm Se, as compared to 0.23 ppm for the Western United States (Shacklette and Boerngen, 1984). The Uncompahgre Project Area is definitely a naturally selenium-enriched area.

Table 6 lists site and analytical variances for elements measured in soil samples from the UPA. For elements other than beryllium (Be), cadmium (Cd), and thorium (Th), there is a significant amount of variance (0.05 probability level) seen between geologic units. This variance implies that soils developed on the different parent geologic units are significantly different and that the area would be most efficiently mapped for its elemental content using geologic units. The elements not showing significant differences, such as Be, were close to the limit of determination, or had a very small concentration range. Table 6 also shows many elements having significant variations at levels between townships, between sections, and within sections. For most elements that show a wide range of values significantly above the limit of detection, the variance in the laboratory analysis is small, indicating good analytical precision and also that the partitioning of the remaining variance is related to landscape differences. The high analytical variance seen in Ba is due to the formation of barium sulfate in the dissolution procedure. The very large analytical variance for Be is attributed to the small observed range. Very large analytical variances for Cd and ytterbium (Yb) are attributed to their small observed concentration ranges and low detection range. Variances for Se are significant (0.05 confidence level) at all levels, with precise analyses.

Elements of interest noted from tables 6, 8, and 9 - 13 include Cu and Mo. The following table compares Cu and Mo for soils derived from each of the parent geologic units. There is significant (0.05 confidence level) difference for both elements between geologic units and within sections (high local variability) and for Mo between sections. Precision for both elements was excellent.

Copper and Molybdenum in UPA Soils

Parent Geologic Unit	Copper Geometric Mean (ppm)	Copper Observed Range (ppm)	Molybdenum Geometric Mean (ppm)	Molybdenum Observed Range (ppm)
UPA (entire study)	24	6 - 67	3	<2 - 38
Dakota Sandstone	17	8 - 27	---	<2 - 2
Mancos Shale	23	10 - 67	5	<2 - 38
Alluvium, Mancos	26	9 - 45	5	<2 - 19
Alluvium, Recent	22	8 - 46	1	<2 - 12
Alluvium, Tertiary	25	6 - 40	2	<2 - 20

---, Not Determined

Two units again are very noticeable in this table. Although all the units have a similar GM for their copper content, they are still significantly different from one another at the 0.05 confidence level. The expected baseline range for copper is 4.9 - 90 ppm with a GM of 21 ppm (table 5). These soils fall well into this range and the GM for each of the geologic units is similar to the reported GM for the Western United States. The expected baseline range for molybdenum is 0.18 - 4.0 ppm with a GM of 0.85 ppm (table 5). The soils of the UPA generally fall out of this normal range, especially for the Km and Qm units. Therefore, the UPA is not low in total Cu, but is elevated in total Mo. The Cu/Mo ratio in cattle and sheep forage is important in occurrence of molybdenosis in both animals. Depending on the mobility and plant availability of both elements, there is the potential problem with low Cu/Mo ratios in soils. Molybdenum tends to form oxy-anions, i.e., molybdate, in the alkaline environment common to the Western United States and would be bioavailable (Adriano, 1986; Newman and others, 1987).

Vanadium (V) and U are also of interest in the soils of the UPA. The following table summarizes their statistics.

Uranium and Vanadium in UPA Soils

Parent Geologic Unit	Uranium Geometric Mean (ppm)	Uranium Observed Range (ppm)	Vanadium Geometric Mean (ppm)	Vanadium Observed Range (ppm)
UPA (entire study)	4.3	2.0 - 13	110	27 - 320
Dakota Sandstone	2.7	2.1 - 3.9	47	30 - 140
Mancos Shale	5.3	3.4 - 13	145	80 - 320
Alluvium, Mancos	5.0	3.5 - 8.6	140	92 - 280
Alluvium, Recent	3.5	2.0 - 7.6	93	27 - 260
Alluvium, Tertiary	3.6	2.0 - 7.4	89	40 - 480

Table 6 shows significant (0.05 confidence level) variance at all levels for both elements and both elements were determined precisely. The only exception was a small variance at the between township level for U. The Km and Qm units are elevated both in the calculated GM and the observed ranges for U and V, and both elements are high when compared to the GM and baseline ranges for the Western U.S. (table 5) (for U: GM of 2.5 ppm and a baseline range of 1.2 - 5.3 ppm; for V: GM of 70 and a baseline range of 18 - 270 ppm). These elements also will be mobile as oxy-anions under the alkaline conditions found commonly in the Western United States.

Other elements of interest in the soils of the UPA are Zn and As. The following table summarizes their statistics.

Zinc and Arsenic in UPA Soils

	Zinc		Arsenic	
Parent Geologic Unit	Geometric Mean (ppm)	Observed Range (ppm)	Geometric Mean (ppm)	Observed Range (ppm)
UPA (entire study)	100	28 - 270	8.3	3.6 - 13
Dakota Sandstone	64	33 - 120	7.5	6.0 - 9.9
Mancos Shale	100	68 - 270	8.9	5.1 - 13
Alluvium, Mancos	110	84 - 130	9.3	5.6 - 13
Alluvium, Recent	98	28 - 190	5.8	3.6 - 10
Alluvium, Tertiary	100	46 - 170	8.7	6.0 - 11

Table 6 shows that both elements are significantly different on the geologic unit scale, with the Km and Qm units again showing the highest GM and range. Both determinations were highly precise and both show a large degree of local variability. Table 5 lists GM for Zn at 55 ppm and 5.5 ppm for As and calculated baseline ranges for Zn to be 17 - 180 ppm Zn and 1.2 - 22 ppm for As. Although the GM for each element for the UPA as well as the individual geologic unit fall within the baselines, the UPA GM are about twice what the GM are as reported for the Western United States.

Considering all the mentioned elements, soils derived from the Mancos Shale and the alluvium derived from the Mancos Shale are distinct from the other three units in the UPA based on their elevated, and potentially mobile and bioavailable Se, As, Mo, U, Zn, and V concentrations.

Alfalfa

Appendix Table A2 lists all the analytical results determined on an ash-weight basis and dry-weight basis (method-dependent) for the alfalfa collected from the UPA, except those elements that were mostly below the limit of determination for the method as given in table 2. These elements include (element symbol followed by the ratio of samples above the limit of detection to the total number of samples analyzed and the method of analysis if that element was reported by more than one method): Ag (1:150), As (0:150, ICP-AES), Au (0:150), Be (0:150), Bi (0:150), Cd (0:150), cerium (Ce) (2:150), Eu (0:150), gallium (Ga) (1:150), Ho (0:150), niobium (Nb) (0:150), lead (Pb) (2:150), scandium (Sc) (0:150), Sn (0:150), tantalum (Ta) (0:150), Th (0:150), U (0:150, ICP-AES), yttrium (Y)(0:150), and Yb (0:150). These elements will not be included in further discussions. Appendix Table A3 lists all detectable elements on a dry-weight basis (only if the original method of determination used the ashed material).

Appendix Table A5 lists the mercury results for a randomly chosen subset of alfalfa samples from the UPA. Most Hg concentrations were below or just barely above the limit of determination. Mercury concentrations in alfalfa were not significant for the UPA, and this also supports the conclusions of Butler and others (1991).

Selenium also was considered to be the main target element in alfalfa in this study, based on previous reports of this study area (Harms and others, 1990; Butler and others, 1991) and from other DOI Irrigation Task Force studies (e.g., See and others, 1992). Alfalfa was sampled and analyzed as an indicator of element bioavailability in the UPA. Although numerous extraction schemes exists to assess bioavailability in soils, the best measure remains the elemental content of the vegetation grown on a given soil. Table 7 lists the site and analytical variances for all elements measured above the respective limits of detection as given in table 2 in alfalfa on the dry-weight basis from the UPA. From this table, there is significant variance (0.05) for Se in alfalfa at the among geologic units, among townships, and within section levels. The analytical precision was acceptable, accounting for only 11% of the total variance. These variances imply that the alfalfa grown on different units in different townships are significantly different, but variance at the local level is large. Table 8 lists the summary statistics for all the alfalfa of the UPA - a GM of 0.33 ppm Se and an observed range of <0.03 - 9.5 ppm Se. Tables 9 - 13 list summary statistics for samples of alfalfa from the UPA broken down by the soil parent geologic unit. Table 15 lists the GM for each element by the soil parent geologic unit. The following table summarizes Se in the alfalfa of the UPA.

Selenium in UPA Alfalfa

Parent Geologic Unit	Geometric Mean (ppm)	Observed Range (ppm)	Detection Ratio
UPA (entire study)	0.33	<0.03 - 9.5	118:128
Dakota Sandstone	0.12	<0.03 - 0.69	10:11
Mancos Shale	0.28	<0.03 - 1.6	31:35
Alluvium, Mancos	0.56	<0.03 - 6.3	30:34
Alluvium, Recent	0.48	<0.03 - 9.5	21:22
Alluvium, Tertiary	0.25	<0.03 - 1.8	25:26

When comparing the UPA alfalfa to the KRPA study, the UPA soils are definitely lower in available Se as indicated by total Se in alfalfa. Selenium for the alfalfas from the KRPA have an observed range of 0.1 - 40 ppm Se, median of 0.9 ppm and the 25th and 75th percentiles of 0.4 ppm and 2.0 ppm, respectively (See and others, 1992). Only 4 samples of alfalfa from the UPA contained higher selenium than the proposed dietary limit of 4 ppm Se - three from Qm (4.1, 4.7. and 6.7 ppm Se) and one from Qr (9.5 ppm Se). Selenium is a required element for most higher forms of life, but depending on the concentration can be potentially toxic as well. Fisher and others (1987) list a requirement of 0.10 ppm Se for cattle feed, a tolerance level of 2.0 ppm Se, and a toxic level of 8.0 ppm Se (taken from the National Ecological Research Laboratory). Only one sample of alfalfa from the UPA is above this proposed toxic level. The following is a breakdown of the alfalfa by parent geologic unit using the above criteria of Se levels in cattle feed. All of the samples considered to be above the required Se concentration were not sampled from actively irrigated alfalfa fields. Samples QR05211 and QM08111 were volunteer plants on the edges of corn fields. Samples QM03311 and QM12211 were old alfalfa plants in mixed-grass pastures.

Selenium in the Alfalfa of the UPA

Parent Geologic Unit	Insufficient (<0.1 ppm)	Required (0.1-2 ppm)	Questionable (2.1-8 ppm)	Toxic (>8 ppm)
UPA (entire study)	20	103	4	1
Dakota Sandstone	5	6	0	0
Mancos Shale	5	30	0	0
Alluvium, Mancos	4	26	4	0
Alluvium, Recent	2	19	0	1
Alluvium, Tertiary	4	22	0	0

From the above table, considerably more alfalfa samples are nutritionally deficient with respect to Se than are at questionable or toxic levels. Most areas of the UPA have alfalfa with a Se content in the dietary-required level for cattle feed. The difference seen between the total Se in soils (naturally Seenriched) to the non-enriched alfalfa is due to the bioavailability of Se in the UPA soils. The UPA has better hydrologic drainage than the KRPA and the UPA represents a more open hydrologic system than the KRPA. Where agricultural drainage is confined or allowed to concentrate due to evaporation, as is possible at Sweitzer Lake, there is a greater possibility for Se enrichment in the biota.

Table 7 lists site and analytical variances for elements measured in the alfalfa samples from the UPA. For most elements above the limit of detection for a given method, the laboratory analyses were precise. Notable exceptions were potassium (K), cobalt (Co), and chromium (Cr). Cobalt and Cr were of low concentrations (GM of 0.3 and 0.4 ppm, respectively). Small variation in the determination on the ash would be accentuated in these low values. There is no explanation why the K values were imprecise, since K is usually a precise determination by ICP-AES. Most variation for most elements was at the between-sections and within-sections levels. This suggests large local variability. Elements showing significant variance at the between-parent geologic units were Ca, P, Mn, Ba, Mo, nickel (Ni), strontium (Sr), U, and Se.

Copper and Molybdenum in UPA Alfalfa

	Copper		Molybdenum		
Parent Geologic Unit	Geometric Mean (ppm)	Observed Range (ppm)	Geometric Mean (ppm)	Observed Range (ppm)	Cu/Mo
UPA (entire study)	8.4	4.8 - 13	4.4	1.3 - 32	1.9
Dakota Sandstone	7.4	5.0 - 11	4.5	1.9 - 12	1.6
Mancos Shale	8.5	5.4 - 12	5.3	1.8 - 17	1.6
Alluvium, Mancos	8.7	4.8 - 12	5.5	1.6 - 32	1.7
Alluvium, Recent	8.0	6.0 - 11	5.0	1.3 - 14	2.2
Alluvium, Tertiary	8.8	6.7 - 13	3.7	1.8 - 5.5	2.7

The above table was prepared by combining information given in tables 8-13. Both Cu and Mo are essential elements for proper plant and animal growth. Their proper balance in animal feedstuffs must be maintained to prevent molybdenosis. Adriano (1986) and Newman and others (1987) present a concise summary of the geochemistry and nutrition of Cu and Mo and their interactions. The single most important factor in the control of the bioavailability of both elements is soil pH. Under alkaline conditions, Mo tends to be soluble as the molybdate anion and Cu tends to precipitate, usually as a carbonate, hydroxide, or oxide, and therefore, Cu tends not to be bioavailable. From the above table, three units have an alfalfa Cu/Mo ratio below the critical value of 2.0 as given by Newman and others (1987). There is a potential for molybdenosis in cattle consuming only alfalfa produced on these three units, if they are not fed a dietary supplement for Cu.

The following table summarizes U in the alfalfa of the UPA. Although not toxic at these levels (Erdman and Ebens, 1979), alfalfa associated with the Qm are noticeably higher in U than the other units, implying that U is more bioavailable in the Qm.

Uranium in UPA Alfalfa

Parent Geologic Unit	Geometric Mean (ppm)	Observed Range (ppm)
UPA (entire study)	0.043	0.005 - 0.67
Dakota Sandstone	0.018	0.008 - 0.039
Mancos Shale	0.031	0.006 - 0.43
Alluvium, Mancos	0.057	0.012 - 0.47
Alluvium, Recent	0.031	0.013 - 0.67
Alluvium, Tertiary	0.033	0.012 - 0.085

SUMMARY AND CONCLUSIONS

An unbalanced, four-level, stratified random sampling design was used to assess variation of total element concentrations in the soils and associated alfalfa among and within parent geologic units in the Uncompahgre Project Area in west-central Colorado. Alfalfa, a major agricultural crop from the UPA, was chosen as an indication of the bioavailability of environmentally important elements, based on previous DOI irrigation studies. The parent geologic units were defined based on a composite of geologic maps and a soil survey map of the project area. Soils derived from five geologic units were sampled (Kd, Km, Qt, Qm, and, Qr. These soils and associated alfalfa were analyzed for a wide range of total element concentrations, including environmentally and nutritionally important elements, such as As, Se, Hg, U, Cu, Mo, Zn, and V. Selenium concentrations in the soils from the project area ranged from 0.1 to 8.6 ppm Se with a geometric mean (GM) of 1.4 ppm as compared to a calculated baseline range of 0.039 - 1.4 ppm Se with a GM of 0.23 ppm for soils in the Western United States. Mean concentrations of Se in the Km (2.2 ppm) and Qm (2.9 ppm) were 10 - 15 times higher than the GM (0.23 ppm) of the Western United States. Selenium in alfalfa ranged from <0.03 - 9.5 ppm Se with a GM of 0.33 ppm, but only 4 of 128 samples fell into the dietary questionable category for cattle forage (2.1 - 8 ppm Se) and only 1 sample fell into the toxic range (>8 ppm Se). Alfalfa samples from the Qm soils are noticeably higher than the other geologic units in their Se content, with a GM of 0.56 ppm Se. Of more interest are the 20 samples of alfalfa that contain Se at insufficient levels (0.1) for cattle feed. Other elements that distinguished the Km and Qm units from the other units include higher soil levels of Mo, U, V, As, and Zn. Of greatest interest are the observed Cu/Mo ratios of alfalfa grown on the soils derived from the Kd, Km, and Qm of the UPA. These alfalfa samples generally fall below the required 2.0 ratio value needed to prevent the occurrence of molybdenosis in cattle. Cattle must have their diets supplemented with an available Cu source if they are fed only alfalfa with a Cu:Mo ratio of <2.0.

For most of the elements of concern, the analytical data was precise, and there is significant (0.05 confidence level) variation between geologic units, between sections, and within sections levels. Between townships show the least number of elements having significant variance.

ACKNOWLEDGMENTS

Sample preparation and analysis were conducted by the authors, P.H. Briggs, G. Gourdin, T.R. Peacock, G.O. Riddle, A.L. Meier, A.H. Love, E.P. Welsch, and P.L. Hageman, all with the U.S. Geological Survey in Denver, Colorado. We wish to offer special thanks to David Butler and Winfield Wright, WRD-USGS, Grand Junction, CO, for their many suggestions, help in the field work, and reviewing this manuscript.

REFERENCES CITED

Adriano, D.C., 1986, Trace elements in the terrestrial environment: Springer Verlag, New York, pp. 329 - 361.

Arbogast, B.F. (editor), 1990, Quality assurance manual for the Branch of Geochemistry, U.S. Geological Survey: U.S. Geological Survey Open File Report 90-668, 184 p.

Butler, D.L., Krueger, R.P., Osmundson, B.C., Thompson, A.L., and McCall, S.K., 1991, Reconnaissance Investigation of water quality, bottom sediment, and biota associated with irrigation drainage in the Gunnison and Uncompahgre River Basins and at Sweitzer Lake, West-Central Colorado, 1988-89: U.S. Geological Survey Water-Resources Investigations Report 91-4103, 99 p.

Cline, A.J., Spears, Clayton, Mehaffy, Forrest, Kubin, Edwin, Franklin, Richard, and Pachek, Carl, 1967, Soil survey of Delta-Montrose area, Colorado: Soil Conservation Service, U.S. Department of Agriculture and Colorado Agriculture Experiment Station, 73 p.

Crock, J. G. and Lichte, F. E., 1982, An improved method for the determination of trace levels of arsenic and antimony in geologic materials by automated hydride generation-atomic absorption spectroscopy: Analytica Chimica Acta 144, pp. 223-233.

Crock, J. G., Lichte, F. E., and Briggs, P. E., 1983, Determination of elements in National Bureau of Standards Geologic Reference Materials SRM 278 obsidian and SRM 688 basalt by inductively coupled argon plasma-atomic emission spectrometry: Geostandards Newsletter, 7, pp. 335-340.

Erdman, J. A. and Ebens, R. J., 1979, Element content of crested wheatgrass grown on reclaimed coal spoils and on soils nearby: Journal of Range Management, 32, pp. 159 - 161.

Erdman, J. A., Severson, R. C., Crock, J. G., Harms, T. F., and Mayland, H. F., 1989, Selenium in soils and plants from native and irrigated lands at the Kendrick Reclamation Project Area: U.S. Geological Open-File Report 89-628, 28 p.

Fisher, S. E., Jr., Munshower, F. F., Parady, Fred, 1987, Selenium, *in* Reclaiming mine soils and overburden: Analytical parameters and procedures, R. D. Williams and G. E. Schuman, Editors, Soil Conservation Society of America, Ankeny, IA, pp. 109 - 133.

Gladney, E. S., 1980, Elemental concentrations in NBS biological and environmental standard reference materials: Analytica Chimica Acta, 118, pp. 385-396.

Harms, T.F., Stewart, K.C., Briggs, P.H., Hageman, P.L., and Papp, C.S.E., 1990, Chemical results for bottom material for Department of the Interior irrigation drainage task group studies, 1988-1989: U.S. Geological Survey Open-File Report 90-50, 47 p.

Jacobs, L. W. (Editor), 1989, Selenium in agriculture and the environment, SSSA Special Publication 23: American Society of Agronomy, Madison, WI, 233 p.

Kennedy, K. R. and Crock, J. G., 1987, Determination of mercury in geologic materials by continuous flow, cold vapor, atomic absorption spectrophotometry: Analytical Letters, 20, pp. 899-908.

Ihnat, Milan, 1989, Occurrence and distribution of selenium: CRC Press, Boca Raton, FL, 354 p.

Lichte, F.E., Meier, A.L., and Crock, J.G., 1986, Determination of the rare earth elements in geological materials by inductively coupled plasma-mass spectrometry: Analytical Chemistry, 59, pp. 1150-1157.

Marshall, C.H., 1959, Photogeologic map of the Delta Quadrangle, Montrose and Delta Counties, Colorado: U.S. Geological Survey Miscellaneous Investigation Series Map I-282.

McKown, D.M. and Millard, H.T., Jr., 1987, Determination of uranium and thorium by delayed neutron counting, in: Methods for Geochemical Analysis, Chapter I, P.A. Baedecker, editor, U.S. Geological Survey Bulletin 1770, pp. I1-I12.

Newman, D. R., Schrack, J. L., and Gough, L. P., 1987, Copper and Molybdenum, *in* Reclaiming Mine Soils and Overburden: Analytical parameters and procedures, R. D. Williams and G. E. Schuman, Editors, Soil Conservation Society of America, Ankeny, IA, pp. 215 - 232.

Rose, A.W., H.E. Hawkes, and J.S. Webb. 1979. Geochemistry in mineral exploration. 2nd ed. Academic Press, NY.

Sanzolone, R. F. and Chao, T. T., 1987, Determination of selenium in thirty-two geochemical reference materials by continuous-flow hydride generation atomic absorption spectrophotometry: Geostandards Newsletter, 11, pp. 81-85.

See, R. B., Naftz, D. L., Peterson, D. A., Crock., J.G., Erdman, J.A., and Severson, R.C., 1992, Soil and representative plants, *in*, Detailed study of selenium in soil, representative plants, water, bottom sediment, and biota in the Kendrick Reclamation Project Area, Wyoming, 1988-90, U.S. Geological Survey Water-Resources Investigation Report 91-4131, pp. 12-30.

Severson, R. C., Fisher, S. E., Jr., and Gough, L. P. (Editors), 1991, Proceedings of the 1990 Billings Land Reclamation Symposium on Selenium in Arid and Semiarid Environments, Western United States: U. S. Geological Survey Circular 1064, 146 p.

Severson, R. C. and Tidball, R. R., 1979, Spatial variation in total element concentration in soil within the northern Great Plains coal region: U.S. Geological Survey Professional Paper 1134-A, 18 p.

Severson, R. C., Tidball, R. R., and Wilson, S. A., 1987, Chemical composition and variability of soils in the Western San Joaquin Valley, California, p. 75-87, in, J. B. Summers, editor, Toxic Substances in Agricultural Water Supply and Drainage, U.S. Committee on Irrigation and Drainage, Denver, CO, 358 p.

Severson, R. C., Wilson, S. A., and McNeal, J. M., 1987, Analyses of bottom material collected at nine areas in the Western United States for the DOI irrigation drainage task group: U.S. Geological Survey Open-File Report 87-490, 24 p.

Shacklette, H. T., and Boerngen, J. G., 1984, Element concentrations in soils and other surficial materials of the conterminous United States: U.S. Geological Survey Professional Paper 1270, 105 p.

Steven, T.A., and Hail, W.J. Jr., 1989, Geologic map of the Montrose 30' x 60' Quadrangle, Southwestern Colorado: U.S. Geological Survey Miscellaneous Investigation Series Map I-1939.

Stewart, K.C., Crock, J.G, and Severson, R.C., Chemical results and variability assessment of selected water-extractable constituents from soils of the Uncompahgre Project Area, West-Central Colorado: U.S. Geological Survey Open-File Report 93-507, 27 p.

Tweto, Ogden, Steven, T.A., Hail, W.J. Jr., and Moench, R.H., 1976, Preliminary geological map of the Montrose 1° x 2° Quadrangle, Southwestern Colorado: U.S. Geological Survey Map MF-761.

Williams, P.L., 1964, Geology, structure, and uranium deposits of the Moab Quadrangle, Colorado and Utah: U.S. Geological Survey Miscellaneous Investigation Series Map I-360.

Table 1.--Distribution of geologic units and number of sites sampled for each township of the Uncompahgre Project Area.

	Township	Geologic Formation[a]				
		Kd	Km	Qm	Qr	Qt
1	T15S, R96W (NW corner)		3	3	3	3
2	T15S, R95W		3	3	3	3
3	T15S, R94W (NE corner)		3	3		
4	T51N, R11W		4[b]			3
5	T51N, R10W		3	3	3	3
6	T51N, R09W		3			3
7	T50N, R11W	3				3
8	T50N, R10W		3	3	3	3
9	T50N, R09W		3	3		
10	T49N, R10W	3	3	3	3	3
11	T49N, R09W		3	3		
12	T49N, R08W		3	3	3	
13	T48N, R10W (SW corner)	3				
14	T48N, R09W		3	3	3	
15	T48N, R08W (SE corner)		3	3		

One additional sample, Qd (alluvium derived from the Dakota Sandstone), in Township 13 was collected, but not used in the statistics. There were a total of 128 sites visited.

[a]Names of the geologic formations:
- Km - Mancos Shale
- Kd - Dakota Sandstone
- Qm - Alluvium derived from the Mancos Shale
- Qr - Alluvium derived from recent deposits on the river flood plains
- Qt - Alluvium derived from older Tertiary gravels on the high terraces

[b]Only 3 sites were used for the analysis of variance.

Table 2.--Listing of approximate limits of determination for elements reported.

Analytical method	Medium	Determination Limit	Variables
Continuous flow hydride generation-atomic absorption spectroscopy (AAS)	Soil	0.1 ppm	As, Se
	Plant[1]	0.05 ppm	As, Se
Inductively coupled plasma-atomic emission spectroscopy	Soil and Plant[2,3]	2 ppm	Ag, Cd, La, Li, Mo, Ni, Sc, Sr, V, Y
		0.05 %	Al, Ca, Fe, K, Mg, Na, P, Ti
		1 ppm	Ba, Be, Co, Cr, Cu, Yb
		4 ppm	Ce, Ga, Ho, Mn, Nb, Nb, Pb, Th, Zn
		8 ppm	Au
		10 ppm	Bi
		20 ppm	Sn
		40 ppm	Ta
		100 ppm	U
Continuous flow cold vapor-AAS	Soil	0.02 ppm	Hg
	Plant[1]	0.01 ppm	
Inductively coupled plasma-mass spectrometry	Plant[2]	0.01 ppm	U
Delayed Neutron Activation	Soil	0.1 ppm	U

[1] Determined on dry plant material.
[2] Determined on plant ash.
[3] Sample mass for plants was one-half that for soils, so determination limits are twice those listed for soils.

Table 3.--Analyses of in-house standards: soil SJS-1 and alfalfa.

Variable, Unit of Measure	Soil, SJS-1 Accepted value[a]	Mean[b]	Standard[b] Deviatio	Alfalfa Mean[b]	Standard[b] Deviation
Al, %	8.0	7.94	0.12	0.0062	0.0008
Ca, %	2.2	2.24	0.052	1.12	0.05
Fe, %	3.9	3.85	0.053	0.0079	0.0004
K, %	1.9	1.86	0.052	1.70	0.32
Mg, %	1.5	1.50	---[c]	0.261	0.010
Na, %	1.1	1.10	---	0.0936	0.0068
P, %	0.06	0.06	---	0.193	0.012
Ti, %	0.37	0.36	0.009	0.0008	0.00003
Mn, ppm	540	535	14	23	0.8
Ba, ppm	880	810	120	2.5	0.2
Be, ppm	1	1.0	---	<0.2	---
Ce, ppm	45	44	3	<0.4	---
Co, ppm	15	15	0.4	0.31	0.05
Cr, ppm	120	115	8	0.23	0.05
Cu, ppm	40	39	2	5.9	0.3
Ga, ppm	18	18	0.9	<0.4	---
La, ppm	24	25	0.9	<0.4	---
Li, ppm	69	67	2	2.3	0.1
Mo, ppm	<2	<2	---	2.3	0.3
Nb, ppm	7	10	1	<0.8	---
Nd, ppm	21	20	1	<0.8	---
Ni, ppm	73	72	2	0.57	0.09
Pb, ppm	17	16	1	<0.4	---
Sc, ppm	14	14	0.4	<0.4	---
Sr, ppm	240	238	5	56	2
Th, ppm	12	13	1	<0.8	---
V, ppm	130	130	---	<0.4	---
Y, ppm	16	16	0.5	<0.4	---
Yb, ppm	2	2	0.5	<0.4	---
Zn, ppm	110	110	---	19.7	0.8
As, ppm	9.3	9.1	0.5	0.06	0.02
Se, ppm	1.2	1.3	0.1	0.15	0.02
U, ppm		3.8	0.2	0.075	0.007
Ash, %	---	---	---	8.0	0.3

[a] Written communication, P.H. Briggs, USGS, Branch of Geochemistry, 1992.

[b] Arithmetic mean and standard deviation (n=8) of the data presented in Appendix Table A1.

[c] Not calculated, no variation observed in the data.

Table 4. Geochemical baselines for selenium in soils from selected studies in the western United States. All Values are as parts per million (ppm).

[Detection ratio, number of samples in which the element was found in measurable concentrations to number of samples analyzed; GM, geometric mean; GD, geometric deviation; baseline, expected 95-percent range]

Reference; General location of the study area	Detection ratio	GM	GD	Calculated baseline range	Observed range
Shacklette and Boerngen (1984); Western United States	590:733	0.23	2.43	0.039-1.4	<0.1-4.3
Severson and Tidball (1979); Northern Great Plains	104:136	0.45	2.72	0.061-3.3	<0.1-20
McNeal (unpublished); San Joaquin Valley, CA	240:328	0.14	2.56	0.021-0.92	<0.1-2.8
Severson and others (1987); Panoche Fan, San Joaquin Valley, CA	713:721	0.68	1.94	0.1-2.2	<0.1-4.5

Erdman and others (1989); Native soils by parent formation from the Kendrick Reclamation Project Area, Central Wyoming

Geologic[1] unit	Detection ratio	Geometric Mean	Observed Range
Qal	18:18	0.35	0.1-1.9
Qs	7:10	0.11	<0.1-0.5
Twr	7:8	0.14	<0.1-0.3
Twdr	8:10	0.14	<0.1-0.4
Tfu	7:7	0.25	0.1-1.0
Kl	6:6	0.28	0.1-1.4
Kfh	2:2	0.24	0.2-0.3
Kml	10:10	0.19	0.1-0.5
Kmv	10:11	0.13	<0.1-0.5
Kc	15:16	0.64	<0.1-2.1
Ks	2:2	0.17	0.1-0.3
Kf	11:12	0.19	<0.1-0.5
Kmt	8:8	0.47	0.2-1.2

[1]Qal, Quaternary alluvium; Qs, Quaternary sand dunes; Twr, White River Formation, upper and lower units combined; Twdr, Wind River Formation; Tfu, Fort Union Formation; Kl, Lance Formation; Kfh, Fox Hills Sandstone; Kml, Meeteetse Formation; Kmv, Mesaverde Formation; Kc, Cody Shale; Ks, Steele Shale; Kf, Frontier Formation; Kmt, Mowry and Thermopolis Shale.

Table 5.--Geochemical baselines for soils from the Western United States[1].

[Detection Ratio, number of samples in which the element was found in measurable concentrations to number of samples analyzed; *, values preceded by an asterisk are arithmetic means or standard deviations; GM, geometric mean; GD, geometric deviation; Baseline, expected 95-percent range; ---, not determined]

Element, unit of measure	Detection ratio	GM	GD	Calculated baseline range	Observed range
Al, %	661:770	5.8	2.00	1.5-23	0.5->10
As, ppm	728:730	5.5	1.98	1.2-22	<0.1-97
B, ppm	506:778	23	1.99	5.8-91	<20-300
Ba, ppm	778:778	580	1.72	200-1,700	70-5,000
Be, ppm	310:778	0.68	2.30	0.13-3.6	<1-15
Ca, %	777:777	1.8	3.05	0.19-17	0.06-32
Ce, ppm	81:683	65	1.71	22-190	<150-300
Co, ppm	698:778	7.1	1.97	1.8-28	<3-50
Cr, ppm	778:778	41	2.19	8.5-200	3-2,000
Cu, ppm	778:778	21	2.07	4.9-90	2-300
Fe, %	776:777	2.1	1.95	0.55-8.0	0.1->10
Ga, ppm	767:776	16	1.68	5.7-45	<5-70
Hg, ppm	729:733	0.046	2.33	0.0085-0.25	<0.01-4.6
K, %	777:777	*1.8	*0.71	0.38-3.2	0.19-6.3
La, ppm	462:777	30	1.89	8.4-110	<30-200
Li, ppm	731:731	22	1.58	8.8-55	5.0-130
Mg, %	777:778	0.74	2.21	0.15-3.6	0.03->10
Mn, ppm	777:777	380	1.98	97-1,500	30-5,000
Mo, ppm	57:774	0.85	2.17	0.18-4.0	<3-7
Na, %	744:744	0.97	1.95	0.26-3.7	0.05-10
Nd, ppm	120:538	36	1.76	12-110	<70-300
Ni, ppm	747:778	15	2.10	3.4-66	<5-700
P, %	524:524	0.032	2.33	0.0059-0.17	0.004-0.45
Pb, ppm	712:778	17	1.80	5.2-55	<10-700
Sc, ppm	685:778	8.2	1.74	2.7-25	<5.0-50
Se, ppm	590:733	0.23	2.43	0.039-1.4	<0.1-4.3
Sr, ppm	778:778	200	2.16	43-930	10-3,000
Ti, %	777:777	0.22	1.78	0.069-0.70	0.05-2.0
Th, ppm	195:195	9.1	1.49	4.1-20	2.4-31
U, ppm	224:224	2.5	1.45	1.2-5.3	0.68-7.9
V, ppm	778:778	70	1.95	18-270	70-500
Y, ppm	759:778	22	1.66	8.0-60	<10-150
Yb, ppm	754:764	2.6	1.63	0.98-6.9	<1-20
Zn, ppm	766:766	55	1.79	17-180	10-2,100

[1]Shacklette, H. T., and Boerngen, J. G., 1984, Element concentrations in soils and other surficial materials of the conterminous United States: U.S. Geological Survey Professional Paper 1270, 105 p.

Table 6.--Site and analytical variance for elements measured in samples of soil from the Uncompahgre Project Area.

Variable, unit of measure	Total Log10 variance	Percentage of variance among: Geologic units	Townships	Between sections	Within sections	Laboratory analyses
Al, %	0.0094	31*	4	27	38*	<1
Ca, %	0.0829	31*	17*	12	40*	<1
Fe, %	0.0119	25*	5	44*	25*	<1
K, %	0.0152	36*	8	11	45*	<1
Mg, %	0.0317	49*	18*	22*	11*	<1
Na, %	0.0615	32*	3	30	33*	<1
P, %	0.0194	37*	<1	26	33*	4
Ti, %	0.0131	21*	6	25	46*	2
Mn, ppm	0.0510	54*	9*	5	31*	<1
Ba, ppm	0.1638	35*	<1	30	14	21
Be, ppm	0.0116	<1	15*	<1	<1	84
Cd, ppm	0.0065	<1	43*	35*	5	17
Ce, ppm	0.0088	22*	12*	38*	21*	7
Co, ppm	0.0103	22*	7	55*	12*	5
Cr, ppm	0.0364	62*	6*	16	11*	6
Cu, ppm	0.0262	9*	1	33	45*	12
Ga, ppm	0.0111	28*	9*	35*	23*	4
La, ppm	0.0067	25*	7	40*	23*	5
Li, ppm	0.0097	21*	8	33	38*	<1
Mo, ppm	0.1065	32*	8	50*	7*	4
Nb, ppm	0.0186	26*	7	39*	8	20
Nd, ppm	0.0075	18*	4	40	17	21
Ni, ppm	0.0457	60*	<1	35*	4*	<1
Pb, ppm	0.0444	23*	<1	5	69*	3
Sc, ppm	0.0127	37*	5	31*	23*	4
Sr, ppm	0.0372	18*	19*	53*	10*	<1
Th, ppm	0.0113	5	3	53*	13	26
V, ppm	0.0524	55*	11*	25*	9*	<1
Y, ppm	0.0064	28*	<1	21	45*	5
Yb, ppm	0.0255	8*	<1	7	6	79
Zn, ppm	0.0226	18*	<1	14	67*	<1
As, ppm	0.0140	44*	<1	46*	7*	3
Se, ppm	0.1780	57*	13*	25*	4*	<1
U, ppm	0.0221	55*	<1	36*	7*	2

* Statistically significant at the 0.05 probability level.

Table 7.--Site and analytical variance for elements measured in alfalfa (dry-weight basis) from the Uncompahgre Project Area.

Variable, unit of measure	Total Log10 variance	Percentage of variance among: Geologic units	Townships	Between sections	Within sections	Laboratory analyses
Ash, %	0.0037	4	<1	65*	27*	4
Al, %	0.1251	<1	13	<1	81*	6
Ca, %	0.0142	16*	<1	66*	16*	2
Fe, %	0.0959	3	7	<1	86*	4
K, %	0.0106	<1	10	47*	4	39
Mg, %	0.0212	1	9	76*	11*	3
Na, %	0.1756	<1	11	38	51*	<1
P, %	0.0108	12*	<1	53*	33*	3
Mn, ppm	0.0211	33*	5	22	37*	3
Ba, ppm	0.1312	17*	35*	37*	7*	3
Co, ppm	0.0402	2	5	45*	<1	48
Cr, ppm	0.0575	6	7	<1	66*	21
Cu, ppm	0.0072	5	<1	56*	37*	2
Li, ppm	0.1085	<1	9	57*	30*	4
Mo, ppm	0.0568	11*	27*	45*	13*	5
Ni, ppm	0.0848	23*	8	43*	22*	5
Sr, ppm	0.0172	11*	2	19	67*	1
U, ppm	0.1402	29*	14*	37*	19*	2
Zn, ppm	0.0166	6	<1	59*	33*	2
Se, ppm	0.3386	13*	19*	23	34*	11

* Statistically significant at the 0.05 probability level.

Table 8.--Summary statistics for samples of soil and alfalfa (dry-weight basis) collected from the Uncompahgre Project Area.

[Detection Ratio, number of samples in which the element was found in measurable concentrations to number of samples analyzed; ---, not determined]

Variable, unit of measure	Soil			Alfalfa		
	Detection Ratio	Geometric Mean	Observed Range	Detection Ratio	Geometric Mean	Observed Range
Al, %	142:142	5.6	2.4-8.0	129:129	0.0094	0.0023-0.044
Ca, %	142:142	5.9	0.51-27	129:129	1.6	0.56-2.9
Fe, %	142:142	2.5	1.2-5.1	129:129	0.012	0.0040-0.77
K, %	142:142	1.6	0.56-2.3	129:129	1.4	0.75-2.4
Mg, %	142:142	1.1	0.38-2.2	129:129	0.21	0.13-0.65
Na, %	142:142	0.54	0.12-2.1	129:129	0.026	0.0028-0.26
P, %	142:142	0.09	0.03-0.16	129:129	0.25	0.14-0.46
Ti, %	142:142	0.24	0.10-0.49	27:129	---	<0.001-0.0027
Mn, ppm	142:142	310	93-890	129:129	16	6.9-50
Ba, ppm	142:142	350	29-1400	129:129	5.7	0.77-82
Be, ppm	131:142	1	<1-2	0:129	---	
Cd, ppm	20:142	3	<2-6	0:129	---	
Ce, ppm	142:142	52	30-86	2:129	---	
Co, ppm	142:142	10	5-17	127:129	0.3	<0.1-2.0
Cr, ppm	142:142	44	12-82	125:129	0.4	<0.1-7.2
Cu, ppm	142:142	24	6-67	129:129	8.4	4.8-13
Ga, ppm	142:142	13	6-20	1:129	---	
La, ppm	142:142	30	18-47	13:129	---	
Li, ppm	142:142	38	20-74	128:129	1.4	<0.3-8.6
Mo, ppm	90:142	3	<2-38	129:129	4.4	1.3-32
Nb, ppm	135:142	8	<4-16	0:129	---	
Nd, ppm	142:142	25	11-41	8:129	---	
Ni, ppm	142:142	22	6-54	121:129	0.8	<0.3-5.0
Pb, ppm	142:142	22	10-120	2:129	---	
Sc, ppm	142:142	8	3-12	0:129	---	
Sr, ppm	142:142	360	130-1300	129:129	160	82-420
Th, ppm	141:142	9	<4-13	2:129	---	
V, ppm	142:142	110	27-320	35:129	0.2	<0.2-1.8
Y, ppm	142:142	17	9-26	0:129	---	
Yb, ppm	124:142	2	<1-3	0:129	---	
Zn, ppm	142:142	100	28-270	129:129	28	14-67
As, ppm	142:142	8.3	3.6-13	75:128	0.06	<0.05-1.9
Se, ppm	142:142	1.4	0.1-8.6	118:128	0.33	<0.03-9.5
U, ppm	142:142	4.3	2.0-13	129:129	0.043	0.0057-0.60
Ash Yield, %				129:129	8.23	5.47-11.1

Table 9.--Summary statistics for samples of soil and alfalfa (dry-weight basis) collected from the Cretaceous Dakota Formation, Uncompahgre Project Area.

[Detection Ratio, number of samples in which the element was found in measurable concentrations to number of samples analyzed; ---, not determined]

Variable, unit of measure	Soil			Alfalfa		
	Detection Ratio	Geometric Mean	Observed Range	Detection Ratio	Geometric Mean	Observed Range
Al, %	11:11	3.9	2.4-6.5	11:11	0.0065	0.0011-0.018
Ca, %	11:11	2.9	1.4-7.6	11:11	1.8	1.4-2.6
Fe, %	11:11	1.8	1.2-5.1	11:11	0.0098	0.0062-0.024
K, %	11:11	1.0	0.56-2.1	11:11	1.4	1.1-1.8
Mg, %	11:11	5.9	0.38-0.96	11:11	0.24	0.17-0.55
Na, %	11:11	0.31	0.12-1.7	11:11	0.016	0.01-0.05
P, %	11:11	0.05	0.03-0.11	11:11	0.21	0.14-0.34
Ti, %	11:11	0.18	0.11-0.49	0:11	---	
Mn, ppm	11:11	280	130-830	11:11	21	12-28
Ba, ppm	11:11	400	120-850	11:11	12	1.6-76
Be, ppm	7:11	---	<1-1	0:11	---	
Cd, ppm	0:11	---	<2	0:11	---	
Ce, ppm	11:11	45	32-86	0:11	---	
Co, ppm	11:11	7	5-15	11:11	0.3	0.2-0.6
Cr, ppm	11:11	24	12-36	11:11	0.3	0.1-0.7
Cu, ppm	11:11	17	8-27	11:11	7.4	5.0-11
Ga, ppm	11:11	9	6-15	0:11	---	
La, ppm	11:11	26	18-47	0:11	---	
Li, ppm	11:11	30	20-39	11:11	1.4	0.6-6.1
Mo, ppm	1:11	---	<2-2	11:11	4.5	1.9-12
Nb, ppm	8:11	5	<4-12	0:11	---	
Nd, ppm	11:11	22	14-41	3:11	---	<0.6-0.9
Ni, ppm	11:11	11	9-16	11:11	0.7	0.3-1.7
Pb, ppm	11:11	19	10-47	0:11	---	
Sc, ppm	11:11	5	3-10	0:11	---	
Sr, ppm	11:11	250	150-520	11:11	180	100-420
Th, ppm	11:11	7	4-12	0:11	---	
V, ppm	11:11	47	30-140	2:11	---	<0.3-0.6
Y, ppm	11:11	13	9-21	0:11	---	
Yb, ppm	8:11	1	<1-2	0:11	---	
Zn, ppm	11:11	64	33-120	11:11	23	16-56
As, ppm	11:11	7.5	6.0-9.9	4:11	0.04	<0.05-0.11
Se, ppm	11:11	0.5	0.3-0.6	10:11	0.12	<0.03-0.69
U, ppm	11:11	2.7	2.1-3.9	11:11	0.018	0.008-0.039
Ash Yield, %				11:11	8.3	6.86-11.1

Table 10.--Summary statistics for samples ofsoil and alfalfa (dry-weight basis) collected from the Cretaceous Mancos Formation, Uncompahgre Project Area.

[Detection Ratio, number of samples in which the element was found in measurable concentrations to number of samples analyzed; ---, not determined]

Variable, unit of measure	Soil			Alfalfa		
	Detection Ratio	Geometric Mean	Observed Range	Detection Ratio	Geometric Mean	Observed Range
Al, %	43:43	5.8	3.8-8.0	35:35	0.010	0.0025-0.041
Ca, %	43:43	8.0	0.51-18	35:35	1.6	0.56-2.9
Fe, %	43:43	2.4	1.7-3.2	35:35	0.011	0.0056-0.032
K, %	43:43	1.6	0.83-2.0	35:35	1.5	0.75-2.4
Mg, %	43:43	1.3	0.64-2.2	35:35	0.19	0.14-0.65
Na, %	43:43	0.46	0.17-1.3	35:35	0.03	0.01-0.18
P, %	43:43	0.09	0.05-0.13	35:35	0.24	0.14-0.46
Ti, %	43:43	0.23	0.15-0.33	7:35	---	<0.0010-0.0027
Mn, ppm	43:43	210	93-500	35:35	14	6.9-26
Ba, ppm	43:43	170	32-730	35:35	3.8	0.8-48
Be, ppm	42:43	1	<1-2	0:35	---	
Cd, ppm	9:43	1	<2-4	0:35	---	
Ce, ppm	43:43	48	34-73	0:35	---	
Co, ppm	43:43	10	7-17	34:35	0.3	<0.1-0.7
Cr, ppm	43:43	58	34-82	34:35	0.4	<0.2-0.8
Cu, ppm	43:43	23	10-67	35:35	8.5	5.4-12
Ga, ppm	43:43	14	9-20	0:35	---	
La, ppm	43:43	28	20-39	7:35	---	<0.2-1.0
Li, ppm	43:43	42	28-74	35:35	1.8	0.4-8.6
Mo, ppm	35:43	5	<2-38	35:35	5.3	1.8-17
Nb, ppm	43:43	9	6-16	0:35	---	
Nd, ppm	43:43	24	11-33	0:35	---	
Ni, ppm	43:43	30	17-54	34:35	1.2	<0.4-3.0
Pb, ppm	43:43	18	11-120	0:35	---	
Sc, ppm	43:43	8	6-12	0:35	---	
Sr, ppm	43:43	450	130-1300	35:35	180	110-290
Th, ppm	42:43	8	<4-13	0:35	---	
V, ppm	43:43	145	80-320	11:35	0.4	<0.2-1.8
Y, ppm	43:43	17	11-21	0:35	---	
Yb, ppm	30:43	2	<1-3	0:35	---	
Zn, ppm	43:43	100	68-270	35:35	29	16-61
As, ppm	43:43	8.9	5.1-13	22:35	0.07	<0.05-1.9
Se, ppm	43:43	2.2	0.3-7.5	31:35	0.28	<0.03-1.6
U, ppm	43:43	5.3	3.4-13	35:35	0.031	0.006-0.43
Ash Yield, %				35:35	8.3	5.78-10.7

Table 11.--Summary statistics for samples of soil and alfalfa (dry-weight basis) collected from the Quaternary Alluvium, Mancos Formation Derived, Uncompahgre Project Area.

[Detection Ratio, number of samples in which the element was found in measurable concentrations to number of samples analyzed; ---, not determined]

Variable, unit of measure	Soil			Alfalfa		
	Detection Ratio	Geometric Mean	Observed Range	Detection Ratio	Geometric Mean	Observed Range
Al, %	36:36	5.7	3.1-7.6	34:34	0.011	0.0041-0.032
Ca, %	36:36	7.5	2.4-27	34:34	1.4	0.88-2.4
Fe, %	36:36	2.5	1.6-3.3	34:34	0.015	0.0061-0.35
K, %	36:36	1.7	0.88-2.2	34:34	1.4	0.81-2.1
Mg, %	36:36	1.5	0.72-2.1	34:34	0.19	0.13-0.34
Na, %	36:36	0.52	0.20-1.2	34:34	0.03	0.01-0.26
P, %	36:36	0.10	0.07-0.16	34:34	0.25	0.14-0.35
Ti, %	36:36	0.23	0.10-0.32	10:34	---	<0.001-0.0021
Mn, ppm	36:36	270	120-450	34:34	14	8.6-23
Ba, ppm	36:36	370	29-890	34:34	5.6	1.9-31
Be, ppm	34:36	1	<1-2	0:34	---	
Cd, ppm	9:36	1	<2-6	0:34	---	
Ce, ppm	36:36	50	30-63	0:34	---	
Co, ppm	36:36	10	7-12	33:34	0.3	<0.2-0.8
Cr, ppm	36:36	57	40-77	34:34	0.5	0.2-3.3
Cu, ppm	36:36	26	9-45	34:34	8.7	4.8-12
Ga, ppm	36:36	13	7-17	0:34	---	
La, ppm	36:36	29	19-36	4:34	---	<0.3-0.5
Li, ppm	36:36	40	23-53	33:34	1.4	<0.3-6.4
Mo, ppm	34:36	5	<2-19	34:34	5.0	1.6-32
Nb, ppm	35:36	7	<4-14	0:34	---	
Nd, ppm	36:36	26	18-30	3:34	---	<0.3-1.7
Ni, ppm	36:36	30	16-44	34:34	1.0	0.3-3.5
Pb, ppm	36:36	22	11-79	0:34	---	
Sc, ppm	36:36	9	6-12	0:34	---	
Sr, ppm	36:36	330	170-1000	34:34	140	84-290
Th, ppm	36:36	9	4-13	0:34	---	
V, ppm	36:36	140	92-280	13:34	0.4	<0.3-0.7
Y, ppm	36:36	18	14-23	0:34	---	
Yb, ppm	34:36	2	<1-3	0:34	---	
Zn, ppm	36:36	110	84-130	34:34	29	14-47
As, ppm	36:36	9.3	5.6-13	18:34	0.06	<0.05-0.73
Se, ppm	36:36	2.9	0.9-8.6	30:34	0.56	<0.03-6.3
U, ppm	36:36	5.0	3.5-8.6	34:34	0.057	0.012-0.47
Ash Yield, %				34:34	7.4	5.98-9.73

Table 12.--Summary statistics for samples of soil and alfalfa (dry-weight basis) collected from the Quaternary Alluvium, Recent Deposits, Uncompahgre Project Area.

[Detection Ratio, number of samples in which the element was found in measurable concentrations to number of samples analyzed; ---, not determined]

Variable, unit of measure	Soil			Alfalfa		
	Detection Ratio	Geometric Mean	Observed Range	Detection Ratio	Geometric Mean	Observed Range
Al, %	23:23	6.4	2.8-7.8	22:22	0.0088	0.0023-0.040
Ca, %	23:23	3.7	1.1-8.9	22:22	1.4	0.69-2.0
Fe, %	23:23	2.9	1.2-4.3	22:22	0.011	0.0040-0.031
K, %	23:23	1.9	1.1-2.3	22:22	1.6	0.93-2.4
Mg, %	23:23	1.0	0.48-1.5	22:22	0.18	0.15-0.32
Na, %	23:23	0.99	0.27-2.1	22:22	0.024	0.01-0.13
P, %	23:23	0.09	0.03-0.14	22:22	0.25	0.18-0.38
Ti, %	23:23	0.30	0.13-0.42	4:22	---	<0.0010-0.0025
Mn, ppm	23:23	560	280-890	22:22	16	8.4-23
Ba, ppm	23:23	630	190-1000	22:22	4.7	0.8-16
Be, ppm	22:23	1	<1-1	0:22	---	
Cd, ppm	1:23	---	<2-3	0:22	---	
Ce, ppm	23:23	62	32-75	0:22	---	
Co, ppm	23:23	11	5-15	22:22	0.2	0.1-0.4
Cr, ppm	23:23	31	15-72	22:22	0.3	0.2-0.6
Cu, ppm	23:23	22	8-46	22:22	8.0	6.0-11
Ga, ppm	23:23	15	6-19	0:22	---	
La, ppm	23:23	35	19-40	0:22	---	
Li, ppm	23:23	34	20-59	22:22	1.3	0.3-5.6
Mo, ppm	7:23	1	<2-12	22:22	3.7	1.3-14
Nb, ppm	23:23	9	4-14	0:22	---	
Nd, ppm	23:23	29	17-34	0:22	---	
Ni, ppm	23:23	15	6-39	20:22	0.6	<0.4-1.8
Pb, ppm	23:23	26	12-78	0:22	---	
Sc, ppm	23:23	8	3-11	0:22	---	
Sr, ppm	23:23	420	180-710	22:22	130	82-200
Th, ppm	23:23	9	4-12	0:22	---	
V, ppm	23:23	93	27-260	3:22	---	<0.2-0.7
Y, ppm	23:23	18	12-22	0:22	---	
Yb, ppm	21:23	2	<1-3	0:22	---	
Zn, ppm	23:23	98	28-190	22:22	25	17-37
As, ppm	23:23	5.8	3.6-10	10:22	0.05	<0.05-0.14
Se, ppm	23:23	0.6	0.1-2.9	21:22	0.48	<0.03-9.5
U, ppm	23:23	3.5	2.0-7.6	22:22	0.031	0.013-0.67
Ash Yield, %				22:22	8.0	5.47-9.98

Table 13.--Summary statistics for samples of soil and alfalfa (dry-weight basis) collected from the Quaternary Alluvium, Tertiary Deposits Derived, Uncompahgre Project Area.

[Detection Ratio, number of samples in which the element was found in measurable concentrations to number of samples analyzed; ---, not determined]

Variable, unit of measure	Soil			Alfalfa		
	Detection Ratio	Geometric Mean	Observed Range	Detection Ratio	Geometric Mean	Observed Range
Al, %	28:28	5.4	2.7-6.8	26:26	0.0087	0.0025-0.0440
Ca, %	28:28	5.7	2.1-11	26:26	1.8	1.4-2.4
Fe, %	28:28	2.5	1.3-3.3	26:26	0.013	0.0051-0.77
K, %	28:28	1.5	0.75-2.1	26:26	1.4	0.96-2.1
Mg, %	28:28	0.99	0.50-1.3	26:26	0.20	0.16-0.34
Na, %	28:28	0.58	0.21-1.0	26:26	0.03	0.01-0.17
P, %	28:28	0.08	0.04-0.12	26:26	0.28	0.21-0.35
Ti, %	28:28	0.24	0.13-0.33	6:26	---	<0.0010-0.0026
Mn, ppm	28:28	410	200-640	26:26	21	13-50
Ba, ppm	28:28	610	61-1400	26:26	8.0	2.9-24
Be, ppm	25:28	1	<1-2	0:26	---	
Cd, ppm	1:28		<2-2	0:26	---	
Ce, ppm	28:28	56	31-70	0:26	---	
Co, ppm	28:28	10	6-16	26:26	0.3	0.2-2.0
Cr, ppm	28:28	37	19-61	24:26	0.4	<0.2-7.2
Cu, ppm	28:28	25	6-40	26:26	8.8	6.7-13
Ga, ppm	28:28	13	6-18	0:26	---	
La, ppm	28:28	33	19-40	2:26	---	<0.3-0.4
Li, ppm	28:28	37	22-47	26:26	1.1	0.5-3.4
Mo, ppm	13:28	2	<2-20	26:26	3.3	1.8-5.5
Nb, ppm	25:28	7	<4-13	0:26	---	
Nd, ppm	28:28	26	13-34	1:26	---	
Ni, ppm	28:28	19	9-49	21:26	0.6	<0.3-5.0
Pb, ppm	28:28	30	14-66	0:26	---	
Sc, ppm	28:28	8	4-10	0:26	---	
Sr, ppm	28:28	320	210-660	26:26	160	100-370
Th, ppm	28:28	9	6-12	0:26	---	
V, ppm	28:28	89	40-480	6:26	---	<0.3-0.7
Y, ppm	28:28	17	9-26	0:26	---	
Yb, ppm	25:28	2	<1-3	0:26	---	
Zn, ppm	28:28	100	46-170	26:26	29	20-67
As, ppm	28:28	8.7	6.0-11	21:26	0.09	<0.05-0.31
Se, ppm	28:28	1.0	0.4-3.4	25:26	0.25	<0.03-1.8
U, ppm	28:28	3.6	2.0-7.4	26:26	0.033	0.012-0.085
Ash Yield, %				26:26	8.5	7.35-10.3

Table 14.--Listing of the geometric means by geologic unit parent material for the soils collected at the Uncompahgre Project Area.

Variable, unit of measure	All Samples	Dakota Sandstone	Mancos Shale	Alluvium, Mancos	Alluvium, Recent	Alluvium, Tertiary
Al, %	5.6	3.9	5.8	5.7	6.4	5.4
Ca, %	5.9	2.9	8.0	7.5	3.7	5.7
Fe, %	2.5	1.8	2.4	2.5	2.9	2.5
K, %	1.6	1.0	1.6	1.7	1.9	1.5
Mg, %	1.1	5.9	1.3	1.5	1.0	0.99
Na, %	0.54	0.31	0.46	0.52	0.99	0.58
P, %	0.09	0.05	0.09	0.10	0.09	0.08
Ti, %	0.24	0.18	0.23	0.23	0.30	0.24
Mn, ppm	310	280	210	270	560	410
Ba, ppm	350	400	170	370	630	610
Be, ppm	1	---	1	1	1	1
Cd, ppm	3	---	1	1	---	---
Ce, ppm	52	45	48	50	62	56
Co, ppm	10	7	10	10	11	10
Cr, ppm	44	24	58	57	31	37
Cu, ppm	24	17	23	26	22	25
Ga, ppm	13	9	14	13	15	13
La, ppm	30	26	28	29	35	33
Li, ppm	38	30	42	40	34	37
Mo, ppm	3	---	5	5	1	2
Nb, ppm	8	5	9	7	9	7
Nd, ppm	25	22	24	26	29	26
Ni, ppm	22	11	30	30	15	19
Pb, ppm	22	19	18	22	26	30
Sc, ppm	8	5	8	9	8	8
Sr, ppm	360	250	450	330	420	320
Th, ppm	9	7	8	9	9	9
V, ppm	110	47	145	140	93	89
Y, ppm	17	13	17	18	18	17
Yb, ppm	2	1	2	2	2	2
Zn, ppm	100	64	100	110	98	100
As, ppm	8.3	7.5	8.9	9.3	5.8	8.7
Se, ppm	1.4	0.5	2.2	2.9	0.6	1.0
U, ppm	4.3	2.7	5.3	5.0	3.5	3.6

Table 15.--Listing of the geometric means by geologic unit parent material for the alfalfa (dry-weight basis) collected at the Uncompahgre Project Area.

Variable, unit of measure	All Samples	Dakota Sandstone	Mancos Shale	Alluvium, Mancos	Alluvium, Recent	Alluvium, Tertiary
Al, %	0.0094	0.0065	0.010	0.011	0.0088	0.0087
Ca, %	1.6	1.8	1.6	1.4	1.4	1.8
Fe, %	0.012	0.0098	0.011	0.015	0.011	0.013
K, %	1.4	1.4	1.5	1.4	1.6	1.4
Mg, %	0.21	0.24	0.19	0.19	0.18	0.20
Na, %	0.026	0.016	0.03	0.03	0.024	0.03
P, %	0.25	0.21	0.24	0.25	0.25	0.28
Mn, ppm	16	21	14	14	16	21
Ba, ppm	5.7	12	3.8	5.6	4.7	8.0
Co, ppm	0.3	0.3	0.3	0.3	0.2	0.3
Cr, ppm	0.4	0.3	0.4	0.5	0.3	0.4
Cu, ppm	8.4	7.4	8.5	8.7	8.0	8.8
Li, ppm	1.4	1.4	1.8	1.4	1.3	1.1
Mo, ppm	4.4	4.5	5.3	5.0	3.7	3.3
Ni, ppm	0.8	0.7	1.2	1.0	0.6	0.6
Sr, ppm	160	180	180	140	130	160
V, ppm	0.2	---	0.4	0.4	---	---
Zn, ppm	28	23	29	29	25	29
As, ppm	0.06	0.04	0.07	0.06	0.05	0.09
Se, ppm	0.33	0.12	0.28	0.56	0.48	0.25
U, ppm	0.043	0.018	0.068	0.057	0.031	0.033
Ash Yield, %	8.2	8.3	8.3	7.4	8.0	8.5

Explanation of the Appendices

For each of the samples media (no designation for matrix in the sample ID):

Positions 1, 2: Parent Geologic Unit:

- KM - Cretaceous Mancos Shale
- KD - Cretaceous Dakota Sandstone
- QM - Quaternary Alluvium derived from the Cretaceous Mancos Shale
- QD - Quaternary Alluvium derived from the Cretaceous Dakota Sandstone
- QR - Quaternary Alluvium derived from the Recent deposits
- QT - Quaternary Alluvium derived from the terrace gravels

Positions 3, 4: Township number (01 - 15). See table 1 and figure 3 for township and range for exact location.

Position 5: Sample within a township (1 - 3, and one a 4 for Km, Township 4).

Position 6: Field within a Section replicate (1 - 2).

Position 7: Analytical split (1 - 2).

Table A1.--Listing of analytical results for soils collected from the Uncompahgre Project Area.

Sample	Latitude	Longitude	Al, %	Ca, %	Fe, %	K, %	Mg, %	Na, %	P, %	Ti, %
					Cretaceous Dakota Formation					
KD07111	383609	1075849	6.5	2.6	5.1	2.1	0.96	1.7	0.11	0.49
KD07211	383506	1075751	4.7	4.5	1.7	0.93	0.47	0.23	0.06	0.21
KD07212	383506	1075751	4.8	4.5	1.7	0.95	0.48	0.23	0.06	0.21
KD07311	383710	1075935	2.4	7.6	1.3	0.61	0.66	0.19	0.04	0.12
KD07321	383705	1075936	3.8	2.2	1.6	0.98	0.60	0.29	0.03	0.18
KD07322	383705	1075936	3.8	2.3	1.6	1.0	0.62	0.30	0.04	0.18
KD10111	382912	1075936	5.4	3.9	2.1	1.4	0.83	0.36	0.07	0.21
KD10211	382800	1075711	3.3	1.4	1.4	0.87	0.48	0.27	0.05	0.14
KD10311	382832	1075805	3.1	5.2	1.2	0.78	0.51	0.17	0.05	0.14
KD13111	382553	1075825	4 0	1.7	1.5	1.2	0.56	0.35	0.05	0.21
KD13211	382717	1075616	4.2	2.4	1.7	1.1	0.62	0.37	0.05	0.19
KD13221	382724	1075616	2.9	2.9	1.6	0.56	0.38	0.12	0.04	0.11
KD13311	382528	1075500	4.7	1.6	1.8	1.4	0.62	0.46	0.06	0.21
					Cretaceous Mancos Formation					
KM01111	384353	1080632	6.4	5.9	3.2	1.7	1.3	1.0	0.08	0.31
KM01211	384156	1080724	5.5	8.9	2.5	1.1	0.94	0.38	0.07	0.22
KM01311	384346	1080828	5.7	8.5	2.7	1.5	0.90	0.71	0.08	0.25
KM02111	384156	1080020	5.6	13	2.5	1.8	1.5	0.31	0.13	0.22
KM02112	384156	1080020	5.5	13	2.4	1.7	1.5	0.30	0.13	0.21
KM02211	384326	1080021	5.7	9.5	2.2	1.8	1.6	0.33	0.10	0.22
KM02311	384436	1075854	5.8	8.9	2.2	1.9	1.6	0.41	0.11	0.22
KM03111	384239	1075623	4.3	17	1.7	1.2	0.89	0.27	0.08	0.15
KM03112	384239	1075623	4.3	17	1.6	1.2	0.88	0.27	0.07	0.15
KM03211	384328	1075630	6.2	12	2.2	1.9	1.6	0.34	0.10	0.23
KM03311	384338	1075620	5.6	13	2.1	1.7	1.5	0.36	0.10	0.21
KM03321	384337	1075629	4.9	15	1.9	1.4	1.1	0.35	0.09	0.16
KM04111	384138	1080649	4.6	16	2.0	0.83	0.64	0.17	0.05	0.16
KM04211	384138	1080700	6.5	12	2.8	1.3	0.82	0.55	0.09	0.26
KM04311	384148	1080739	6.4	3.1	2.5	1.8	1.1	0.51	0.08	0.25
KM04411	384149	1080717	5.8	11	2.5	1.1	0.75	0.26	0.07	0.24
KM05111	384009	1075731	5.3	14	2.9	1.5	1.1	0.34	0.10	0.18
KM05211	384010	1075817	5.4	10	2.2	1.6	1.5	0.41	0.09	0.22
KM05221	384010	1075817	5.9	12	2.3	1.9	1.6	0.44	0.11	0.22
KM05311	384049	1075805	5.5	18	2.3	1.1	1.4	0.21	0.07	0.20
KM06111	384112	1075352	6.6	0.5	3.0	2.1	1.2	1.3	0.07	0.29
KM06211	384148	1075403	8.0	3.7	2.8	2.2	1.3	0.65	0.10	0.33
KM06311	383822	1075541	4.9	13	2.4	1.6	1.3	0.43	0.12	0.18
KM08111	383309	1075855	5.7	8.5	2.8	1.8	0.97	0.91	0.09	0.24
KM08211	383412	1075622	5.3	13	2.2	1.7	1.4	0.32	0.12	0.22
KM08311	383556	1075343	5.9	11	3.2	1.6	0.94	0.63	0.08	0.26
KM08312	383556	1075343	6.1	11	3.2	1.7	0.94	0.68	0.08	0.26
KM09111	383715	1075528	5.8	7.5	2.3	1.8	2.0	0.37	0.13	0.24
KM09211	383543	1075350	6.2	7.9	2.4	1.8	2.0	0.54	0.11	0.24
KM09212	383543	1075350	6.2	7.8	2.4	1.8	2.0	0.54	0.11	0.24
KM09311	383307	1075444	5.2	11	1.9	1.7	2.1	0.32	0.09	0.19
KM10111	383139	1075819	6.8	1.9	2.5	2.1	1.1	0.77	0.08	0.26

Table A1.--Listing of analytical results for soils collected from the Uncompahgre Project Area (continued).

Sample	Latitude	Longitude	Al, %	Ca, %	Fe, %	K, %	Mg, %	Na, %	P, %	Ti, %
					Cretaceous Mancos Formation (continued)					
KM10211	383004	1075706	6.5	8.1	3.1	1.3	0.80	0.23	0.10	0.26
KM10311	383120	1075918	7.1	1.9	2.6	2.2	1.4	0.62	0.06	0.31
KM11111	383127	1075156	5.9	8.8	2.4	1.7	1.5	0.44	0.09	0.22
KM11211	383055	1074937	4.8	10	1.9	1.4	1.7	0.52	0.07	0.18
KM11311	382825	1074913	6.8	6.1	2.7	1.8	2.0	0.51	0.09	0.28
KM12111	382747	1074624	6.0	7.4	2.0	1.8	1.9	0.48	0.10	0.22
KM12211	382836	1074603	7.0	4.5	2.7	1.8	2.1	0.62	0.08	0.30
KM12311	382905	1074806	5.6	8.4	2.1	1.6	2.2	0.37	0.08	0.23
KM14111	382521	1075404	5.5	5.4	2.7	1.4	0.87	0.53	0.07	0.26
KM14211	382244	1074746	6.1	6.4	3.0	1.8	1.2	0.82	0.09	0.29
KM14311	382632	1075136	3.8	14	2.0	1.0	0.78	0.45	0.06	0.17
KM15111	382714	1074619	6.9	5.2	2.4	2.0	2.0	0.82	0.10	0.28
KM15211	382534	1074802	6.7	7.9	2.5	1.9	1.7	0.60	0.09	0.24
KM15212	382534	1074802	6.7	7.7	2.5	1.9	1.7	0.63	0.09	0.23
KM15221	382532	1074807	6.4	7.8	2.3	1.8	1.5	0.56	0.08	0.23
KM15311	382449	1074709	5.9	11	2.4	1.7	1.5	0.38	0.09	0.22
					Quaternary Alluvium, Dakota Formation Derived					
QD13111	382547	1075748	5.3	1.3	2.0	1.4	0.56	0.32	0.05	0.21
					Quaternary Alluvium, Mancos Formation Derived					
QM01111	384607	1080421	4.2	17	1.8	1.3	1.2	0.37	0.08	0.16
QM01211	384342	1080409	6.1	7.3	2.6	1.9	1.5	0.63	0.11	0.26
QM01311	384403	1080822	6.3	7.8	2.9	1.6	1.1	0.55	0.11	0.25
QM02111	384245	1080307	6.0	8.2	2.7	1.8	1.5	0.65	0.12	0.25
QM02211	384540	1075918	6.0	9.6	2.5	1.9	1.5	0.48	0.14	0.24
QM02311	384553	1075730	6.0	6.2	2.8	1.9	1.3	0.73	0.10	0.28
QM03111	384621	1075632	6.3	4.1	2.6	2.2	0.95	1.2	0.09	0.27
QM03211	384540	1075605	6.0	5.5	2.5	1.5	1.0	0.37	0.08	0.22
QM03221	384540	1075605	5.2	9.5	2.5	1.4	1.1	0.37	0.11	0.20
QM03311	384450	1075555	5.7	12	2.9	1.7	1.4	0.40	0.16	0.21
QM05111	383913	1075805	6.1	7.9	3.3	1.8	1.8	0.51	0.10	0.24
QM05211	384055	1080003	5.7	10	2.7	1.7	1.5	0.59	0.11	0.23
QM05311	384134	1080101	6.2	8.6	2.5	2.0	1.7	0.62	0.11	0.24
QM08111	383748	1075700	5.7	7.3	2.4	1.8	2.0	0.43	0.12	0.23
QM08211	383646	1075552	5.0	12	2.3	1.4	1.2	0.32	0.08	0.20
QM08311	383516	1075624	4.5	13	1.9	1.4	1.2	0.41	0.09	0.15
QM09111	383512	1075404	5.5	6.3	2.5	1.7	2.1	0.44	0.11	0.23
QM09211	383522	1075528	6.4	5.8	2.5	2.0	2.1	0.64	0.11	0.27
QM09212	383522	1075528	6.5	5.9	2.5	2.0	2.1	0.65	0.11	0.27
QM09311	383411	1075405	5.8	5.6	2.4	1.8	1.9	0.46	0.09	0.25
QM10111	383135	1075615	6.5	5.7	2.6	2.0	1.9	0.52	0.10	0.28
QM10211	383235	1075707	5.4	8.5	2.4	1.8	1.5	0.54	0.11	0.21
QM10311	383156	1075713	7.6	4.7	2.8	2.1	1.6	0.65	0.11	0.32
QM11111	383206	1075307	4.9	17	2.1	1.4	1.2	0.30	0.08	0.17

Table A1.--Listing of analytical results for soils collected from the Uncompahgre Project Area (continued).

Sample	Latitude	Longitude	Al, %	Ca, %	Fe, %	K, %	Mg, %	Na, %	P, %	Ti, %
				Quaternary Alluvium, Mancos Formation Derived (continued)						
QM11211	383027	1075032	5.3	5.5	2.4	1.6	2.0	0.53	0.10	0.23
QM11311	382940	1075052	5.1	15	2.2	1.4	1.1	0.38	0.08	0.19
QM12111	382857	1074602	5.6	2.7	2.7	1.8	1.1	0.72	0.08	0.25
QM12121	382857	1074557	6.3	2.4	2.8	1.9	1.3	0.69	0.08	0.27
QM12211	382740	1074633	6.7	5.4	2.6	1.9	2.1	0.50	0.10	0.27
QM12212	382740	1074633	6.6	5.3	2.6	1.8	2.0	0.50	0.10	0.30
QM12311	382910	1074458	6.0	2.5	2.7	1.9	1.2	0.66	0.09	0.25
QM14111	382536	1075012	5.6	9.2	2.5	1.7	1.4	0.58	0.11	0.23
QM14211	382652	1074854	3.1	27	1.6	0.88	0.72	0.20	0.07	0.10
QM14311	382705	1074938	5.7	8.8	2.6	1.7	2.0	0.89	0.10	0.22
QM14321	382705	1074926	5.6	6.4	2.8	1.6	1.7	0.87	0.09	0.23
QM15111	382703	1074749	5.6	7.4	2.7	1.6	1.7	0.56	0.09	0.23
QM15211	382658	1074651	6.0	5.7	2.6	1.7	1.8	0.49	0.09	0.24
QM15311	382538	1074740	6.7	7.7	2.8	2.0	1.7	0.52	0.10	0.24
				Quaternary Alluvium, Recent Deposits						
QR01111	384220	1080354	5.5	3.9	2.1	1.6	0.92	0.47	0.07	0.24
QR01112	384220	1080354	5.6	3.8	2.0	1.7	0.92	0.49	0.07	0.23
QR01211	384457	1080529	6.6	4.3	3.2	1.9	1.1	1.4	0.14	0.34
QR01311	384405	1080947	2.8	2.5	1.2	1.1	0.48	0.27	0.03	0.13
QR02111	384630	1080133	5.8	5.9	2.3	1.4	0.92	0.47	0.05	0.24
QR02121	384630	1080124	6.8	2.5	3.9	2.2	0.89	1.7	0.10	0.42
QR02211	384614	1080026	6.6	3.5	3.2	2.1	1.0	1.5	0.10	0.33
QR02311	384604	1080210	7.0	2.7	3.0	2.2	0.94	1.6	0.12	0.31
QR05111	384149	1080229	6.9	5.2	3.4	1.9	1.3	1.2	0.12	0.35
QR05211	384044	1080027	6.3	5.7	3.3	1.8	1.4	1.3	0.11	0.33
QR05311	383828	1075959	7.2	4.3	3.4	2.1	1.3	1.3	0.13	0.34
QR08111	383737	1080005	6.2	6.1	2.7	2.1	1.4	0.79	0.10	0.27
QR08211	383506	1075846	7.2	3.2	4.2	2.1	0.84	2.0	0.10	0.40
QR08311	383323	1075825	7.4	4.4	3.6	2.2	1.2	1.5	0.13	0.36
QR08321	383329	1075826	7.5	3.9	3.5	2.2	1.3	1.4	0.13	0.35
QR10111	383134	1075657	7.2	2.5	4.3	2.3	0.68	2.1	0.10	0.39
QR10211	383206	1075756	4.9	1.1	1.8	1.5	0.64	0.40	0.06	0.21
QR10311	383229	1075806	7.2	2.9	3.4	2.0	1.1	1.1	0.11	0.33
QR11111	383017	1075506	5.8	5.0	2.2	1.9	1.2	0.46	0.07	0.26
QR11211	382906	1075411	5.4	2.4	2.2	1.6	0.78	0.49	0.07	0.22
QR11311	382932	1075409	7.5	3.3	3.2	2.2	1.1	1.4	0.11	0.33
QR14111	382337	1074906	6.9	8.9	2.6	2.0	1.5	0.49	0.11	0.27
QR14211	382237	1074826	7.8	3.0	3.6	2.2	0.84	2.1	0.11	0.37
QR14311	382549	1075117	7.3	5.5	3.1	2.2	1.3	1.1	0.12	0.30

Table A1.--Listing of analytical results for soils collected from the Uncompahgre Project Area (continued).

Sample	Latitude	Longitude	Al, %	Ca, %	Fe, %	K, %	Mg, %	Na, %	P, %	Ti, %
Quaternary Alluvium, Tertiary Deposits Derived										
QT01111	384214	1080617	6.4	7.4	2.8	1.7	1.2	0.78	0.09	0.30
QT01112	384214	1080617	6.5	7.4	2.8	1.8	1.2	0.83	0.09	0.27
QT01211	384325	1080903	6.8	5.2	3.0	2.0	1.2	0.91	0.09	0.30
QT01311	384256	1080453	6.5	5.0	3.0	2.0	1.2	0.75	0.08	0.30
QT02111	384344	1080207	6.3	5.5	3.3	1.8	1.1	0.99	0.07	0.33
QT02211	384338	1080057	6.4	6.5	2.9	1.8	1.3	0.70	0.09	0.29
QT02311	384434	1080220	5.7	7.2	2.6	2.1	1.0	1.0	0.07	0.27
QT02312	384434	1080220	5.6	7.0	2.6	2.1	1.0	1.0	0.07	0.26
QT02321	384431	1080221	6.5	4.8	3.0	2.1	1.3	1.0	0.10	0.31
QT04111	384010	1080552	5.7	8.9	2.7	1.2	1.1	0.40	0.12	0.23
QT04211	384020	1080817	3.8	11	1.9	0.93	0.91	0.31	0.05	0.16
QT04311	384139	1080541	6.0	5.9	2.8	1.7	1.2	0.71	0.08	0.28
QT04321	384138	1080535	5.6	10	2.5	1.5	1.1	0.64	0.08	0.24
QT05111	383835	1080213	5.6	6.6	2.5	1.6	1.0	0.68	0.07	0.24
QT05211	384041	1080116	5.0	5.9	2.4	1.5	0.87	0.67	0.07	0.22
QT05311	384133	1080217	6.0	5.2	2.8	1.8	1.1	0.72	0.10	0.27
QT06111	383954	1075410	6.1	8.5	2.6	1.8	1.3	0.41	0.11	0.25
QT06211	384101	1075359	5.3	2.1	2.0	1.3	0.72	0.32	0.06	0.22
QT06212	384101	1075359	5.2	2.2	2.0	1.3	0.72	0.31	0.06	0.23
QT06311	384141	1075358	4.0	2.2	1.8	0.91	0.50	0.21	0.05	0.16
QT07111	383350	1075615	3.6	5.4	1.6	0.92	0.64	0.30	0.05	0.15
QT07211	383528	1075516	2.7	9.7	1.3	0.75	0.64	0.25	0.04	0.13
QT07311	383711	1075828	6.0	9.2	2.7	1.7	1.2	0.89	0.08	0.25
QT08111	383254	1075705	6.3	6.3	3.0	1.8	1.3	0.83	0.10	0.29
QT08121	383300	1075704	6.0	6.1	3.0	1.7	1.3	0.78	0.10	0.29
QT08211	383347	1075359	5.5	3.9	2.7	1.8	0.89	0.89	0.08	0.25
QT08311	383619	1075428	4.3	3.5	1.9	1.3	0.75	0.35	0.06	0.20
QT10111	383030	1075743	5.0	4.7	2.2	1.4	0.79	0.43	0.07	0.22
QT10211	382956	1075617	5.0	12	2.2	1.4	0.91	0.44	0.07	0.23
QT10212	382956	1075617	4.9	12	2.2	1.4	0.90	0.44	0.06	0.21
QT10221	382957	1075609	5.9	3.9	2.8	1.7	1.0	0.60	0.10	0.26
QT10311	382924	1075837	4.4	2.2	1.8	1.3	0.59	0.34	0.05	0.20

Table A1.--Listing of analytical results for soils collected from the Uncompahgre Project Area (continued).

Sample	Latitude	Longitude	Al, %	Ca, %	Fe, %	K, %	Mg, %	Na, %	P, %	Ti, %
					Standard Reference Material San Joaquin Soil					
SJS1			7.9	2.2	3.8	1.9	1.5	1.1	0.06	0.37
SJS1			7.8	2.2	3.8	1.9	1.5	1.1	0.06	0.35
SJS1			7.8	2.2	3.9	1.8	1.5	1.1	0.06	0.36
SJS1			7.9	2.3	3.9	1.8	1.5	1.1	0.06	0.36
SJS1			8.1	2.3	3.9	1.9	1.5	1.1	0.06	0.37
SJS1			8.1	2.3	3.9	1.9	1.5	1.1	0.06	0.37
SJS1			8.0	2.2	3.8	1.9	1.5	1.1	0.06	0.35
SJS1			7.9	2.2	3.8	1.8	1.5	1.1	0.06	0.35

Table A1.--Listing of analytical results for soils collected from the Uncompahgre Project Area (continued).

Sample	Mn, ppm	Ba, ppm	Be, ppm	Cd, ppm	Ce, ppm	Co, ppm	Cr, ppm	Cu, ppm	Ga, ppm	La, ppm
					Cretaceous Dakota Formation					
KD07111	830	850	1	<2	86	15	36	24	15	47
KD07211	250	440	1	<2	57	9	27	16	11	32
KD07212	270	440	1	<2	53	8	27	17	11	30
KD07311	130	420	<1	<2	32	6	18	17	6	18
KD07321	240	330	1	<2	46	6	29	11	9	25
KD07322	250	320	1	<2	44	6	31	12	8	25
KD10111	330	480	1	<2	52	9	33	27	13	31
KD10211	320	330	<1	<2	34	5	22	25	7	20
KD10311	260	120	<1	<2	37	6	24	23	7	21
KD13111	320	360	1	<2	47	6	27	8	8	26
KD13211	300	490	1	<2	43	7	19	25	9	25
KD13221	160	500	<1	<2	33	6	12	13	7	20
KD13311	350	450	1	<2	49	7	32	15	10	27
					Cretaceous Mancos Formation					
KM01111	500	71	1	<2	67	12	45	24	15	36
KM01211	250	51	1	<2	53	12	46	27	12	29
KM01311	290	550	1	<2	59	11	46	20	13	31
KM02111	220	130	1	<2	45	11	70	31	14	29
KM02112	220	500	1	<2	42	11	70	22	13	27
KM02211	170	110	1	<2	45	8	68	25	14	28
KM02311	220	160	1	<2	49	9	66	18	15	28
KM03111	140	32	1	4	34	7	42	24	10	21
KM03112	130	83	<1	4	32	7	58	23	10	21
KM03211	180	470	1	4	47	9	74	27	14	29
KM03311	200	110	1	4	42	8	72	17	12	26
KM03321	230	530	1	4	42	9	55	24	10	26
KM04111	110	160	1	<2	37	10	35	21	11	22
KM04211	140	240	1	<2	60	14	61	26	16	32
KM04311	140	130	1	<2	59	11	49	16	14	32
KM04411	150	42	1	<2	50	13	53	34	14	28
KM05111	290	450	1	<2	43	11	57	33	12	26
KM05211	210	70	1	<2	42	9	63	14	11	27
KM05221	240	490	1	<2	43	9	69	19	14	27
KM05311	220	190	1	<2	55	10	53	30	13	31
KM06111	93	300	2	<2	63	8	56	11	15	31
KM06211	200	360	2	<2	73	10	72	24	20	39
KM06311	260	580	1	<2	43	11	50	22	11	26
KM08111	390	730	1	<2	51	10	34	26	13	30
KM08211	240	150	1	<2	42	11	67	26	14	28
KM08311	340	540	1	<2	56	11	36	33	13	32
KM08312	350	630	1	<2	51	12	49	24	14	31
KM09111	230	120	1	<2	44	9	72	23	15	28
KM09211	230	82	2	2	47	9	80	20	15	28
KM09212	230	170	1	2	44	8	96	24	14	27
KM09311	170	54	1	3	42	7	73	15	12	25
KM10111	100	310	2	<2	56	10	54	10	15	32

Table A1.--Listing of analytical results for soils collected from the Uncompahgre Project Area (continued).

Sample	Mn, ppm	Ba, ppm	Be, ppm	Cd, ppm	Ce, ppm	Co, ppm	Cr, ppm	Cu, ppm	Ga, ppm	La, ppm
					Cretaceous Mancos Formation (continued)					
KM10211	130	55	1	<2	61	17	56	31	14	33
KM10311	150	64	2	<2	58	8	58	22	16	32
KM11111	450	330	1	3	41	10	62	67	14	26
KM11211	170	120	1	<2	34	7	54	17	11	20
KM11311	260	34	1	<2	51	10	67	30	17	29
KM12111	190	360	1	<2	40	8	82	20	14	26
KM12211	210	73	2	<2	59	10	74	18	17	33
KM12311	180	43	1	<2	44	8	60	19	14	26
KM14111	370	500	1	<2	58	9	36	20	12	33
KM14211	470	700	1	<2	57	10	48	38	14	34
KM14311	240	46	<1	<2	37	7	35	18	9	21
KM15111	210	390	2	<2	51	10	79	23	17	30
KM15211	170	110	1	2	43	9	78	31	15	27
KM15212	170	400	1	3	41	9	82	25	16	26
KM15221	160	300	1	2	39	10	76	26	15	24
KM15311	210	490	1	<2	44	9	64	31	14	27
					Quaternary Alluvium, Dakota Formation Derived					
QD13111	410	460	1	<2	54	7	30	15	12	31
					Quaternary Alluvium, Mancos Formation Derived					
QM01111	220	350	<1	5	35	8	43	25	10	23
QM01211	410	530	1	<2	57	10	57	33	14	34
QM01311	240	92	1	<2	63	11	54	23	15	33
QM02111	380	550	1	<2	55	11	48	28	16	32
QM02211	270	230	1	<2	52	10	64	19	14	32
QM02311	380	580	1	<2	63	11	54	26	15	34
QM03111	450	660	2	<2	63	10	40	9	13	36
QM03211	230	440	1	<2	55	10	48	21	14	30
QM03221	240	520	1	<2	49	10	46	21	12	29
QM03311	260	550	1	<2	56	12	45	36	13	33
QM05111	300	480	1	<2	50	10	65	36	14	30
QM05211	370	570	1	<2	48	11	57	29	13	28
QM05311	320	510	1	<2	46	11	67	25	14	29
QM08111	220	320	1	<2	47	9	47	30	14	28
QM08211	180	29	1	3	39	9	62	22	11	22
QM08311	200	400	1	2	38	7	53	22	10	23
QM09111	250	470	1	<2	50	9	71	26	12	29
QM09211	240	390	1	<2	59	10	71	28	15	32
QM09212	240	270	1	<2	58	9	72	21	15	34
QM09311	260	440	1	<2	55	9	61	20	14	31
QM10111	270	460	2	<2	60	10	58	30	15	33
QM10211	300	530	1	<2	50	9	57	27	12	30
QM10311	380	530	2	<2	60	11	72	34	17	36
QM11111	170	200	1	3	38	8	56	31	11	24

Table A1.--Listing of analytical results for soils collected from the Uncompahgre Project Area (continued).

Sample	Mn, ppm	Ba, ppm	Be, ppm	Cd, ppm	Ce, ppm	Co, ppm	Cr, ppm	Cu, ppm	Ga, ppm	La, ppm
				Quaternary Alluvium, Mancos Formation Derived (continued)						
QM11211	260	480	1	<2	52	9	62	31	12	28
QM11311	370	650	1	3	42	8	53	45	12	26
QM12111	380	690	1	<2	55	11	54	29	13	30
QM12121	350	610	2	<2	57	10	58	24	14	33
QM12211	260	470	1	<2	56	10	77	25	16	31
QM12212	260	460	2	<2	56	10	76	24	15	33
QM12311	390	600	1	<2	55	11	54	24	14	32
QM14111	360	500	1	<2	53	10	59	25	13	32
QM14211	120	380	<1	6	30	7	40	35	7	19
QM14311	210	89	1	3	46	9	68	25	13	28
QM14321	200	140	1	2	48	10	66	31	12	28
QM15111	200	63	1	<2	51	10	67	26	13	27
QM15211	190	470	1	<2	45	10	68	24	13	27
QM15311	250	890	1	2	50	10	69	34	16	30
				Quaternary Alluvium, Recent Deposits						
QR01111	430	620	1	<2	60	9	35	22	13	32
QR01112	420	610	1	<2	55	8	35	19	12	32
QR01211	890	310	1	<2	64	12	28	46	16	37
QR01311	280	870	<1	<2	32	5	15	8	6	19
QR02111	320	990	1	<2	61	10	35	24	14	34
QR02121	700	830	1	<2	75	14	30	15	17	40
QR02211	640	780	1	<2	67	12	33	17	15	38
QR02311	560	800	1	<2	70	12	29	19	17	39
QR05111	610	690	1	<2	67	12	45	18	17	37
QR05211	540	190	1	<2	65	11	41	18	15	35
QR05311	690	730	1	<2	70	13	38	28	16	38
QR08111	550	590	1	<2	58	11	46	32	14	35
QR08211	720	930	1	<2	64	13	21	16	16	37
QR08311	750	830	1	<2	64	14	28	29	15	37
QR08321	760	230	1	<2	72	14	32	27	19	40
QR10111	750	1000	1	<2	69	12	15	20	16	40
QR10211	320	510	1	<2	47	7	29	15	11	27
QR10311	710	740	1	<2	68	15	35	31	16	38
QR11111	430	540	1	<2	60	9	44	22	13	33
QR11211	370	490	1	<2	52	8	35	16	12	29
QR11311	660	780	1	<2	68	12	29	32	17	38
QR14111	320	460	1	3	54	11	72	34	19	33
QR14211	700	970	1	<2	67	12	15	17	16	39
QR14311	760	730	1	<2	62	13	42	44	17	36

Table A1.--Listing of analytical results for soils collected from the Uncompahgre Project Area (continued).

Sample	Mn, ppm	Ba, ppm	Be, ppm	Cd, ppm	Ce, ppm	Co, ppm	Cr, ppm	Cu, ppm	Ga, ppm	La, ppm
					Quaternary Alluvium, Tertiary Deposits Derived					
QT01111	470	1000	2	<2	70	12	33	32	16	40
QT01112	480	1100	1	<2	59	12	43	28	15	35
QT01211	550	910	1	<2	65	12	42	32	15	38
QT01311	540	640	1	<2	66	11	34	35	15	39
QT02111	530	870	2	<2	69	13	44	31	18	39
QT02211	440	99	2	<2	64	11	54	26	14	37
QT02311	440	960	1	<2	66	11	40	17	13	37
QT02312	450	950	1	<2	57	10	39	19	14	34
QT02321	580	670	2	<2	68	12	46	36	15	38
QT04111	280	61	1	<2	61	13	50	34	12	32
QT04211	230	1400	<1	<2	44	9	26	18	9	27
QT04311	530	610	1	<2	68	11	44	31	14	38
QT04321	400	840	1	<2	57	10	35	32	13	33
QT05111	540	860	1	<2	54	10	36	40	13	32
QT05211	340	950	1	<2	48	10	39	30	11	29
QT05311	570	560	2	<2	66	11	48	38	13	37
QT06111	250	460	1	<2	56	11	61	16	14	34
QT06211	300	380	1	<2	58	8	36	19	13	32
QT06212	320	370	1	<2	59	8	37	19	12	32
QT06311	300	340	1	<2	42	7	22	11	9	24
QT07111	300	520	<1	<2	41	7	19	16	6	24
QT07211	200	540	<1	<2	31	6	19	6	6	19
QT07311	500	1100	1	<2	51	11	31	35	13	31
QT08111	520	730	1	<2	64	11	53	35	16	36
QT08121	530	650	1	<2	62	12	39	35	14	35
QT08211	640	800	1	<2	49	11	32	36	13	29
QT08311	370	670	1	<2	52	8	28	14	11	30
QT10111	540	820	2	2	56	16	33	38	13	32
QT10211	270	600	1	<2	54	10	37	27	12	31
QT10212	270	600	1	<2	54	10	37	27	12	31
QT10221	600	490	1	<2	65	12	47	52	12	35
QT10311	300	430	1	<2	48	6	30	23	9	27

Table A1.--Listing of analytical results for soils collected from the Uncompahgre Project Area (continued).

Sample	Mn, ppm	Ba, ppm	Be, ppm	Cd, ppm	Ce, ppm	Co, ppm	Cr, ppm	Cu, ppm	Ga, ppm	La, ppm
					Standard Reference Material San Joaquin Soil					
SJS1	520	860	1	<2	47	15	100	38	17	25
SJS1	520	880	1	<2	42	14	110	38	17	24
SJS1	540	840	1	<2	45	15	120	35	18	25
SJS1	550	610	1	<2	47	15	120	40	17	26
SJS1	530	630	1	<2	45	15	120	42	19	25
SJS1	560	890	1	<2	42	15	120	40	19	24
SJS1	530	870	1	<2	42	15	110	40	18	24
SJS1	530	860	1	<2	40	15	120	38	17	23

Table A1.--Listing of analytical results for soils collected from the Uncompahgre Project Area (continued).

Sample	Li, ppm	Mo, ppm	Nb, ppm	Nd, ppm	Ni, ppm	Pb, ppm	Sc, ppm	Sr, ppm	Th, ppm	V, ppm
					Cretaceous Dakota Formation					
KD07111	20	<2	12	41	13	16	10	430	12	140
KD07211	35	<2	6	28	11	23	6	520	9	47
KD07212	36	<2	8	27	12	25	5	520	8	47
KD07311	21	<2	<4	14	10	10	4	250	4	37
KD07321	27	<2	<4	22	11	14	5	200	8	41
KD07322	28	<2	4	19	12	16	5	200	5	42
KD10111	36	<2	8	28	16	42	7	240	8	61
KD10211	26	<2	5	18	10	47	4	170	5	37
KD10311	25	<2	5	18	15	13	4	430	5	37
KD13111	35	<2	4	20	10	14	5	150	8	38
KD13211	39	<2	5	20	10	29	5	220	8	47
KD13221	39	2	<4	16	9	11	3	190	6	30
KD13311	36	<2	6	22	12	20	6	190	8	50
					Cretaceous Mancos Formation					
KM01111	46	6	10	28	25	16	9	430	11	110
KM01211	40	17	10	23	39	26	8	490	8	140
KM01311	40	7	10	26	29	17	8	420	9	100
KM02111	52	7	9	27	38	11	9	590	8	170
KM02112	51	6	9	24	38	13	9	590	7	170
KM02211	47	7	9	24	31	12	8	1100	7	140
KM02311	41	<2	7	25	28	14	9	440	10	130
KM03111	28	9	7	14	34	11	6	700	5	250
KM03112	29	10	9	20	33	12	6	740	6	250
KM03211	47	11	9	23	39	15	9	450	10	320
KM03311	40	9	9	20	39	20	8	450	6	310
KM03321	33	9	7	26	33	18	7	590	7	220
KM04111	39	13	8	18	33	13	6	1300	6	110
KM04211	42	11	12	23	51	19	9	650	10	200
KM04311	47	2	8	26	21	13	8	310	9	80
KM04411	40	23	12	18	51	15	8	390	10	180
KM05111	45	4	8	25	37	24	8	720	8	130
KM05211	41	5	8	21	30	20	8	660	9	160
KM05221	42	11	10	25	37	13	9	720	9	210
KM05311	50	2	8	21	31	16	7	880	11	94
KM06111	38	<2	11	26	18	22	9	130	12	85
KM06211	74	<2	16	33	29	13	12	250	13	110
KM06311	33	7	8	26	33	16	8	530	7	130
KM08111	31	<2	7	26	17	29	8	380	8	92
KM08211	37	5	9	21	31	16	8	600	9	170
KM08311	41	2	8	28	26	16	8	480	9	120
KM08312	43	2	9	27	27	19	9	490	9	120
KM09111	43	5	9	22	26	24	9	460	10	180
KM09211	44	6	7	23	32	17	9	300	7	210
KM09212	45	5	10	22	32	21	9	290	8	210
KM09311	35	8	9	17	32	15	7	520	6	240
KM10111	43	<2	10	28	19	16	9	280	10	90

Table A1.--Listing of analytical results for soils collected from the Uncompahgre Project Area (continued).

Sample	Li, ppm	Mo, ppm	Nb, ppm	Nd, ppm	Ni, ppm	Pb, ppm	Sc, ppm	Sr, ppm	Th, ppm	V, ppm
					Cretaceous Mancos Formation (continued)					
KM10211	46	38	11	30	54	16	9	480	11	180
KM10311	44	<2	12	29	25	15	10	310	13	96
KM11111	45	10	9	25	30	120	9	450	7	170
KM11211	34	3	7	19	21	11	7	690	6	100
KM11311	51	10	9	28	30	15	10	440	11	170
KM12111	47	3	10	24	28	16	9	260	8	150
KM12211	51	<2	11	32	27	12	11	240	13	120
KM12311	44	3	8	22	23	11	8	490	9	130
KM14111	34	<2	7	22	17	28	8	220	8	81
KM14211	37	3	9	29	22	39	9	320	9	130
KM14311	30	6	6	11	18	30	6	920	<4	87
KM15111	48	2	11	26	29	20	11	210	9	140
KM15211	50	15	10	23	36	14	10	370	8	220
KM15212	51	15	12	22	37	17	10	380	7	220
KM15221	49	20	12	23	36	13	9	380	7	210
KM15311	44	14	7	24	35	17	9	350	8	190
					Quaternary Alluvium, Dakota Formation Derived					
QD13111	51	<2	8	24	14	19	6	180	8	47
					Quaternary Alluvium, Mancos Formation Derived					
QM01111	29	9	6	23	33	12	7	720	7	190
QM01211	42	3	6	29	28	47	9	370	12	130
QM01311	47	6	9	29	34	17	9	410	12	110
QM02111	42	4	6	29	29	37	9	390	8	140
QM02211	40	5	9	27	34	16	9	390	11	180
QM02311	37	<2	7	26	23	21	8	300	12	130
QM03111	28	2	7	28	16	23	8	330	8	92
QM03211	49	3	7	27	26	19	8	310	10	94
QM03221	41	5	7	25	31	17	7	450	7	110
QM03311	41	5	8	30	39	16	9	480	9	150
QM05111	45	4	8	26	34	23	9	340	10	140
QM05211	38	6	9	26	32	33	9	460	8	150
QM05311	46	6	10	25	33	24	9	380	8	160
QM08111	42	3	6	26	29	18	9	300	8	140
QM08211	35	9	6	18	33	22	7	410	5	190
QM08311	31	6	7	23	30	17	6	630	7	180
QM09111	39	4	9	23	27	26	9	200	7	130
QM09211	50	3	8	29	28	18	10	200	11	130
QM09212	50	2	9	31	27	18	10	210	10	140
QM09311	43	2	8	28	24	21	9	200	13	110
QM10111	49	4	<4	26	30	28	10	230	11	150
QM10211	37	5	7	26	29	30	8	340	9	140
QM10311	53	4	14	29	27	28	12	300	10	160
QM11111	38	18	8	23	34	12	8	560	5	200

Table A1.--Listing of analytical results for soils collected from the Uncompahgre Project Area (continued).

Sample	Li, ppm	Mo, ppm	Nb, ppm	Nd, ppm	Ni, ppm	Pb, ppm	Sc, ppm	Sr, ppm	Th, ppm	V, ppm
				Quaternary Alluvium, Mancos Formation Derived (continued)						
QM11211	36	3	9	25	24	25	8	200	10	100
QM11311	38	16	8	24	30	79	9	520	7	180
QM12111	39	3	7	26	24	21	9	190	8	100
QM12121	43	4	9	29	27	22	9	170	10	110
QM12211	47	<2	6	30	26	20	10	180	11	130
QM12212	46	3	7	25	26	21	11	180	12	140
QM12311	40	5	9	27	27	22	9	210	9	110
QM14111	37	7	8	26	32	45	8	360	9	160
QM14211	23	19	4	22	44	11	6	1000	4	280
QM14311	42	11	8	22	37	17	9	330	8	190
QM14321	42	12	9	25	38	19	9	330	8	160
QM15111	41	8	7	23	29	20	9	270	7	130
QM15211	46	6	9	25	29	19	9	210	8	120
QM15311	47	10	8	26	34	18	10	310	10	190
					Quaternary Alluvium, Recent Deposits					
QR01111	46	<2	5	28	14	23	7	280	9	64
QR01112	46	<2	6	28	14	20	7	280	9	65
QR01211	30	2	9	30	13	57	9	550	10	98
QR01311	26	<2	4	17	6	12	3	180	4	27
QR02111	38	<2	6	27	15	38	8	320	10	65
QR02121	20	<2	10	34	12	15	9	450	11	110
QR02211	26	<2	10	33	14	20	9	410	9	88
QR02311	24	<2	11	30	13	23	9	430	10	82
QR05111	36	2	11	28	20	24	10	510	9	130
QR05211	35	3	10	29	17	22	9	510	9	120
QR05311	37	<2	13	30	17	27	11	520	10	120
QR08111	41	3	7	28	22	35	9	420	8	110
QR08211	25	<2	10	28	9	25	9	670	8	120
QR08311	35	4	14	32	18	27	10	570	9	110
QR08321	38	<2	11	33	17	20	11	530	11	110
QR10111	22	<2	11	31	7	21	8	650	8	110
QR10211	42	<2	8	23	14	21	6	180	8	52
QR10311	42	3	13	32	28	35	10	420	10	110
QR11111	59	<2	6	27	20	16	8	370	12	80
QR11211	50	<2	7	26	16	22	6	270	9	61
QR11311	42	<2	10	34	14	32	10	540	11	94
QR14111	49	12	9	26	39	25	10	370	9	260
QR14211	22	<2	14	30	6	39	9	710	8	95
QR14311	40	<2	12	32	22	78	10	470	10	110

Table A1.--Listing of analytical results for soils collected from the Uncompahgre Project Area (continued).

Sample	Li, ppm	Mo, ppm	Nb, ppm	Nd, ppm	Ni, ppm	Pb, ppm	Sc, ppm	Sr, ppm	Th, ppm	V, ppm
					Quaternary Alluvium, Tertiary Deposits Derived					
QT01111	43	<2	10	34	22	31	10	360	12	100
QT01112	44	2	10	29	22	32	9	370	9	100
QT01211	40	3	13	31	19	42	9	390	11	100
QT01311	40	<2	10	33	20	33	10	290	10	98
QT02111	38	<2	7	30	19	23	9	370	8	110
QT02211	41	2	9	26	23	22	10	340	9	120
QT02311	34	<2	8	30	19	23	7	360	9	100
QT02312	33	<2	8	29	20	25	7	350	9	98
QT02321	35	3	9	30	25	38	9	330	9	120
QT04111	42	20	10	24	49	30	8	660	9	180
QT04211	30	2	5	21	12	14	5	370	6	63
QT04311	40	<2	6	31	20	47	9	300	11	94
QT04321	39	<2	7	29	18	32	8	340	9	88
QT05111	36	<2	8	28	17	66	8	320	10	85
QT05211	37	3	9	23	20	28	7	360	8	120
QT05311	39	3	9	27	20	40	9	280	9	97
QT06111	44	7	7	27	35	15	9	340	9	150
QT06211	39	<2	7	27	15	25	7	210	10	62
QT06212	39	3	7	26	15	28	7	210	11	63
QT06311	35	<2	5	20	12	21	5	210	7	40
QT07111	26	<2	<4	19	11	23	5	310	6	46
QT07211	22	<2	<4	13	9	15	4	260	7	43
QT07311	37	<2	10	28	14	47	8	420	8	81
QT08111	40	5	8	29	25	38	10	350	9	140
QT08121	37	4	9	26	22	47	9	310	8	130
QT08211	32	<2	6	24	15	59	7	310	7	86
QT08311	38	<2	<4	26	12	19	6	220	10	52
QT10111	47	3	8	27	38	62	7	240	11	75
QT10211	37	4	6	26	19	27	7	320	8	88
QT10212	36	4	<4	25	20	26	7	320	9	89
QT10221	37	4	7	26	23	99	8	230	8	95
QT10311	30	<2	6	23	13	21	6	190	7	50

Table A1.--Listing of analytical results for soils collected from the Uncompahgre Project Area (continued).

Sample	Li, ppm	Mo, ppm	Nb, ppm	Nd, ppm	Ni, ppm	Pb, ppm	Sc, ppm	Sr, ppm	Th, ppm	V, ppm
Standard Reference Material San Joaquin Soil										
SJS1	67	<2	8	20	70	14	14	240	14	130
SJS1	67	<2	10	21	71	16	14	240	13	130
SJS1	65	<2	11	21	74	19	14	230	13	130
SJS1	66	<2	9	21	73	17	14	230	13	130
SJS1	69	<2	9	19	70	16	13	240	13	130
SJS1	70	<2	11	21	76	16	14	240	12	130
SJS1	68	<2	10	21	71	16	14	240	12	130
SJS1	67	<2	9	19	72	15	14	240	10	130

Table A1.--Listing of analytical results for soils collected from the Uncompahgre Project Area (continued).

Sample	Y, ppm	Yb, ppm	Zn, ppm	As, ppm	Se, ppm	U, ppm*
					Cretaceous Dakota Formation	
KD07111	21	2	97	8.5	0.6	3.87
KD07211	17	2	76	6.4	0.6	3.93
KD07212	15	2	79	7.6	0.5	3.53
KD07311	9	2	33	6.0	0.4	2.05
KD07321	14	1	44	6.2	0.4	2.41
KD07322	13	1	46	6.2	0.4	2.53
KD10111	16	2	120	9.8	0.6	3.35
KD10211	10	<1	120	7.3	0.5	2.16
KD10311	10	<1	50	6.7	0.6	2.19
KD13111	13	1	46	6.1	0.3	2.74
KD13211	13	1	84	8.3	0.4	2.77
KD13221	9	<1	41	9.9	0.4	2.11
KD13311	15	1	64	8.2	0.3	2.88
					Cretaceous Mancos Formation	
KM01111	20	2	110	8.0	2.0	4.61
KM01211	17	<1	140	12	3.8	6.80
KM01311	18	2	86	8.4	1.4	4.43
KM02111	19	2	110	10	2.3	6.61
KM02112	19	2	110	11	2.6	6.45
KM02211	16	2	86	7.2	1.9	6.18
KM02311	17	2	87	6.1	1.3	4.86
KM03111	15	2	110	8.7	4.8	5.69
KM03112	14	1	110	8.4	4.2	6.60
KM03211	18	<1	120	12	7.5	8.06
KM03311	17	<1	130	9.8	6.6	6.41
KM03321	19	2	110	10	5	5.78
KM04111	11	1	81	10	2.5	6.39
KM04211	18	<1	130	11	3	7.18
KM04311	19	2	73	8.4	0.9	4.77
KM04411	15	2	120	11	2.8	5.80
KM05111	17	2	120	13	4.4	4.35
KM05211	16	1	110	8.5	3.2	6.12
KM05221	17	2	120	9.6	2.1	6.19
KM05311	17	1	79	10	1.6	5.70
KM06111	18	2	71	10	0.3	4.03
KM06211	20	2	94	10	0.6	5.25
KM06311	19	2	100	11	3.3	5.24
KM08111	15	1	100	9.0	1.5	3.37
KM08211	17	2	130	7.6	1.7	5.01
KM08311	16	2	91	8.2	2.3	5.08
KM08312	16	2	94	8.5	2	5.05
KM09111	17	<1	120	9.4	5.1	4.66
KM09211	18	2	110	8.8	3.5	4.54
KM09212	17	2	110	9.1	3.7	4.28
KM09311	16	<1	96	8.4	3.3	7.73

* U, Delayed Neutron Activation Analysis

Table A1.--Listing of analytical results for soils collected from the Uncompahgre Project Area (continued).

Sample	Y, ppm	Yb, ppm	Zn, ppm	As, ppm	Se, ppm	U, ppm*
				Cretaceous Mancos Formation (continued)		
KM10111	17	1	68	8.1	0.5	4.25
KM10211	20	<1	130	13	2.5	12.5
KM10311	18	2	70	5.3	0.6	3.89
KM11111	16	2	270	11	4.3	5.47
KM11211	13	1	68	5.8	1.8	4.43
KM11311	19	2	130	9.9	6.3	6.06
KM12111	16	2	87	6.9	1.7	4.29
KM12211	21	3	95	5.1	2.0	5.11
KM12311	16	1	80	6.7	1.8	5.10
KM14111	17	2	90	10	0.5	3.44
KM14211	17	2	130	11	1.4	4.17
KM14311	12	<1	87	7.7	1.7	3.51
KM15111	19	2	100	7.4	2.7	4.21
KM15211	16	2	110	9.0	3.4	6.21
KM15212	16	2	110	9.7	4.2	6.45
KM15221	15	1	100	8.5	5.0	6.32
KM15311	17	2	100	9.6	5.2	6.88
				Quaternary Alluvium, Dakota Formation Derived		
QD13111	15	2	56	12	0.3	2.95
				Quaternary Alluvium, Mancos Formation Derived		
QM01111	16	1	96	8.2	4.8	5.78
QM01211	20	1	150	8.5	2.5	4.36
QM01311	20	2	100	9.9	2.2	4.95
QM02111	19	2	130	9.7	2.3	4.60
QM02211	20	3	120	9.9	2.6	5.50
QM02311	20	3	99	8.4	1.2	4.37
QM03111	18	1	84	5.6	0.9	3.47
QM03211	16	2	88	9.0	2.0	4.57
QM03221	19	2	93	10	3.8	5.20
QM03311	23	2	110	12	3.5	7.23
QM05111	18	2	110	11	4.4	4.73
QM05211	18	2	130	9.6	2.6	4.84
QM05311	18	2	120	8.4	3.1	5.26
QM08111	18	2	100	8.1	4.2	4.92
QM08211	15	<1	110	11	5.5	4.73
QM08311	16	2	95	9.5	6.6	4.99
QM09111	18	2	110	8.7	2.7	4.13
QM09211	20	2	99	7.9	3.6	4.73
QM09212	20	<1	98	7.4	3.1	4.84
QM09311	19	3	97	7.9	1.7	4.00
QM10111	20	3	120	9.0	2.2	4.98

* U, Delayed Neutron Activation Analysis

Table A1.--Listing of analytical results for soils collected from the Uncompahgre Project Area (continued).

Sample	Y, ppm	Yb, ppm	Zn, ppm	As, ppm	Se, ppm	U, ppm*
			Quaternary Alluvium, Mancos Formation Derived (continued)			
QM10211	18	2	120	9.6	2.1	4.68
QM10311	21	2	120	7.1	1.7	4.99
QM11111	15	2	100	8.9	4.2	7.41
QM11211	18	3	98	7.9	2.5	3.81
QM11311	17	2	190	11	3.5	6.17
QM12111	18	2	90	12	1.4	4.10
QM12121	19	2	100	11	1.5	4.29
QM12211	20	2	100	6.7	1.4	4.44
QM12212	21	3	100	7.4	1.3	4.14
QM12311	20	2	100	12	2.5	4.19
QM14111	19	2	140	10	2.7	5.30
QM14211	14	1	120	6.9	7.3	8.60
QM14311	18	<1	120	11	8.6	6.76
QM14321	19	2	130	13	7.6	7.61
QM15111	18	2	100	9.8	3.1	4.40
QM15211	18	2	98	10	3.4	4.57
QM15311	18	2	110	9.0	4.1	6.27
			Quaternary Alluvium, Recent Deposits			
QR01111	20	2	72	5.4	0.8	3.20
QR01112	19	2	71	5.0	0.7	3.23
QR01211	19	2	180	6.2	0.8	3.39
QR01311	12	<1	28	4.9	0.2	1.96
QR02111	18	2	120	3.6	0.4	3.79
QR02121	20	3	81	4.2	0.3	3.31
QR02211	20	2	77	4.3	0.7	3.68
QR02311	20	2	83	4.4	0.7	3.15
QR05111	20	2	110	6.4	1.2	3.60
QR05211	18	3	100	6.2	2.9	3.79
QR05311	20	3	120	6.1	1.4	3.51
QR08111	18	1	120	7.2	1.4	3.98
QR08211	16	2	100	4.5	0.3	2.94
QR08311	20	2	120	6.1	0.7	3.09
QR08321	21	3	110	7.0	0.8	3.95
QR10111	16	2	85	3.6	0.1	3.02
QR10211	16	1	67	5.5	0.5	3.13
QR10311	22	2	130	7.8	1.0	4.13
QR11111	20	2	75	7.2	0.4	3.77
QR11211	15	1	70	9.9	0.5	3.35
QR11311	18	2	110	6.8	0.5	3.56
QR14111	18	<1	140	10	2.9	7.57
QR14211	18	2	110	4.0	0.3	2.79
QR14311	19	2	190	7.3	1.0	3.53

* U, Delayed Neutron Activation Analysis

Table A1.--Listing of analytical results for soils collected from the Uncompahgre Project Area (continued).

Sample	Y, ppm	Yb, ppm	Zn, ppm	As, ppm	Se, ppm	U, ppm*
				Quaternary Alluvium, Tertiary Deposits Derived		
QT01111	20	2	100	9.1	1.1	4.25
QT01112	18	2	110	8.9	1.2	3.65
QT01211	19	2	130	8.7	1.2	4.18
QT01311	20	2	110	8.5	0.8	3.82
QT02111	20	2	94	9.4	1.0	3.62
QT02211	19	2	98	9.7	1.4	3.81
QT02311	18	2	81	9.8	1.3	3.40
QT02312	17	1	82	9.5	1.5	3.64
QT02321	20	2	130	7.8	2.3	3.98
QT04111	20	2	150	9.3	3.4	7.39
QT04211	12	<1	53	10	0.5	2.79
QT04311	19	2	130	8.9	1.1	3.61
QT04321	16	2	96	8.5	0.8	3.38
QT05111	16	2	160	8.8	0.5	3.29
QT05211	16	2	93	10	1.3	4.17
QT05311	19	1	130	7.6	1.4	3.88
QT06111	20	<1	100	9.9	2.0	5.36
QT06211	18	2	82	7.3	0.9	3.86
QT06212	19	3	85	7.5	1.0	3.74
QT06311	12	1	70	7.5	0.7	3.14
QT07111	13	<1	77	8.1	0.5	2.36
QT07211	9	2	46	6.0	0.4	1.97
QT07311	15	2	140	8.0	0.5	3.15
QT08111	20	2	160	11	1.9	4.59
QT08121	19	2	160	10	1.4	4.33
QT08211	16	1	160	8.3	0.5	3.01
QT08311	17	1	58	7.7	0.4	2.95
QT10111	26	3	170	11	0.6	3.19
QT10211	16	1	89	10	0.8	3.46
QT10212	16	3	87	9.9	0.8	3.35
QT10221	19	2	230	9.7	1.0	4.18
QT10311	15	2	63	7.5	0.4	2.93

* U, Delayed Neutron Activation Analysis

Table A1.--Listing of analytical results for soils collected from the Uncompahgre Project Area (continued).

Sample	Y, ppm	Yb, ppm	Zn, ppm	As, ppm	Se, ppm	U, ppm*
				Standard Reference Material San Joaquin Soil		
SJS1	16	3	110	9.3	1.2	3.76
SJS1	15	2	110	8.8	1.2	3.88
SJS1	16	2	110	8.7	1.3	3.73
SJS1	16	2	110	8.8	1.3	3.87
SJS1	16	2	110	8.6	1.1	4.06
SJS1	16	2	110	9.5	1.3	3.55
SJS1	15	2	110	9.2	1.3	4.17
SJS1	15	1	110	9.9	1.4	3.69

* U, Delayed Neutron Activation Analysis

Table A2.--Listing of analytical results for alfalfa (ash-weight basis, unless noted with an *) collected from the Uncompahgre Project Area.

Sample	Latitude	Longitude	Al, %	Ca, %	Fe, %	K, %	Mg, %	Na, %	P, %	Ti, %
					Cretaceous Mancos Formation					
KM01111	384353	1080632	0.08	18	0.10	21	3.9	2.4	3.9	<0.01
KM01211	384156	1080724	0.08	23	0.10	16	3.2	0.87	3.8	<0.01
KM01311	384346	1080828	0.09	18	0.10	21	2.3	0.74	2.8	<0.01
KM01312	384346	1080828	0.08	18	0.10	25	2.3	0.76	2.8	<0.01
KM02111	384156	1080020	0.20	12	0.20	18	2.5	1.0	4.3	<0.01
KM02211	384326	1080021	0.37	19	0.29	22	2.4	0.35	2.3	0.02
KM02311	384436	1075854	0.05	17	0.08	25	2.4	0.25	3.7	<0.01
KM03111	384239	1075623	0.10	17	0.10	19	3.6	1.6	3.5	<0.01
KM03211	384328	1075630	0.35	20	0.35	15	2.8	0.10	3.3	0.01
KM03311	384338	1075620	0.28	18	0.39	19	2.3	0.32	1.9	0.01
KM03321	384337	1075629	0.10	20	0.10	16	2.6	0.35	3.4	<0.01
KM03322	384337	1075629	0.20	20	0.10	14	2.6	0.35	3.3	<0.01
KM04311	384148	1080739	0.08	15	0.20	17	4.7	2.4	3.9	<0.01
KM04411	384149	1080717	0.10	28	0.10	12	3.0	0.33	2.3	<0.01
KM05111	384009	1075731	0.10	18	0.20	17	3.8	1.7	3.4	<0.01
KM05211	384010	1075817	0.10	17	0.10	17	2.8	0.88	3.6	<0.01
KM05212	384010	1075817	0.10	17	0.10	19	2.8	0.91	3.5	<0.01
KM05221	384010	1075817	0.10	20	0.10	20	2.5	0.23	3.5	<0.01
KM05311	384049	1075805	0.10	22	0.10	21	2.2	0.21	2.6	<0.01
KM06311	383822	1075541	0.10	18	0.10	23	2.6	1.7	2.8	<0.01
KM08111	383309	1075855	0.10	26	0.10	12	1.7	0.22	2.7	<0.01
KM08211	383412	1075622	0.06	21	0.08	20	1.7	0.07	3.8	<0.01
KM09111	383715	1075528	0.09	19	0.10	13	2.5	0.68	3.7	<0.01
KM09211	383543	1075350	0.31	14	0.20	23	2.5	0.47	3.7	0.01
KM09311	383307	1075444	0.20	22	0.10	18	1.9	0.10	1.8	<0.01
KM10211	383004	1075706	0.10	24	0.10	16	2.7	0.04	2.2	<0.01
KM10212	383004	1075706	0.10	24	0.10	13	2.7	0.04	2.2	<0.01
KM10311	383120	1075918	0.05	7.2	0.09	20	8.3	0.32	3.2	<0.01
KM11111	383127	1075156	0.35	21	0.32	15	2.8	0.20	2.4	0.03
KM11211	383055	1074937	0.51	19	0.32	11	3.3	1.2	2.8	0.03
KM11311	382825	1074913	0.20	21	0.10	21	2.0	0.10	2.9	<0.01
KM12111	382747	1074624	0.20	25	0.10	11	2.5	0.24	2.1	<0.01
KM12211	382836	1074603	0.43	17	0.23	24	3.3	0.40	3.0	0.02
KM12311	382905	1074806	0.08	17	0.10	17	3.8	0.22	3.1	<0.01
KM14111	382521	1075404	0.06	26	0.07	13	3.3	0.67	2.4	<0.01
KM14211	382244	1074746	0.03	25	0.06	18	2.1	0.03	2.2	<0.01
KM14311	382632	1075136	0.03	21	0.08	20	2.6	0.20	2.7	<0.01
KM15111	382714	1074619	0.20	25	0.22	13	3.0	0.50	2.0	<0.01
KM15311	382449	1074709	0.20	22	0.20	19	2.8	0.09	2.1	<0.01

Table A2.--Listing of analytical results for alfalfa (ash-weight basis, unless noted with an *) collected from the Uncompahgre Project Area (continued).

Sample	Latitude	Longitude	Al, %	Ca, %	Fe, %	K, %	Mg, %	Na, %	P, %	Ti, %
					Quaternary Alluvium, Dakota Formation Derived					
QD13111	382547	1075748	0.07	24	0.07	13	2.6	0.04	4.1	<0.01
					Quaternary Alluvium, Mancos Formation Derived					
QM01111	384607	1080421	0.06	15	4.0	19	3.0	0.29	4.0	<0.01
QM01211	384342	1080409	0.20	16	0.20	18	2.6	0.21	3.9	<0.01
QM01212	384342	1080409	0.20	16	0.20	26	2.6	0.22	4.0	<0.01
QM01311	384403	1080822	0.10	16	0.20	26	3.6	0.89	4.0	<0.01
QM02111	384245	1080307	0.33	16	0.33	24	3.0	0.98	4.2	0.02
QM02211	384540	1075918	0.21	17	0.20	18	2.5	0.51	3.1	<0.01
QM02311	384553	1075730	0.05	21	0.10	16	2.9	0.20	3.6	<0.01
QM03111	384621	1075632	0.20	21	0.20	14	3.3	0.20	3.0	0.01
QM03211	384540	1075605	0.06	22	0.20	12	3.9	0.43	3.0	<0.01
QM03212	384540	1075605	0.06	21	0.34	15	4.1	0.41	3.0	<0.01
QM03221	384540	1075605	0.06	26	0.09	13	3.4	0.10	2.5	<0.01
QM03311	384450	1075555	0.10	17	0.20	20	3.9	0.25	2.4	<0.01
QM05111	383913	1075805	0.10	16	0.29	19	3.0	4.3	2.4	<0.01
QM05211	384055	1080003	0.07	18	0.10	16	2.8	0.56	3.4	<0.01
QM05311	384134	1080101	0.10	15	0.10	25	4.0	1.9	3.1	<0.01
QM08111	383748	1075700	0.30	18	0.28	24	3.0	0.42	4.2	0.01
QM08112	383748	1075700	0.20	17	0.20	17	2.9	0.41	3.8	<0.01
QM08211	383646	1075552	0.06	23	0.10	14	2.4	0.27	3.0	<0.01
QM08311	383516	1075624	0.20	18	0.10	22	2.9	1.4	3.3	<0.01
QM09111	383512	1075404	0.08	18	0.10	18	2.1	0.42	3.4	<0.01
QM09211	383522	1075528	0.10	17	0.20	26	3.3	0.77	3.7	<0.01
QM09311	383411	1075405	0.20	19	0.20	22	3.1	0.10	3.4	<0.01
QM10111	383135	1075615	0.35	23	0.30	13	2.8	0.29	3.3	0.02
QM10211	383235	1075707	0.06	19	0.08	17	2.1	0.10	3.1	<0.01
QM10311	383156	1075713	0.10	19	0.10	11	2.3	0.20	2.9	<0.01
QM11111	383206	1075307	0.10	21	0.46	14	3.5	0.33	2.9	<0.01
QM11211	383027	1075032	0.30	19	0.21	15	3.0	0.24	3.6	0.02
QM11311	382940	1075052	0.08	24	0.08	14	2.4	0.39	2.5	<0.01
QM12111	382857	1074602	0.10	21	0.20	19	3.8	0.21	4.3	<0.01
QM12121	382857	1074557	0.20	23	0.20	15	3.3	0.10	3.3	<0.01
QM12211	382740	1074633	0.22	23	0.20	14	1.6	0.20	2.1	0.01
QM12311	382910	1074458	0.21	18	0.23	21	4.2	0.24	4.4	0.01
QM14111	382536	1075012	0.45	17	0.43	21	4.0	1.9	3.4	0.03
QM14211	382652	1074854	0.10	23	0.10	18	3.2	0.07	2.9	<0.01
QM14311	382705	1074938	0.30	13	0.22	22	5.5	2.6	3.7	<0.01
QM14312	382705	1074938	0.31	13	0.23	22	5.5	2.6	3.6	0.01
QM14321	382705	1074926	0.39	13	0.25	23	6.1	1.0	4.6	0.01
QM15311	382538	1074740	0.45	18	0.61	19	3.6	0.48	2.8	0.03

Table A2.--Listing of analytical results for alfalfa (ash-weight basis, unless noted with an *) collected from the Uncompahgre Project Area (continued).

Sample	Latitude	Longitude	Al, %	Ca, %	Fe, %	K, %	Mg, %	Na, %	P, %	Ti, %
					Cretaceous Dakota Formation					
KD07111	383609	1075849	0.05	23	0.08	16	3.4	0.27	2.5	<0.01
KD07211	383506	1075751	0.10	25	0.10	13	2.8	0.57	2.3	<0.01
KD07212	383506	1075751	0.10	26	0.10	15	2.9	0.58	2.5	<0.01
KD07311	383710	1075935	0.10	24	0.21	15	4.0	0.20	2.7	<0.01
KD07321	383705	1075936	0.09	20	0.09	18	5.2	0.06	2.2	<0.01
KD07322	383705	1075936	0.07	22	0.10	13	5.3	0.07	2.3	<0.01
KD10111	382912	1075936	0.05	19	0.09	22	2.5	0.10	2.2	<0.01
KD10211	382800	1075711	0.06	19	0.25	14	6.0	0.68	3.1	<0.01
KD10311	382832	1075805	0.07	24	0.09	13	5.0	0.10	1.3	<0.01
KD13111	382553	1075825	0.20	22	0.27	17	3.5	0.09	3.8	<0.01
KD13211	382717	1075616	0.10	21	0.10	21	2.6	0.22	3.0	<0.01
KD13221	382724	1075616	0.06	22	0.09	16	2.4	0.10	2.7	<0.01
KD13311	382528	1075500	0.06	24	0.08	17	3.0	0.43	3.3	<0.01
					Quaternary Alluvium, Recent Deposits					
QR01111	384220	1080354	0.06	19	0.10	25	2.5	0.35	3.1	<0.01
QR01211	384457	1080529	0.06	16	0.08	17	2.8	0.45	3.9	<0.01
QR02111	384630	1080133	0.24	17	0.28	17	3.2	0.74	3.4	0.01
QR02121	384630	1080124	0.26	18	0.46	22	3.2	1.2	3.3	0.03
QR02211	384614	1080026	0.08	18	0.09	23	2.8	0.20	3.0	<0.01
QR02311	384604	1080210	0.08	16	0.10	24	3.1	0.57	4.1	<0.01
QR05111	384149	1080229	0.20	20	0.20	17	3.0	0.79	3.1	<0.01
QR05211	384044	1080027	0.03	9.0	0.09	19	4.2	0.10	2.4	<0.01
QR05311	383828	1075959	0.23	17	0.29	18	2.4	1.6	2.3	<0.01
QR08111	383737	1080005	0.20	20	0.20	22	2.5	0.10	4.0	<0.01
QR08211	383506	1075846	0.07	13	0.10	30	3.9	1.3	2.5	<0.01
QR08311	383323	1075825	0.03	14	0.04	24	2.3	0.36	3.3	<0.01
QR08321	383329	1075826	0.05	17	0.07	23	2.4	0.21	3.0	<0.01
QR10111	383134	1075657	0.20	16	0.29	24	3.6	0.25	3.8	<0.01
QR10211	383206	1075756	0.08	21	0.10	16	2.9	0.09	3.4	<0.01
QR10311	383229	1075806	0.35	18	0.24	22	3.1	0.30	3.3	0.01
QR11111	383017	1075506	0.48	17	0.34	16	3.3	0.32	3.4	0.03
QR11211	382906	1075411	0.07	20	0.10	17	2.5	0.09	2.2	<0.01
QR11311	382932	1075409	0.08	17	0.10	26	2.2	0.23	2.8	<0.01
QR14111	382337	1074906	0.06	21	0.10	18	2.5	0.20	3.3	<0.01
QR14211	382237	1074826	0.20	20	0.20	17	2.7	0.20	3.3	<0.01
QR14311	382549	1075117	0.10	21	0.09	12	2.5	0.10	2.9	<0.01

Table A2.--Listing of analytical results for alfalfa (ash-weight basis, unless noted with an *) collected from the Uncompahgre Project Area (continued).

Sample	Latitude	Longitude	Al, %	Ca, %	Fe, %	K, %	Mg, %	Na, %	P, %	Ti, %
				Quaternary Alluvium, Tertiary Deposits Derived						
QT01111	384214	1080617	0.08	17	0.09	25	2.4	0.33	3.5	<0.01
QT01311	384256	1080453	0.06	21	0.10	21	3.0	0.32	4.4	<0.01
QT02111	384344	1080207	0.10	22	0.10	20	2.5	0.49	3.7	<0.01
QT02211	384338	1080057	0.07	26	0.10	11	3.9	0.69	3.1	<0.01
QT02311	384434	1080220	0.04	18	0.10	16	2.8	0.22	3.4	<0.01
QT02321	384431	1080221	0.43	19	0.42	17	3.1	1.9	3.3	0.03
QT04111	384010	1080552	0.05	22	0.09	14	2.8	0.37	3.2	<0.01
QT04211	384020	1080817	0.10	23	0.10	13	3.2	0.42	3.1	<0.01
QT04212	384020	1080817	0.10	24	0.10	17	3.2	0.43	3.1	<0.01
QT04311	384139	1080541	0.04	21	0.08	17	2.5	0.32	3.6	<0.01
QT04312	384139	1080541	0.04	21	0.10	22	2.6	0.34	4.0	<0.01
QT04321	384138	1080535	0.45	18	0.55	13	2.6	0.57	3.6	0.01
QT05111	383835	1080213	0.31	20	0.33	19	2.8	0.10	3.2	0.01
QT05211	384041	1080116	0.10	20	0.20	19	3.2	0.30	3.3	<0.01
QT05311	384133	1080217	0.06	21	0.09	14	2.5	0.45	3.8	<0.01
QT06211	384101	1075359	0.45	21	7.8	15	1.9	0.21	2.8	0.02
QT06311	384141	1075358	0.47	20	0.24	18	2.9	0.30	3.5	0.01
QT07111	383350	1075615	0.05	18	0.08	20	3.2	1.0	3.6	<0.01
QT07211	383528	1075516	0.10	27	0.20	12	3.8	0.47	2.6	<0.01
QT07311	383711	1075828	0.04	23	0.08	14	2.5	0.05	3.3	<0.01
QT08111	383254	1075705	0.20	25	0.21	13	3.6	1.2	2.7	0.01
QT08121	383300	1075704	0.06	24	0.10	16	3.4	1.0	3.3	<0.01
QT08122	383300	1075704	0.10	23	0.09	14	3.3	0.98	2.9	<0.01
QT08211	383347	1075359	0.20	19	0.20	24	2.2	0.20	4.1	<0.01
QT08311	383619	1075428	0.03	20	0.06	19	2.9	0.21	3.4	<0.01
QT10111	383030	1075743	0.10	25	0.20	18	2.2	0.10	4.1	<0.01
QT10211	382956	1075617	0.07	23	0.10	21	2.1	0.10	3.0	<0.01
QT10221	382957	1075609	0.10	21	0.10	23	2.3	0.08	3.0	<0.01
QT10311	382924	1075837	0.10	18	0.10	21	2.5	0.20	2.8	<0.01
					In-house Alfalfa Standard					
ALF1-1			0.07	14	0.09	18	3.3	1.2	2.4	<0.01
ALF1-2			0.07	14	0.10	20	3.3	1.1	2.3	<0.01
ALF1-3			0.09	14	0.10	16	3.2	1.2	2.3	<0.01
ALF1-4			0.07	14	0.10	19	3.2	1.2	2.4	<0.01
ALF1-5			0.08	14	0.10	27	3.3	1.2	2.6	<0.01
ALF1-6			0.07	15	0.10	27	3.3	1.2	2.6	<0.01
ALF1-7			0.09	14	0.10	23	3.3	1.2	2.4	<0.01
ALF1-8			0.08	14	0.10	21	3.3	1.1	2.4	<0.01

Table A2.--Listing of analytical results for alfalfa (ash-weight basis, unless noted with an *) collected from the Uncompahgre Project Area (continued).

Sample	Mn, ppm	Ba, ppm	Co, ppm	Cr, ppm	Cu, ppm	La, ppm	Li, ppm	Mo, ppm	Nd, ppm	Ni, ppm
					Cretaceous Mancos Formation					
KM01111	220	35	4	6	120	<4	66	70	<8	10
KM01211	170	40	4	4	140	<4	26	47	<8	5
KM01311	270	34	4	5	94	<4	22	82	<8	20
KM01312	270	35	3	5	94	<4	22	65	<8	20
KM02111	220	31	6	7	110	<4	20	110	<8	26
KM02211	200	45	4	9	130	4	22	90	<8	24
KM02311	180	20	4	3	110	<4	20	63	<8	20
KM03111	120	28	4	7	94	<4	63	41	<8	20
KM03211	180	57	4	6	90	5	7	79	<8	21
KM03311	150	63	3	6	100	5	20	96	<8	10
KM03321	150	86	4	4	130	<4	9	92	<8	10
KM03322	150	84	2	5	130	<4	7	87	<8	10
KM04311	180	21	10	5	90	<4	66	39	<8	20
KM04411	110	42	7	3	82	<4	24	47	<8	10
KM05111	160	28	4	6	110	<4	75	84	<8	21
KM05211	130	25	4	5	100	<4	26	64	<8	10
KM05212	120	24	3	5	100	<4	25	60	<8	10
KM05221	220	24	4	4	74	<4	10	69	<8	20
KM05311	110	34	4	4	110	<4	10	70	<8	20
KM06311	100	25	2	5	97	<4	37	40	<8	20
KM08111	250	76	3	4	110	<4	20	39	<8	10
KM08211	160	28	5	5	84	<4	5	41	<8	10
KM09111	190	53	7	4	88	<4	21	31	<8	9
KM09211	160	25	3	8	85	<4	26	46	<8	28
KM09311	160	33	3	2	90	10	20	59	<8	9
KM10211	150	26	4	4	89	4	20	180	<8	23
KM10212	150	25	4	3	91	4	10	230	<8	25
KM10311	290	10	3	3	71	<4	110	120	<8	6
KM11111	180	53	3	8	120	<4	20	95	<8	10
KM11211	220	67	4	10	150	4	70	110	<8	21
KM11311	110	130	4	5	120	<4	5	38	<8	7
KM12111	190	64	3	5	110	<4	20	69	<8	20
KM12211	210	170	3	8	120	<4	10	47	<8	10
KM12311	210	33	2	4	120	<4	67	39	<8	31
KM14111	280	510	3	<2	98	<4	5	20	<8	<4
KM14211	180	160	2	3	82	<4	8	61	<8	10
KM14311	180	73	3	2	100	<4	30	47	<8	9
KM15111	160	45	3	6	91	5	80	74	<8	20
KM15311	140	48	<2	3	110	<4	6	240	<8	10

Table A2.--Listing of analytical results for alfalfa (ash-weight basis, unless noted with an *) collected from the Uncompahgre Project Area (continued).

Sample	Mn, ppm	Ba, ppm	Co, ppm	Cr, ppm	Cu, ppm	La, ppm	Li, ppm	Mo, ppm	Nd, ppm	Ni, ppm
					Quaternary Alluvium, Dakota Formation Derived					
QD13111	310	910	3	4	79	<4	4	29	8	10
					Quaternary Alluvium, Mancos Formation Derived					
QM01111	230	23	8	37	130	<4	10	58	<8	39
QM01211	180	27	3	7	130	<4	22	72	<8	8
QM01212	180	34	3	6	130	<4	22	59	<8	7
QM01311	160	28	4	5	110	<4	73	45	<8	10
QM02111	180	50	3	6	140	<4	10	62	<8	6
QM02211	170	49	2	6	110	<4	20	66	<8	20
QM02311	190	150	6	3	95	<4	8	51	<8	10
QM03111	240	41	3	4	100	<4	20	63	<8	10
QM03211	180	42	4	4	120	5	70	87	<8	21
QM03212	170	29	6	8	120	<4	67	110	32	21
QM03221	180	32	6	4	110	<4	26	80	<8	23
QM03311	190	57	6	10	93	<4	10	470	9	21
QM05111	150	41	7	4	81	<4	77	40	<8	10
QM05211	160	42	2	4	130	<4	20	33	<8	5
QM05311	210	48	4	4	100	<4	77	51	<8	9
QM08111	160	79	5	20	130	<4	26	40	<8	20
QM08112	140	45	<2	10	120	<4	25	41	<8	10
QM08211	140	47	10	4	110	<4	10	59	<8	10
QM08311	290	100	6	6	89	<4	22	89	<8	7
QM09111	120	81	3	4	90	4	10	47	<8	10
QM09211	150	55	3	6	98	<4	20	63	<8	6
QM09311	190	46	4	6	140	<4	20	47	<8	10
QM10111	160	100	3	10	140	<4	20	90	<8	20
QM10211	220	120	4	4	89	<4	9	79	23	8
QM10311	140	71	2	4	130	<4	10	69	<8	4
QM11111	120	41	4	10	140	<4	31	160	<8	23
QM11211	170	240	3	5	100	<4	10	22	<8	10
QM11311	110	72	2	2	110	<4	10	52	<8	10
QM12111	230	350	3	6	150	<4	7	42	<8	20
QM12121	150	390	5	4	120	<4	<4	48	<8	20
QM12211	210	160	<2	7	89	<4	10	65	<8	10
QM12311	260	190	5	6	95	<4	8	68	<8	20
QM14111	240	280	4	8	120	4	20	26	<8	10
QM14211	120	75	2	4	120	<4	23	78	<8	26
QM14311	190	36	3	8	140	<4	47	120	<8	32
QM14312	190	41	4	8	140	<4	46	120	<8	30
QM14321	120	36	4	9	140	4	29	140	<8	28
QM15311	260	240	7	8	100	<4	36	110	10	20

Table A2.--Listing of analytical results for alfalfa (ash-weight basis, unless noted with an *) collected from the Uncompahgre Project Area (continued).

Sample	Mn, ppm	Ba, ppm	Co, ppm	Cr, ppm	Cu, ppm	La, ppm	Li, ppm	Mo, ppm	Nd, ppm	Ni, ppm
					Cretaceous Dakota Formation Derived					
KD07111	240	150	4	4	93	<4	20	68	8	10
KD07211	260	260	6	3	98	<4	10	31	<8	6
KD07212	260	260	7	4	99	<4	10	30	<8	6
KD07311	240	97	4	8	58	<4	20	84	<8	20
KD07321	180	60	3	2	100	<4	20	150	<8	21
KD07322	210	60	3	2	98	<4	21	140	<8	20
KD10111	240	170	5	5	80	<4	10	82	10	8
KD10211	230	21	2	4	140	<4	38	87	<8	7
KD10311	240	54	3	2	63	<4	55	110	<8	10
KD13111	270	860	4	5	77	<4	41	30	<8	8
KD13211	180	160	3	6	100	<4	9	28	<8	4
KD13221	220	270	3	3	92	<4	8	27	10	4
KD13311	350	400	3	3	110	<4	9	26	<8	5
					Quaternary Alluvium, Recent Deposits					
QR01111	190	34	3	4	94	<4	20	52	<8	9
QR01211	180	23	2	2	79	<4	23	38	<8	<4
QR02111	220	51	3	6	110	<4	10	30	<8	5
QR02121	260	75	3	6	89	<4	20	62	<8	6
QR02211	210	84	3	2	94	<4	8	39	<8	<4
QR02311	250	65	4	4	86	<4	8	43	<8	7
QR05111	260	60	3	5	110	<4	44	78	<8	10
QR05211	110	10	2	3	100	<4	29	180	<8	9
QR05311	250	48	2	6	130	<4	59	58	<8	8
QR08111	170	37	3	5	150	<4	10	65	<8	7
QR08211	210	23	2	3	120	<4	75	61	<8	10
QR08311	150	26	3	3	72	<4	10	43	<8	6
QR08321	180	35	2	3	76	<4	10	52	<8	5
QR10111	200	59	3	7	100	<4	21	59	<8	7
QR10211	210	120	2	4	91	<4	7	30	<8	9
QR10311	270	130	3	8	110	<4	9	34	<8	7
QR11111	210	120	3	6	97	<4	27	35	<8	10
QR11211	180	100	3	<2	120	<4	28	26	<8	20
QR11311	190	110	3	3	120	<4	29	47	<8	6
QR14111	180	91	3	2	91	<4	8	47	<8	10
QR14211	200	130	4	5	110	<4	6	23	<8	7
QR14311	180	170	3	3	88	<4	5	34	<8	5

Table A2.--Listing of analytical results for alfalfa (ash-weight basis, unless noted with an *) collected from the Uncompahgre Project Area (continued).

Sample	Mn, ppm	Ba, ppm	Co, ppm	Cr, ppm	Cu, ppm	La, ppm	Li, ppm	Mo, ppm	Nd, ppm	Ni, ppm
Quaternary Alluvium, Tertiary Deposits Derived										
QT01111	230	84	2	4	110	<4	10	27	<8	5
QT01311	270	76	3	4	100	<4	10	30	<8	<4
QT02111	220	34	4	3	130	<4	24	65	<8	10
QT02211	310	86	5	4	130	<4	10	43	<8	6
QT02311	300	38	3	4	97	<4	20	47	<8	9
QT02321	270	100	4	8	110	<4	20	45	<8	10
QT04111	160	44	5	<2	100	<4	20	59	<8	10
QT04211	260	61	3	3	87	<4	21	37	<8	5
QT04212	260	66	2	3	92	<4	21	30	<8	6
QT04311	280	70	3	2	120	<4	9	42	<8	<4
QT04312	290	76	3	4	120	<4	9	33	<8	<4
QT04321	310	94	4	10	110	<4	10	26	<8	8
QT05111	220	120	3	6	110	<4	10	43	<8	6
QT05211	160	44	3	6	130	<4	20	38	10	8
QT05311	250	49	4	4	120	<4	20	23	<8	6
QT06211	510	110	20	73	130	4	6	47	<8	51
QT06311	270	120	3	7	90	5	10	60	<8	10
QT07111	210	44	4	4	92	<4	44	32	<8	<4
QT07211	250	110	3	5	110	<4	38	34	<8	10
QT07311	250	210	2	<2	110	<4	7	29	<8	5
QT08111	220	130	3	8	110	<4	10	66	<8	10
QT08121	230	140	3	4	110	<4	20	35	<8	6
QT08122	220	130	3	4	110	<4	20	34	<8	6
QT08211	270	180	3	4	90	<4	6	38	<8	<4
QT08311	310	120	3	2	96	<4	10	48	<8	<4
QT10111	270	180	3	5	93	<4	8	38	<8	20
QT10211	180	260	4	4	81	<4	5	30	<8	4
QT10221	230	190	3	4	76	<4	7	26	<8	8
QT10311	270	140	3	4	89	<4	20	59	<8	6
In-house Standard Alfalfa										
ALF1-1	280	28	5	<2	76	<4	30	34	<8	7
ALF1-2	280	31	3	3	78	<4	29	31	<8	7
ALF1-3	280	30	4	2	73	<4	31	28	<8	7
ALF1-4	280	34	4	3	75	<4	29	25	<8	7
ALF1-5	280	33	4	4	75	<4	29	26	<8	9
ALF1-6	290	33	3	3	75	<4	29	25	<8	8
ALF1-7	290	33	4	3	70	<4	30	33	<8	6
ALF1-8	290	34	4	3	74	<4	29	34	<8	6

Table A2.--Listing of analytical results for alfalfa (ash-weight basis, unless noted with an *) collected from the Uncompahgre Project Area (continued).

Sample	Sr, ppm	V, ppm	Zn, ppm	As, ppm*	Se, ppm*	Ash, %*	U, ppm
				Cretaceous Mancos Formation Derived			
KM01111	2700	<4	520	<0.05	0.60	7.26	1.70
KM01211	2100	<4	380	0.10	0.29	7.47	0.74
KM01311	2100	<4	300	0.10	0.16	6.67	0.67
KM01312	2100	<4	300	<0.05	0.20	6.66	0.75
KM02111	1300	5	440	0.12	0.66	10.7	1.40
KM02211	2600	8	480	<0.05	0.68	7.52	1.60
KM02311	1800	<4	430	0.07	0.18	9.37	0.49
KM03111	3000	<4	400	0.11	1.6	5.78	1.80
KM03211	1700	20	410	0.11	1.0	9.10	0.73
KM03311	2100	9	450	1.9	1.6	8.18	0.86
KM03321	2100	5	340	0.12	0.64	6.58	0.47
KM03322	2000	6	340	<0.05	0.72	6.59	0.48
KM04311	1800	<4	410	0.23	0.13	7.29	1.60
KM04411	2500	<4	250	<0.05	0.51	10.2	1.10
KM05111	3200	<4	360	0.06	1.2	6.65	1.40
KM05211	2200	<4	340	0.09	1.4	8.53	1.30
KM05212	2100	<4	340	<0.05	1.4	8.61	1.10
KM05221	2000	<4	320	0.11	0.26	9.40	1.10
KM05311	3600	<4	390	0.11	0.10	7.49	1.60
KM06311	2000	<4	400	<0.05	0.69	7.25	1.90
KM08111	2600	<4	300	0.40	0.34	8.46	0.73
KM08211	1900	<4	260	<0.05	0.23	8.87	0.42
KM09111	1800	<4	340	0.14	0.58	9.78	0.47
KM09211	1400	10	410	0.13	0.59	10.6	0.80
KM09311	2200	<4	280	0.12	<0.03	9.59	1.20
KM10211	2900	<4	200	<0.05	0.22	9.51	3.60
KM10212	3000	<4	200	0.09	0.22	9.57	4.50
KM10311	2100	<4	230	<0.05	<0.03	7.78	0.08
KM11111	2200	8	400	0.14	0.86	8.99	0.88
KM11211	2300	10	530	0.11	0.33	6.86	2.70
KM11311	1600	<4	300	0.08	0.66	9.18	0.35
KM12111	1900	4	310	<0.05	<0.03	8.59	0.58
KM12211	1200	7	420	0.10	0.18	9.47	0.99
KM12311	2700	<4	490	<0.05	0.78	8.09	0.66
KM14111	1300	<4	220	<0.05	0.04	9.39	0.10
KM14211	2600	<4	230	<0.05	0.34	9.35	0.43
KM14311	2200	<4	340	<0.05	0.13	8.15	0.25
KM15111	2700	<4	580	0.20	0.40	10.6	2.10
KM15311	1600	6	230	<0.05	<0.03	6.80	0.64

Table A2.--Listing of analytical results for alfalfa (ash-weight basis, unless noted with an *) collected from the Uncompahgre Project Area (continued).

Sample	Sr, ppm	V, ppm	Zn, ppm	As, ppm*	Se, ppm*	Ash, %*	U, ppm
				Quaternary Alluvium, Dakota Formation Derived			
QD13111	1700	<4	230	<0.05	0.31	9.01	0.06
				Quaternary Alluvium, Mancos Formation Derived			
QM01111	2100	<4	480	0.73	0.87	8.86	0.73
QM01211	1700	<4	480	<0.05	2.2	6.98	0.66
QM01212	1700	<4	490	<0.05	2.4	6.75	0.58
QM01311	2600	<4	350	0.07	0.79	7.95	1.00
QM02111	1800	8	440	<0.05	0.78	7.55	0.46
QM02211	1800	5	460	<0.05	0.75	8.49	0.50
QM02311	1700	<4	270	<0.05	0.39	8.19	0.38
QM03111	1700	<4	370	0.08	0.65	9.73	0.73
QM03211	2700	<4	500	<0.05	0.27	9.04	1.10
QM03212	2600	5	590	<0.05	0.23	9.39	0.75
QM03221	3100	<4	410	0.08	<0.03	9.29	1.20
QM03311	2200	4	210	<0.05	4.1	6.80	0.44
QM05111	2000	<4	450	0.07	0.65	5.98	1.30
QM05211	2000	<4	310	<0.05	0.53	7.24	0.64
QM05311	2100	<4	340	<0.05	1.0	8.37	0.95
QM08111	2000	8	350	0.08	3.9	8.09	1.70
QM08112	2100	5	350	<0.05	4.7	8.28	1.50
QM08211	1700	<4	340	<0.05	0.52	7.68	0.94
QM08311	1800	<4	290	0.09	1.9	7.10	0.42
QM09111	1500	<4	280	<0.05	0.45	8.47	0.28
QM09211	1300	<4	380	0.14	0.76	7.66	0.58
QM09311	1800	5	490	0.18	1.5	8.20	0.66
QM10111	2700	6	410	<0.05	1.3	6.38	0.73
QM10211	1700	<4	250	<0.05	0.20	7.59	0.16
QM10311	1600	<4	320	0.08	<0.03	7.29	0.22
QM11111	2200	<4	370	0.13	1.5	8.67	1.70
QM11211	1700	6	300	<0.05	0.57	7.38	0.73
QM11311	2100	<4	290	0.09	0.52	9.00	0.45
QM12111	1400	<4	420	<0.05	0.34	7.08	0.55
QM12121	1300	<4	380	0.09	<0.03	7.88	0.28
QM12211	1000	4	260	---	---	8.40	0.29
QM12311	1600	<4	330	0.13	0.04	7.38	0.48
QM14111	1900	10	400	0.12	0.30	6.29	0.79
QM14211	3100	5	450	<0.05	6.3	8.77	2.70
QM14311	1500	9	680	0.09	1.2	6.78	7.00
QM14312	1500	9	680	0.09	1.3	6.75	7.00
QM14321	1200	10	660	0.09	0.79	7.17	2.70
QM15311	1900	10	560	0.11	2.0	7.00	2.30

Table A2.--Listing of analytical results for alfalfa (ash-weight basis, unless noted with an *) collected from the Uncompahgre Project Area (continued).

Sample	Sr, ppm	V, ppm	Zn, ppm	As, ppm*	Se, ppm*	Ash, %*	U, ppm
				Cretaceous Dakota Formation			
KD07111	2100	<4	500	<0.05	0.36	11.1	0.17
KD07211	1800	<4	250	0.08	0.05	8.98	0.33
KD07212	1800	<4	260	0.10	0.04	8.79	0.27
KD07311	4900	5	190	0.08	0.34	8.54	0.40
KD07321	2000	<4	240	<0.05	0.31	6.86	0.18
KD07322	2000	<4	220	<0.05	0.33	7.58	0.17
KD10111	1600	<4	270	<0.05	<0.03	7.50	0.16
KD10211	1800	<4	550	<0.05	0.16	7.58	0.51
KD10311	2900	<4	180	<0.05	0.05	11.0	0.07
KD13111	3700	7	270	<0.05	0.69	8.86	0.31
KD13211	1400	<4	280	0.11	0.09	7.17	0.26
KD13221	1500	<4	250	<0.05	0.03	7.20	0.14
KD13311	1600	<4	280	0.11	0.10	7.88	0.18
				Quaternary Alluvium, Recent Deposits			
QR01111	1900	<4	310	<0.05	0.64	7.35	0.65
QR01211	1600	<4	320	0.14	0.41	8.69	0.22
QR02111	1400	<4	340	<0.05	1.4	8.31	0.70
QR02121	1700	10	290	<0.05	0.60	6.79	0.66
QR02211	1400	<4	230	0.09	0.80	8.78	0.40
QR02311	1300	<4	300	<0.05	1.2	9.17	0.62
QR05111	2300	<4	390	<0.05	0.70	7.59	0.79
QR05211	1200	<4	280	<0.05	9.5	7.69	0.17
QR05311	1900	<4	420	0.09	1.3	8.32	0.80
QR08111	2400	<4	440	<0.05	2.0	7.30	0.59
QR08211	1600	<4	500	<0.05	0.73	7.46	0.76
QR08311	1100	<4	210	0.07	0.39	9.98	0.28
QR08321	1600	<4	210	0.08	0.27	9.89	0.18
QR10111	1700	<4	410	0.13	<0.03	7.99	0.35
QR10211	1800	<4	290	<0.05	0.16	8.59	0.24
QR10311	1800	4	270	0.13	0.09	6.47	0.32
QR11111	2000	9	310	0.12	0.25	8.29	0.28
QR11211	2200	<4	330	0.10	0.17	8.88	0.15
QR11311	1500	<4	380	<0.05	0.47	7.65	0.30
QR14111	1700	<4	320	<0.05	0.81	7.69	0.43
QR14211	1500	<4	330	<0.05	0.21	5.47	0.67
QR14311	1500	<4	280	0.08	0.29	9.40	0.17

Table A2.--Listing of analytical results for alfalfa (ash-weight basis, unless noted with an *) collected from the Uncompahgre Project Area (continued).

Sample	Sr, ppm	V, ppm	Zn, ppm	As, ppm*	Se, ppm*	Ash, %*	U, ppm
				Quaternary Alluvium, Tertiary Deposits Derived			
QT01111	1800	<4	240	0.09	0.23	8.48	0.35
QT01311	2200	<4	280	<0.05	0.18	7.94	0.52
QT02111	2100	<4	360	<0.05	0.31	8.48	1.00
QT02211	2400	<4	340	0.06	0.26	8.69	0.37
QT02311	2100	<4	420	0.08	1.6	9.42	0.39
QT02321	1900	7	450	0.10	1.8	8.75	0.59
QT04111	2200	<4	290	<0.05	0.61	8.59	0.83
QT04211	2700	<4	230	0.07	0.08	9.98	0.68
QT04212	2700	<4	230	0.09	0.09	9.88	0.70
QT04311	2200	<4	310	0.12	<0.03	8.38	0.43
QT04312	2200	<4	320	<0.10	0.20	8.11	0.47
QT04321	1700	5	490	0.17	0.14	8.85	0.43
QT05111	1700	6	380	0.14	0.23	8.30	0.27
QT05211	2200	<4	470	0.13	0.75	7.99	0.74
QT05311	2000	<4	300	<0.05	0.44	7.86	0.37
QT06211	1400	7	680	0.31	1.0	9.84	0.45
QT06311	1400	5	420	0.09	0.44	7.48	0.44
QT07111	2100	<4	330	0.11	0.14	7.69	0.87
QT07211	2700	<4	290	0.10	0.33	8.15	0.64
QT07311	2500	<4	350	0.07	0.26	10.3	0.22
QT08111	2000	4	310	<0.05	0.35	7.68	0.34
QT08121	2000	<4	300	0.10	0.38	7.35	0.29
QT08122	1800	<4	290	0.08	0.34	7.78	0.28
QT08211	1400	<4	350	0.25	0.04	8.65	0.22
QT08311	1800	<4	250	0.07	0.09	8.47	0.23
QT10111	1500	<4	370	0.08	0.33	7.36	0.25
QT10211	1600	<4	290	0.19	0.16	9.12	0.13
QT10221	1500	<4	260	0.15	0.10	9.10	0.14
QT10311	1600	<4	270	0.08	0.10	9.14	0.26
				In-house Alfalfa Standard			
ALF1-1	710	<4	250	<0.05	0.14	8.00	0.97
ALF1-2	710	<4	240	<0.05	0.13	7.98	1.10
ALF1-3	690	<4	240	<0.05	0.13	8.20	0.92
ALF1-4	710	<4	240	<0.05	0.17	8.16	0.89
ALF1-5	710	<4	240	0.10	0.15	8.10	1.00
ALF1-6	720	<4	250	0.10	0.16	7.86	0.88
ALF1-7	710	<4	260	0.06	0.15	8.18	0.90
ALF1-8	710	<4	260	0.07	0.13	7.19	0.89

Table A3.--Listing of analytical results for alfalfa (converted to a dry-weight basis) collected from the Uncompahgre Project Area.

Sample	Latitude	Longitude	Al, ppm	Ca, %	Fe, ppm	K, %	Mg, %	Na, %	P, %	Ti, ppm
					Cretaceous Mancos Formation					
KM01111	384353	1080632	58	1.3	73	1.5	0.28	0.17	0.28	<10
KM01211	384156	1080724	60	1.7	75	1.2	0.24	0.06	0.28	<10
KM01311	384346	1080828	60	1.2	67	1.4	0.15	0.05	0.19	<10
KM01312	384346	1080828	53	1.2	67	1.7	0.15	0.05	0.19	<10
KM02111	384156	1080020	210	1.3	214	1.9	0.27	0.11	0.46	<10
KM02211	384326	1080021	280	1.4	218	1.7	0.18	0.03	0.17	15
KM02311	384436	1075854	47	1.6	75	2.3	0.22	0.02	0.35	<10
KM03111	384239	1075623	58	0.98	58	1.1	0.21	0.09	0.20	<10
KM03211	384328	1075630	320	1.8	320	1.4	0.25	0.01	0.30	9
KM03311	384338	1075620	230	1.5	320	1.6	0.19	0.03	0.16	8
KM03321	384337	1075629	66	1.3	66	1.1	0.17	0.02	0.22	<10
KM03322	384337	1075629	130	1.3	66	0.92	0.17	0.02	0.22	<10
KM04311	384148	1080739	58	1.1	150	1.2	0.34	0.17	0.28	<10
KM04411	384149	1080717	100	2.9	100	1.2	0.31	0.03	0.23	<10
KM05111	384009	1075731	67	1.2	130	1.1	0.25	0.11	0.23	<10
KM05211	384010	1075817	85	1.5	85	1.5	0.24	0.08	0.31	<10
KM05212	384010	1075817	86	1.5	86	1.6	0.24	0.08	0.30	<10
KM05221	384010	1075817	94	1.9	94	1.9	0.23	0.02	0.33	<10
KM05311	384049	1075805	75	1.7	75	1.6	0.16	0.02	0.19	<10
KM06311	383822	1075541	73	1.3	73	1.7	0.19	0.12	0.20	<10
KM08111	383309	1075855	85	2.2	85	1.0	0.14	0.02	0.23	<10
KM08211	383412	1075622	53	1.9	71	1.8	0.15	0.01	0.34	<10
KM09111	383715	1075528	88	1.9	98	1.3	0.24	0.07	0.36	<10
KM09211	383543	1075350	330	1.5	210	2.4	0.27	0.05	0.39	11
KM09311	383307	1075444	190	2.1	96	1.7	0.18	0.01	0.17	<10
KM10211	383004	1075706	95	2.3	95	1.5	0.26	<0.01	0.21	<10
KM10212	383004	1075706	96	2.3	96	1.2	0.26	<0.01	0.21	<10
KM10311	383120	1075918	39	0.56	70	1.6	0.65	0.02	0.25	<10
KM11111	383127	1075156	310	1.9	290	1.4	0.25	0.02	0.22	27
KM11211	383055	1074937	350	1.3	220	0.75	0.23	0.08	0.19	20
KM11311	382825	1074913	180	1.9	92	1.9	0.18	0.01	0.27	<10
KM12111	382747	1074624	170	2.2	86	0.94	0.21	0.02	0.18	<10
KM12211	382836	1074603	410	1.6	220	2.3	0.31	0.04	0.28	19
KM12311	382905	1074806	65	1.4	81	1.4	0.31	0.02	0.25	<10
KM14111	382521	1075404	56	2.4	66	1.2	0.31	0.06	0.23	<10
KM14211	382244	1074746	28	2.3	56	1.7	0.20	<0.01	0.21	<10
KM14311	382632	1075136	24	1.7	65	1.6	0.21	0.02	0.22	<10
KM15111	382714	1074619	210	2.7	230	1.4	0.32	0.05	0.21	<10
KM15311	382449	1074709	140	1.5	140	1.3	0.19	0.01	0.14	<10

Table A3.--Listing of analytical results for alfalfa (converted to a dry-weight basis) collected from the Uncompahgre Project Area (continued).

Sample	Latitude	Longitude	Al, ppm	Ca, %	Fe, ppm	K, %	Mg, %	Na, %	P, %	Ti, ppm
					Quaternary Alluvium, Dakota Formation Derived					
QD13111	382547	1075748	63	2.2	63	1.2	0.23	<0.01	0.37	<10
					Quaternary Alluvium, Mancos Formation Derived					
QM01111	384607	1080421	53	1.3	3500	1.7	0.27	0.03	0.35	<10
QM01211	384342	1080409	140	1.1	140	1.3	0.18	0.01	0.27	<10
QM01212	384342	1080409	135	1.1	140	1.8	0.18	0.01	0.27	<10
QM01311	384403	1080822	80	1.3	160	2.1	0.29	0.07	0.32	<10
QM02111	384245	1080307	250	1.2	250	1.8	0.23	0.07	0.32	15
QM02211	384540	1075918	180	1.4	170	1.5	0.21	0.04	0.26	<10
QM02311	384553	1075730	41	1.7	82	1.3	0.24	0.02	0.29	<10
QM03111	384621	1075632	190	2.0	190	1.4	0.32	0.02	0.29	10
QM03211	384540	1075605	54	2.0	180	1.1	0.35	0.04	0.27	<10
QM03212	384540	1075605	56	2.0	320	1.4	0.38	0.04	0.28	<10
QM03221	384540	1075605	56	2.4	84	1.2	0.32	0.01	0.23	<10
QM03311	384450	1075555	68	1.2	140	1.4	0.27	0.02	0.16	<10
QM05111	383913	1075805	60	0.96	170	1.1	0.18	0.26	0.14	<10
QM05211	384055	1080003	51	1.3	72	1.2	0.20	0.04	0.25	<10
QM05311	384134	1080101	84	1.3	84	2.1	0.33	0.16	0.26	<10
QM08111	383748	1075700	240	1.5	220	1.9	0.24	0.03	0.34	8
QM08112	383748	1075700	170	1.4	170	1.4	0.24	0.03	0.31	<10
QM08211	383646	1075552	46	1.8	77	1.1	0.18	0.02	0.23	<10
QM08311	383516	1075624	140	1.3	71	1.6	0.21	0.10	0.23	<10
QM09111	383512	1075404	68	1.5	85	1.5	0.18	0.04	0.29	<10
QM09211	383522	1075528	77	1.3	150	2.0	0.25	0.06	0.28	<10
QM09311	383411	1075405	160	1.6	160	1.8	0.25	0.01	0.28	<10
QM10111	383135	1075615	220	1.5	190	0.83	0.18	0.02	0.21	13
QM10211	383235	1075707	46	1.4	61	1.3	0.16	0.01	0.24	<10
QM10311	383156	1075713	73	1.4	73	0.80	0.17	0.01	0.21	<10
QM11111	383206	1075307	87	1.8	400	1.2	0.30	0.03	0.25	<10
QM11211	383027	1075032	220	1.4	150	1.1	0.22	0.02	0.27	15
QM11311	382940	1075052	72	2.2	72	1.3	0.22	0.04	0.23	<10
QM12111	382857	1074602	71	1.5	140	1.4	0.27	0.01	0.30	<10
QM12121	382857	1074557	160	1.8	150	1.2	0.26	0.01	0.26	<10
QM12211	382740	1074633	180	1.9	170	1.2	0.13	0.02	0.18	8
QM12311	382910	1074458	150	1.3	170	1.6	0.31	0.02	0.32	7
QM14111	382536	1075012	280	1.1	270	1.3	0.25	0.12	0.21	19
QM14211	382652	1074854	88	2.0	88	1.6	0.28	0.01	0.25	<10
QM14311	382705	1074938	200	0.88	150	1.5	0.37	0.18	0.25	<10
QM14312	382705	1074938	210	0.88	160	1.5	0.37	0.18	0.24	7
QM14321	382705	1074926	280	0.93	180	1.7	0.44	0.07	0.33	7
QM15311	382538	1074740	320	1.3	430	1.3	0.25	0.03	0.20	21

Table A3.--Listing of analytical results for alfalfa (converted to a dry-weight basis) collected from the Uncompahgre Project Area (continued).

Sample	Latitude	Longitude	Al, ppm	Ca, %	Fe, ppm	K, %	Mg, %	Na, %	P, %	Ti, ppm
					Cretaceous Dakota Formation					
KD07111	383609	1075849	56	2.6	89	1.8	0.38	0.03	0.28	<10
KD07211	383506	1075751	90	2.2	90	1.2	0.25	0.05	0.21	<10
KD07212	383506	1075751	88	2.4	88	1.3	0.25	0.05	0.22	<10
KD07311	383710	1075935	85	2.1	180	1.3	0.34	0.02	0.23	<10
KD07321	383705	1075936	62	1.4	62	1.2	0.36	<0.01	0.15	<10
KD07322	383705	1075936	53	1.7	76	0.99	0.40	0.01	0.17	<10
KD10111	382912	1075936	38	1.4	68	1.7	0.19	0.01	0.17	<10
KD10211	382800	1075711	45	1.4	190	1.1	0.45	0.05	0.23	<10
KD10311	382832	1075805	77	2.6	99	1.4	0.55	0.01	0.14	<10
KD13111	382553	1075825	180	2.0	240	1.5	0.31	0.01	0.34	<10
KD13211	382717	1075616	72	1.5	72	1.5	0.19	0.02	0.22	<10
KD13221	382724	1075616	43	1.6	65	1.2	0.17	0.01	0.19	<10
KD13311	382528	1075500	47	1.9	63	1.3	0.24	0.03	0.26	<10
					Quaternary Alluvium, Recent Deposits					
QR01111	384220	1080354	44	1.4	74	1.8	0.18	0.03	0.23	<10
QR01211	384457	1080529	52	1.4	70	1.5	0.24	0.04	0.34	<10
QR02111	384630	1080133	200	1.4	230	1.4	0.27	0.06	0.28	8
QR02121	384630	1080124	180	1.2	310	1.5	0.22	0.08	0.22	20
QR02211	384614	1080026	70	1.6	79	2.0	0.25	0.02	0.26	<10
QR02311	384604	1080210	73	1.5	92	2.2	0.28	0.05	0.38	<10
QR05111	384149	1080229	150	1.5	150	1.3	0.23	0.06	0.24	<10
QR05211	384044	1080027	23	0.69	69	1.5	0.32	0.01	0.18	<10
QR05311	383828	1075959	190	1.4	240	1.5	0.20	0.13	0.19	<10
QR08111	383737	1080005	146	1.5	150	1.6	0.18	0.01	0.29	<10
QR08211	383506	1075846	52	0.97	75	2.2	0.29	0.10	0.19	<10
QR08311	383323	1075825	30	1.4	40	2.4	0.23	0.04	0.33	<10
QR08321	383329	1075826	49	1.7	69	2.3	0.24	0.02	0.30	<10
QR10111	383134	1075657	160	1.3	230	1.9	0.29	0.02	0.30	<10
QR10211	383206	1075756	69	1.8	86	1.4	0.25	0.01	0.29	<10
QR10311	383229	1075806	230	1.2	160	1.4	0.20	0.02	0.21	6
QR11111	383017	1075506	400	1.4	280	1.3	0.27	0.03	0.28	25
QR11211	382906	1075411	62	1.8	89	1.5	0.22	0.01	0.20	<10
QR11311	382932	1075409	61	1.3	77	2.0	0.17	0.02	0.21	<10
QR14111	382337	1074906	46	1.6	77	1.4	0.19	0.02	0.25	<10
QR14211	382237	1074826	110	1.1	110	0.93	0.15	0.01	0.18	<10
QR14311	382549	1075117	94	2.0	85	1.1	0.23	0.01	0.27	<10

Table A3.--Listing of analytical results for alfalfa (converted to a dry-weight basis) collected from the Uncompahgre Project Area (continued).

Sample	Latitude	Longitude	Al, ppm	Ca, %	Fe, ppm	K, %	Mg, %	Na, %	P, %	Ti, ppm
					Quaternary Alluvium, Tertiary Deposits Derived					
QT01111	384214	1080617	68	1.4	76	2.1	0.20	0.03	0.30	<10
QT01311	384256	1080453	48	1.7	79	1.7	0.24	0.03	0.35	<10
QT02111	384344	1080207	85	1.9	85	1.7	0.21	0.04	0.31	<10
QT02211	384338	1080057	61	2.3	87	0.96	0.34	0.06	0.27	<10
QT02311	384434	1080220	38	1.7	94	1.5	0.26	0.02	0.32	<10
QT02321	384431	1080221	380	1.7	370	1.5	0.27	0.17	0.29	26
QT04111	384010	1080552	43	1.9	77	1.2	0.24	0.03	0.27	<10
QT04211	384020	1080817	100	2.3	100	1.3	0.32	0.04	0.31	<10
QT04212	384020	1080817	99	2.4	99	1.7	0.32	0.04	0.31	<10
QT04311	384139	1080541	34	1.8	67	1.4	0.21	0.03	0.30	<10
QT04312	384139	1080541	32	1.7	81	1.8	0.21	0.03	0.32	<10
QT04321	384138	1080535	400	1.6	490	1.2	0.23	0.05	0.32	9
QT05111	383835	1080213	260	1.7	270	1.6	0.23	0.01	0.27	8
QT05211	384041	1080116	80	1.6	160	1.5	0.26	0.02	0.26	<10
QT05311	384133	1080217	47	1.7	71	1.1	0.20	0.04	0.30	<10
QT06211	384101	1075359	440	2.1	7700	1.6	0.19	0.02	0.28	20
QT06311	384141	1075358	350	1.5	180	1.4	0.22	0.02	0.26	7
QT07111	383350	1075615	38	1.4	62	1.5	0.25	0.08	0.28	<10
QT07211	383528	1075516	82	2.2	160	0.98	0.31	0.04	0.21	<10
QT07311	383711	1075828	41	2.4	82	1.4	0.26	0.01	0.34	<10
QT08111	383254	1075705	150	1.9	160	1.0	0.28	0.09	0.21	8
QT08121	383300	1075704	44	1.8	74	1.2	0.25	0.07	0.24	<10
QT08122	383300	1075704	78	1.8	70	1.1	0.26	0.08	0.23	<10
QT08211	383347	1075359	170	1.6	170	2.1	0.19	0.02	0.35	<10
QT08311	383619	1075428	25	1.7	51	1.6	0.25	0.02	0.29	<10
QT10111	383030	1075743	74	1.8	150	1.3	0.16	0.01	0.30	<10
QT10211	382956	1075617	64	2.1	91	1.9	0.19	0.01	0.27	<10
QT10221	382957	1075609	91	1.9	91	2.1	0.21	0.01	0.27	<10
QT10311	382924	1075837	91	1.7	91	1.9	0.23	0.02	0.26	<10
					In-house Alfalfa Standard					
ALF1-1			56	1.1	72	1.4	0.26	0.10	0.19	<10
ALF1-2			56	1.1	80	1.6	0.26	0.09	0.18	<10
ALF1-3			74	1.2	82	1.3	0.26	0.10	0.19	<10
ALF1-4			57	1.1	82	1.6	0.26	0.10	0.20	<10
ALF1-5			65	1.1	81	2.2	0.27	0.10	0.21	<10
ALF1-6			55	1.2	79	2.1	0.26	0.09	0.20	<10
ALF1-7			74	1.2	82	1.9	0.27	0.10	0.20	<10
ALF1-8			58	1.0	80	1.5	0.24	0.08	0.17	<10

Table A3.--Listing of analytical results for alfalfa (converted to a dry-weight basis) collected from the Uncompahgre Project Area (continued).

Sample	Mn, ppm	Ba, ppm	Co, ppm	Cr, ppm	Cu, ppm	La, ppm	Li, ppm	Mo, ppm	Nd, ppm	Ni, ppm
					Cretaceous Mancos Formation					
KM01111	16	2.5	0.3	0.4	8.7	<0.3	4.8	5.1	<0.8	0.7
KM01211	13	3.0	0.3	0.3	10	<0.3	1.9	3.5	<0.7	0.4
KM01311	18	2.3	0.3	0.3	6.3	<0.3	1.5	5.5	<0.5	1.3
KM01312	18	2.3	0.2	0.3	6.3	<0.3	1.5	4.3	<0.5	1.3
KM02111	24	3.3	0.6	0.8	12	<0.4	2.1	12	<0.9	2.8
KM02211	15	3.4	0.3	0.7	9.8	0.3	1.7	6.8	<0.7	1.8
KM02311	17	1.9	0.4	0.3	10	<0.4	1.9	5.9	<0.8	1.9
KM03111	6.9	1.6	0.2	0.4	5.4	<0.2	3.6	2.4	<0.5	1.2
KM03211	16	5.2	0.4	0.6	8.2	0.5	0.6	7.2	<0.7	1.9
KM03311	12	5.2	0.3	0.5	8.2	0.4	1.6	7.9	<0.7	0.8
KM03321	10	5.7	0.3	0.3	8.6	<0.3	0.6	6.1	<0.5	0.7
KM03322	9.8	5.5	0.1	0.3	8.6	<0.3	0.5	5.7	<0.5	0.7
KM04311	13	1.5	0.7	0.4	6.6	<0.3	4.8	2.8	<0.6	1.5
KM04411	11	4.3	0.7	0.3	8.4	<0.4	2.5	4.8	<0.8	1.0
KM05111	11	1.9	0.3	0.4	7.3	<0.3	5.0	5.6	<0.5	1.4
KM05211	11	2.1	0.3	0.4	8.5	<0.3	2.2	5.5	<0.7	0.9
KM05212	10	2.1	0.3	0.4	8.6	<0.3	2.2	5.2	<0.7	0.9
KM05221	21	2.3	0.4	0.4	7.0	<0.4	0.9	6.5	<0.8	1.9
KM05311	8.2	2.6	0.3	0.3	8.2	<0.3	0.8	5.2	<0.6	1.5
KM06311	7.3	1.8	0.1	0.4	7.0	<0.3	2.7	2.9	<0.6	1.5
KM08111	21	6.4	0.3	0.3	9.3	<0.3	1.7	3.3	<0.7	0.9
KM08211	15	2.5	0.4	0.4	7.5	<0.4	0.4	3.6	<0.7	0.9
KM09111	19	5.2	0.7	0.4	8.6	<0.4	2.1	3.0	<0.8	0.9
KM09211	17	2.7	0.3	0.9	9.0	<0.4	2.8	4.9	<0.9	3.0
KM09311	15	3.2	0.3	0.2	8.6	1.0	1.9	5.7	<0.8	0.9
KM10211	14	2.5	0.4	0.4	8.5	0.4	1.9	17	<0.8	2.2
KM10212	14	2.4	0.4	0.3	8.7	0.4	1.0	22	<0.8	2.4
KM10311	23	0.8	0.2	0.2	5.5	<0.3	8.6	9.3	<0.6	0.5
KM11111	16	4.8	0.3	0.7	11	<0.4	1.8	8.5	<0.7	0.9
KM11211	15	4.6	0.3	0.7	10	0.3	4.8	7.6	<0.6	1.4
KM11311	10	12	0.4	0.5	11	<0.4	0.5	3.5	<0.7	0.6
KM12111	16	5.5	0.3	0.4	9.5	<0.3	1.7	5.9	<0.7	1.7
KM12211	20	16	0.3	0.8	11	<0.4	1.0	4.5	<0.8	1.0
KM12311	17	2.6	0.2	0.3	9.7	<0.3	5.4	3.2	<0.7	2.5
KM14111	26	48	0.3	<0.2	9.2	<0.4	0.5	1.9	<0.8	<0.4
KM14211	17	15	0.2	0.3	7.7	<0.4	0.8	5.7	<0.8	0.9
KM14311	15	6.0	0.2	0.2	8.2	<0.3	2.4	3.8	<0.7	0.7
KM15111	17	4.8	0.3	0.6	9.7	0.5	8.5	7.8	<0.9	2.1
KM15311	9.5	3.3	<0.1	0.2	7.5	<0.3	0.4	16	<0.6	0.7

Table A3.--Listing of analytical results for alfalfa (converted to a dry-weight basis) collected from the Uncompahgre Project Area (continued).

Sample	Mn, ppm	Ba, ppm	Co, ppm	Cr, ppm	Cu, ppm	La, ppm	Li, ppm	Mo, ppm	Nd, ppm	Ni, ppm
					Quaternary Alluvium, Dakota Formation Derived					
QD13111	28	82	0.3	0.4	7.1	<0.4	0.4	2.6	0.7	0.9
					Quaternary Alluvium, Mancos Formation Derived					
QM01111	20	2.0	0.7	3.2	12	<0.4	0.9	5.1	<0.7	3.5
QM01211	13	1.9	0.2	0.5	9.1	<0.3	1.5	5.0	<0.6	0.6
QM01212	12	2.3	0.2	0.4	8.8	<0.3	1.5	4.0	<0.5	0.5
QM01311	13	2.2	0.3	0.4	8.7	<0.3	5.8	3.6	<0.6	0.8
QM02111	14	3.8	0.2	0.5	11	<0.3	0.8	4.7	<0.6	0.5
QM02211	14	4.2	0.2	0.5	9.3	<0.3	1.7	5.6	<0.7	1.7
QM02311	16	12	0.5	0.3	7.8	<0.3	0.7	4.2	<0.7	0.8
QM03111	23	4.0	0.3	0.4	9.7	<0.4	2.0	6.1	<0.8	1.0
QM03211	16	3.8	0.4	0.4	11	0.5	6.3	7.9	<0.7	1.9
QM03212	16	2.7	0.6	0.8	11	<0.4	6.3	10	3.0	2.0
QM03221	17	3.0	0.6	0.4	10	<0.4	2.4	7.4	<0.7	2.1
QM03311	13	3.9	0.4	0.7	6.3	<0.3	0.7	32	0.6	1.4
QM05111	9.0	2.5	0.4	0.2	4.8	<0.3	4.6	2.4	<0.5	0.6
QM05211	12	3.0	0.1	0.3	9.4	<0.3	1.5	2.4	<0.6	0.4
QM05311	18	4.0	0.3	0.3	8.4	<0.3	6.4	4.3	<0.7	0.8
QM08111	13	6.4	0.4	1.6	11	<0.3	2.1	3.2	<0.7	1.6
QM08112	12	3.7	<0.2	0.8	9.9	<0.3	2.1	3.4	<0.7	0.8
QM08211	11	3.6	0.8	0.3	8.5	<0.3	0.8	4.5	<0.6	0.8
QM08311	21	7.1	0.4	0.4	6.3	<0.3	1.6	6.3	<0.6	0.5
QM09111	10	6.9	0.3	0.3	7.6	0.3	0.9	4.0	<0.7	0.9
QM09211	11	4.2	0.2	0.5	7.5	<0.3	1.5	4.8	<0.6	0.5
QM09311	16	3.8	0.3	0.5	11	<0.3	1.6	3.9	<0.7	0.8
QM10111	10	6.4	0.2	0.6	8.9	<0.3	1.3	5.7	<0.5	1.3
QM10211	16	9.1	0.3	0.3	6.8	<0.3	0.7	6.0	1.8	0.6
QM10311	10	5.2	0.2	0.3	9.5	<0.3	0.7	5.0	<0.6	0.3
QM11111	10	3.6	0.4	0.9	12	<0.4	2.7	14	<0.7	2.0
QM11211	13	18	0.2	0.4	7.4	<0.3	0.7	1.6	<0.6	0.7
QM11311	9.9	6.5	0.2	0.2	9.9	<0.4	0.9	4.7	<0.7	0.9
QM12111	16	25	0.2	0.4	11	<0.3	0.5	3.0	<0.6	1.4
QM12121	12	31	0.4	0.3	9.5	<0.3	<0.3	3.8	<0.6	1.6
QM12211	18	13	<0.2	0.6	7.5	<0.3	0.8	5.5	<0.7	0.8
QM12311	19	14	0.4	0.4	7.0	<0.3	0.6	5.0	<0.6	1.5
QM14111	15	18	0.3	0.5	7.6	0.3	1.3	1.6	<0.6	0.6
QM14211	11	6.6	0.2	0.4	11	<0.4	2.0	6.8	<0.6	2.3
QM14311	13	2.4	0.2	0.5	9.5	<0.3	3.2	8.1	<0.5	2.2
QM14312	13	2.8	0.3	0.5	9.5	<0.3	3.1	8.1	<0.5	2.0
QM14321	8.6	2.6	0.3	0.7	10	0.3	2.1	10	<0.6	2.0
QM15311	18	17	0.5	0.6	7.0	<0.3	2.5	7.7	0.7	1.4

Table A3.--Listing of analytical results for alfalfa (converted to a dry-weight basis) collected from the Uncompahgre Project Area (continued).

Sample	Mn, ppm	Ba, ppm	Co, ppm	Cr, ppm	Cu, ppm	La, ppm	Li, ppm	Mo, ppm	Nd, ppm	Ni, ppm
					Cretaceous Dakota Formation					
KD07111	27	17	0.4	0.4	10	<0.5	2.2	7.6	0.9	1.1
KD07211	23	23	0.5	0.3	8.8	<0.4	0.9	2.8	<0.7	0.5
KD07212	23	23	0.6	0.4	8.7	<0.4	0.9	2.6	<0.7	0.5
KD07311	21	8.3	0.3	0.7	5.0	<0.3	1.7	7.2	<0.7	1.7
KD07321	12	4.1	0.2	0.1	6.9	<0.3	1.4	10	<0.6	1.4
KD07322	16	4.6	0.2	0.2	7.4	<0.3	1.6	11	<0.6	1.5
KD10111	18	13	0.4	0.4	6.0	<0.3	0.8	6.2	0.8	0.6
KD10211	17	1.6	0.2	0.3	11	<0.3	2.9	6.6	<0.6	0.5
KD10311	26	5.9	0.3	0.2	6.9	<0.4	6.1	12	<0.9	1.1
KD13111	24	76	0.4	0.4	6.8	<0.4	3.6	2.7	<0.7	0.7
KD13211	13	11	0.2	0.4	7.2	<0.3	0.7	2.0	<0.6	0.3
KD13221	16	19	0.2	0.2	6.6	<0.3	0.6	1.9	0.7	0.3
KD13311	28	32	0.2	0.2	8.7	<0.3	0.7	2.1	<0.6	0.4
					Quaternary Alluvium, Recent Deposits					
QR01111	14	2.5	0.2	0.3	6.9	<0.3	1.5	3.8	<0.6	0.7
QR01211	16	2.0	0.2	0.2	6.9	<0.4	2.0	3.3	<0.7	<0.4
QR02111	18	4.2	0.3	0.5	9.1	<0.3	0.8	2.5	<0.7	0.4
QR02121	18	5.1	0.2	0.4	6.0	<0.3	1.4	4.2	<0.5	0.4
QR02211	18	7.4	0.3	0.2	8.3	<0.4	0.7	3.4	<0.7	<0.4
QR02311	23	6.0	0.4	0.4	7.9	<0.4	0.7	3.9	<0.7	0.6
QR05111	20	4.6	0.2	0.4	8.4	<0.3	3.3	5.9	<0.6	0.8
QR05211	8.5	0.8	0.2	0.2	7.7	<0.3	2.2	14	<0.6	0.7
QR05311	21	4.0	0.2	0.5	11	<0.3	4.9	4.8	<0.7	0.7
QR08111	12	2.7	0.2	0.4	11	<0.3	0.7	4.7	<0.6	0.5
QR08211	16	1.7	0.2	0.2	9.0	<0.3	5.6	4.6	<0.6	0.8
QR08311	15	2.6	0.3	0.3	7.2	<0.4	1.0	4.3	<0.8	0.6
QR08321	18	3.5	0.2	0.3	7.5	<0.4	1.0	5.1	<0.8	0.5
QR10111	16	4.7	0.2	0.6	8.0	<0.3	1.7	4.7	<0.6	0.6
QR10211	18	10	0.2	0.3	7.8	<0.3	0.6	2.6	<0.7	0.8
QR10311	17	8.4	0.2	0.5	7.1	<0.3	0.6	2.2	<0.5	0.5
QR11111	17	10	0.3	0.5	8.0	<0.3	2.2	2.9	<0.7	0.8
QR11211	16	8.9	0.3	<0.2	11	<0.4	2.5	2.3	<0.7	1.8
QR11311	15	8.4	0.2	0.2	9.2	<0.3	2.2	3.6	<0.7	0.5
QR14111	14	7.0	0.2	0.2	7.0	<0.3	0.6	3.6	<0.6	0.8
QR14211	11	7.1	0.2	0.3	6.0	<0.2	0.3	1.3	<0.4	0.4
QR14311	17	16	0.3	0.3	8.3	<0.4	0.5	3.2	<0.8	0.5

Table A3.--Listing of analytical results for alfalfa (converted to a dry-weight basis) collected from the Uncompahgre Project Area (continued).

Sample	Mn, ppm	Ba, ppm	Co, ppm	Cr, ppm	Cu, ppm	La, ppm	Li, ppm	Mo, ppm	Nd, ppm	Ni, ppm
					Quaternary Alluvium, Tertiary Deposits Derived					
QT01111	20	7.1	0.2	0.3	9.3	<0.3	0.9	2.3	<0.7	0.4
QT01311	21	6.0	0.2	0.3	7.9	<0.3	0.8	2.4	<0.6	<0.3
QT02111	19	2.9	0.3	0.3	11	<0.3	2.0	5.5	<0.7	0.9
QT02211	27	7.5	0.4	0.4	11	<0.3	0.9	3.7	<0.7	0.5
QT02311	28	3.6	0.3	0.4	9.1	<0.4	1.9	4.4	<0.8	0.9
QT02321	24	8.8	0.4	0.7	9.6	<0.4	1.8	3.9	<0.7	0.9
QT04111	14	3.8	0.4	<0.2	8.6	<0.3	1.7	5.1	<0.7	0.9
QT04211	26	6.1	0.3	0.3	8.7	<0.4	2.1	3.7	<0.8	0.5
QT04212	26	6.5	0.2	0.3	9.1	<0.4	2.1	3.0	<0.8	0.6
QT04311	23	5.9	0.3	0.2	10	<0.3	0.8	3.5	<0.7	<0.3
QT04312	24	6.2	0.2	0.3	9.7	<0.3	0.7	2.7	<0.7	<0.3
QT04321	27	8.3	0.4	0.9	9.7	<0.3	0.9	2.3	<0.7	0.7
QT05111	18	10	0.3	0.5	9.1	<0.3	0.8	3.6	<0.7	0.5
QT05211	13	3.5	0.2	0.5	10	<0.3	1.6	3.0	0.8	0.6
QT05311	20	3.9	0.3	0.3	9.4	<0.3	1.6	1.8	<0.6	0.5
QT06211	50	11	2.0	7.2	13	0.4	0.6	4.6	<0.8	5.0
QT06311	20	9.0	0.2	0.5	6.7	0.4	0.8	4.5	<0.6	0.8
QT07111	16	3.4	0.3	0.3	7.1	<0.3	3.4	2.5	<0.6	<0.3
QT07211	20	9.0	0.2	0.4	9.0	<0.3	3.1	2.8	<0.7	0.8
QT07311	26	22	0.2	<0.2	11	<0.4	0.7	3.0	<0.8	0.5
QT08111	17	10	0.2	0.6	8.4	<0.3	0.8	5.1	<0.6	0.8
QT08121	17	10	0.2	0.3	8.1	<0.3	1.5	2.6	<0.6	0.4
QT08122	17	10	0.2	0.3	8.6	<0.3	1.6	2.7	<0.6	0.5
QT08211	23	16	0.3	0.4	7.8	<0.4	0.5	3.3	<0.7	<0.4
QT08311	26	10	0.3	0.2	8.1	<0.3	0.9	4.1	<0.7	<0.3
QT10111	20	13	0.2	0.4	6.8	<0.3	0.6	2.8	<0.6	1.5
QT10211	16	24	0.4	0.4	7.4	<0.4	0.5	2.7	<0.7	0.4
QT10221	21	18	0.3	0.4	6.9	<0.4	0.6	2.4	<0.7	0.7
QT10311	25	13	0.3	0.4	8.1	<0.4	1.8	5.4	<0.7	0.6
					In-house Alfalfa Standard					
ALF1-1	22	2.2	0.4	<0.2	6.1	<0.3	2.4	2.7	<0.6	0.6
ALF1-2	22	2.5	0.2	0.2	6.2	<0.3	2.3	2.5	<0.6	0.6
ALF1-3	23	2.5	0.3	0.2	6.0	<0.3	2.5	2.3	<0.7	0.6
ALF1-4	23	2.8	0.3	0.2	6.1	<0.3	2.4	2.0	<0.7	0.6
ALF1-5	23	2.7	0.3	0.3	6.1	<0.3	2.4	2.1	<0.7	0.7
ALF1-6	23	2.6	0.2	0.2	5.9	<0.3	2.3	2.0	<0.6	0.6
ALF1-7	24	2.7	0.3	0.3	5.7	<0.3	2.5	2.7	<0.6	0.5
ALF1-8	21	2.4	0.3	0.2	5.3	<0.3	2.1	2.4	<0.6	0.4

Table A3.--Listing of analytical results for alfalfa (converted to a dry-weight basis) collected from the Uncompahgre Project Area (continued).

Sample	Sr, ppm	V, ppm	Zn, ppm	As, ppm	Se, ppm	Ash, %	U, ppb
				Cretaceous Mancos Formation			
KM01111	200	<0.3	38	<0.05	0.60	7.26	120
KM01211	160	<0.3	28	0.10	0.29	7.47	55
KM01311	140	<0.3	20	0.10	0.16	6.67	45
KM01312	140	<0.3	20	<0.05	0.20	6.66	50
KM02111	140	0.5	47	0.12	0.66	10.7	150
KM02211	200	0.6	36	<0.05	0.68	7.52	120
KM02311	170	<0.3	40	0.07	0.18	9.37	46
KM03111	170	<0.2	23	0.11	1.6	5.78	100
KM03211	150	1.8	37	0.11	1.0	9.10	66
KM03311	170	0.7	37	1.9	1.6	8.18	70
KM03321	140	0.3	22	0.12	0.64	6.58	31
KM03322	130	0.4	22	<0.05	0.72	6.59	32
KM04311	130	<0.3	30	0.23	0.13	7.29	120
KM04411	260	<0.4	26	<0.05	0.51	10.2	110
KM05111	210	<0.3	24	0.06	1.2	6.65	93
KM05211	190	<0.3	29	0.09	1.4	8.53	110
KM05212	180	<0.3	29	<0.05	1.4	8.61	95
KM05221	190	<0.4	30	0.11	0.26	9.40	100
KM05311	270	<0.3	29	0.11	0.10	7.49	120
KM06311	150	<0.3	29	<0.05	0.69	7.25	140
KM08111	220	<0.3	25	0.40	0.34	8.46	62
KM08211	170	<0.4	23	<0.05	0.23	8.87	37
KM09111	180	<0.4	33	0.14	0.58	9.78	46
KM09211	150	1.1	43	0.13	0.59	10.6	85
KM09311	210	<0.4	26	0.12	<0.03	9.59	120
KM10211	280	<0.4	19	<0.05	0.22	9.51	340
KM10212	290	<0.4	19	0.09	0.22	9.57	430
KM10311	160	<0.3	18	<0.05	<0.03	7.78	6
KM11111	200	0.7	36	0.14	0.86	8.99	79
KM11211	160	0.7	36	0.11	0.33	6.86	190
KM11311	150	<0.4	28	0.08	0.66	9.18	32
KM12111	160	0.3	27	<0.05	<0.03	8.59	50
KM12211	110	0.7	40	0.10	0.18	9.47	94
KM12311	220	<0.3	40	<0.05	0.78	8.09	53
KM14111	120	<0.4	21	<0.05	0.04	9.39	9
KM14211	240	<0.4	22	<0.05	0.34	9.35	40
KM14311	180	<0.3	28	<0.05	0.13	8.15	20
KM15111	290	<0.4	61	0.20	0.40	10.6	220
KM15311	110	0.4	16	<0.05	<0.03	6.80	44

Table A3.--Listing of analytical results for alfalfa (converted to a dry-weight basis) collected from the Uncompahgre Project Area (continued).

Sample	Sr, ppm	V, ppm	Zn, ppm	As, ppm	Se, ppm	Ash, %	U, ppb
				Quaternary Alluvium, Dakota Formation Derived			
QD13111	150	<0.4	21	<0.05	0.31	9.01	5
				Quaternary Alluvium, Mancos Formation Derived			
QM01111	190	<0.4	43	0.73	0.87	8.86	65
QM01211	120	<0.3	34	<0.05	2.2	6.98	47
QM01212	110	<0.3	33	<0.05	2.4	6.75	39
QM01311	210	<0.3	28	0.07	0.79	7.95	80
QM02111	140	0.6	33	<0.05	0.78	7.55	35
QM02211	150	0.4	39	<0.05	0.75	8.49	42
QM02311	140	<0.3	22	<0.05	0.39	8.19	31
QM03111	170	<0.4	36	0.08	0.65	9.73	71
QM03211	240	<0.4	45	<0.05	0.27	9.04	99
QM03212	240	0.5	55	<0.05	0.23	9.39	70
QM03221	290	<0.4	38	0.08	<0.03	9.29	110
QM03311	150	0.3	14	<0.05	4.1	6.80	30
QM05111	120	<0.2	27	0.07	0.65	5.98	78
QM05211	140	<0.3	22	<0.05	0.53	7.24	46
QM05311	180	<0.3	28	<0.05	1.0	8.37	80
QM08111	160	0.7	28	0.08	3.9	8.09	140
QM08112	170	0.4	29	<0.05	4.7	8.28	120
QM08211	130	<0.3	26	<0.05	0.52	7.68	72
QM08311	130	<0.3	21	0.09	1.9	7.10	30
QM09111	130	<0.3	24	<0.05	0.45	8.47	24
QM09211	100	<0.3	29	0.14	0.76	7.66	44
QM09311	150	0.4	40	0.18	1.5	8.20	54
QM10111	170	0.4	26	<0.05	1.3	6.38	47
QM10211	130	<0.3	19	<0.05	0.20	7.59	12
QM10311	120	<0.3	23	0.08	<0.03	7.29	17
QM11111	190	<0.4	32	0.13	1.5	8.67	150
QM11211	130	0.4	22	<0.05	0.57	7.38	54
QM11311	190	<0.4	26	0.09	0.52	9.00	41
QM12111	99	<0.3	30	<0.05	0.34	7.08	39
QM12121	100	<0.3	30	0.09	<0.03	7.88	22
QM12211	84	0.3	22	---	8.40	24	
QM12311	120	<0.3	24	0.13	0.04	7.38	35
QM14111	120	0.6	25	0.12	0.30	6.29	50
QM14211	270	0.4	39	<0.05	6.3	8.77	240
QM14311	100	0.6	46	0.09	1.2	6.78	470
QM14312	100	0.6	46	0.09	1.3	6.75	470
QM14321	86	0.7	47	0.09	0.79	7.17	190
QM15311	130	0.7	39	0.11	2.0	7.00	160

Table A3.--Listing of analytical results for alfalfa (converted to a dry-weight basis) collected from the Uncompahgre Project Area (continued).

Sample	Sr, ppm	V, ppm	Zn, ppm	As, ppm	Se, ppm	Ash, %	U, ppb
				Cretaceous Dakota Formation			
KD07111	230	<0.4	56	<0.05	0.36	11.1	19
KD07211	160	<0.4	22	0.08	0.05	8.98	30
KD07212	160	<0.4	23	0.10	0.04	8.79	24
KD07311	420	0.4	16	0.08	0.34	8.54	34
KD07321	140	<0.3	16	<0.05	0.31	6.86	12
KD07322	150	<0.3	17	<0.05	0.33	7.58	13
KD10111	120	<0.3	20	<0.05	<0.03	7.50	12
KD10211	140	<0.3	42	<0.05	0.16	7.58	39
KD10311	320	<0.4	20	<0.05	0.05	11.0	8
KD13111	330	0.6	24	<0.05	0.69	8.86	27
KD13211	100	<0.3	20	0.11	0.09	7.17	19
KD13221	110	<0.3	18	<0.05	0.03	7.20	10
KD13311	130	<0.3	22	0.11	0.10	7.88	14
				Quaternary Alluvium, Recent Deposits			
QR01111	140	<0.3	23	<0.05	0.64	7.35	48
QR01211	140	<0.4	28	0.14	0.41	8.69	19
QR02111	120	<0.3	28	<0.05	1.4	8.31	58
QR02121	120	0.7	20	<0.05	0.60	6.79	45
QR02211	120	<0.4	20	0.09	0.80	8.78	35
QR02311	120	<0.4	28	<0.05	1.2	9.17	57
QR05111	170	<0.3	30	<0.05	0.70	7.59	60
QR05211	92	<0.3	22	<0.05	9.5	7.69	13
QR05311	160	<0.3	35	0.09	1.3	8.32	67
QR08111	180	<0.3	32	<0.05	2.0	7.30	43
QR08211	120	<0.3	37	<0.05	0.73	7.46	57
QR08311	110	<0.4	21	0.07	0.39	9.98	28
QR08321	160	<0.4	21	0.08	0.27	9.89	18
QR10111	140	<0.3	33	0.13	<0.03	7.99	28
QR10211	150	<0.3	25	<0.05	0.16	8.59	21
QR10311	120	0.3	17	0.13	0.09	6.47	21
QR11111	170	0.8	26	0.12	0.25	8.29	23
QR11211	200	<0.4	29	0.10	0.17	8.88	13
QR11311	110	<0.3	29	<0.05	0.47	7.65	23
QR14111	130	<0.3	25	<0.05	0.81	7.69	33
QR14211	82	<0.2	18	<0.05	0.21	5.47	37
QR14311	140	<0.4	26	0.08	0.29	9.40	16

Table A3.--Listing of analytical results for alfalfa (converted to a dry-weight basis) collected from the Uncompahgre Project Area (continued).

Sample	Sr, ppm	V, ppm	Zn, ppm	As, ppm	Se, ppm	Ash, %	U, ppb
			Quaternary Alluvium, Tertiary Deposits Derived				
QT01111	150	<0.3	20	0.09	0.23	8.48	30
QT01311	170	<0.3	22	<0.05	0.18	7.94	41
QT02111	180	<0.3	31	<0.05	0.31	8.48	85
QT02211	210	<0.4	30	0.06	0.26	8.69	32
QT02311	200	<0.4	40	0.08	1.6	9.42	37
QT02321	170	0.6	39	0.10	1.8	8.75	52
QT04111	190	<0.4	25	<0.05	0.61	8.59	71
QT04211	270	<0.4	23	0.07	0.08	9.98	68
QT04212	270	<0.4	23	0.09	0.09	9.88	69
QT04311	180	<0.3	26	0.12	<0.03	8.38	36
QT04312	180	<0.3	26	<0.10	0.20	8.11	38
QT04321	150	0.4	43	0.17	0.14	8.85	38
QT05111	140	0.5	32	0.14	0.23	8.30	22
QT05211	180	<0.3	38	0.13	0.75	7.99	59
QT05311	160	<0.3	24	<0.05	0.44	7.86	29
QT06211	140	0.7	67	0.31	1.0	9.84	44
QT06311	100	0.4	31	0.09	0.44	7.48	33
QT07111	160	<0.3	25	0.11	0.14	7.69	67
QT07211	220	<0.3	24	0.10	0.33	8.15	52
QT07311	260	<0.4	36	0.07	0.26	10.3	23
QT08111	150	0.3	24	<0.05	0.35	7.68	26
QT08121	150	<0.3	22	0.10	0.38	7.35	21
QT08122	140	<0.3	23	0.08	0.34	7.78	22
QT08211	120	<0.4	30	0.25	0.04	8.65	19
QT08311	150	<0.3	21	0.07	0.09	8.47	19
QT10111	110	<0.3	27	0.08	0.33	7.36	18
QT10211	150	<0.4	26	0.19	0.16	9.12	12
QT10221	140	<0.4	24	0.15	0.10	9.10	13
QT10311	150	<0.4	25	0.08	0.10	9.14	24
				In-house Alfalfa Standard			
ALF1-1	57	<0.3	20	<0.05	0.14	8.00	78
ALF1-2	57	<0.3	19	<0.05	0.13	7.98	88
ALF1-3	57	<0.3	20	<0.05	0.13	8.20	75
ALF1-4	58	<0.3	20	<0.05	0.17	8.16	73
ALF1-5	58	<0.3	19	0.10	0.15	8.10	81
ALF1-6	57	<0.3	20	0.10	0.16	7.86	69
ALF1-7	58	<0.3	21	0.06	0.15	8.18	74
ALF1-8	51	<0.3	19	0.07	0.13	7.19	64

Table A4.--Listing of the mercury results for a randomly chosen subset of the soil samples collected from the Uncompahgre Project Area.

Sample	Latitude	Longitude	Hg, ppm
KD07111	383609	1075849	0.08
KD07211	383506	1075751	0.05
KD10311	382832	1075805	0.04
KD13211	382717	1075616	0.05
KD13311	382528	1075500	0.05
KM02111	384156	1080020	0.05
KM02211	384326	1080021	0.06
KM02311	384436	1075854	0.08
KM03112	384239	1075623	0.07
KM04311	384148	1080739	0.03
KM08311	383556	1075343	0.05
KM14211	382244	1074746	0.07
KM15211	382534	1074802	0.07
KM15311	382449	1074709	0.05
QM01111	384607	1080421	0.03
QM03311	384450	1075555	0.06
QM05111	383913	1075805	0.06
QM08111	383748	1075700	0.06
QM10211	383235	1075707	0.06
QM10311	383156	1075713	0.08
QM11111	383206	1075307	0.02
QM12111	382857	1074602	0.06
QM12121	382857	1074557	0.06
QM12211	382740	1074633	0.06
QM14211	382652	1074854	0.06
QM15311	382538	1074740	0.04
QR01112	384220	1080354	0.05
QR02111	384630	1080133	0.07
QR08311	383323	1075825	0.05
QR10111	383134	1075657	0.03
QR10311	383229	1075806	0.07
QR11311	382932	1075409	0.05
QT01311	384256	1080453	0.15
QT04321	384138	1080535	0.07
QT05111	383835	1080213	0.07
QT05211	384041	1080116	0.06
QT06211	384101	1075359	0.06
QT10311	382924	1075837	0.06
SJS1			0.14

Table A5.--Listing of the mercury results for a randomly chosen subset of the alfalfa samples (dry-weight basis) collected from the Uncompahgre Project Area.

Sample	Latitude	Longitude	Hg, ppm
ALF1-7			0.02
ALF1-8			0.02
KD07111	383609	1075849	0.06
KD10111	382912	1075936	<0.02
KD10211	382800	1075711	0.02
KD13221	382724	1075616	0.02
KM01111	384353	1080632	<0.02
KM03311	384338	1075620	0.02
KM09111	383715	1075528	<0.02
KM09311	383307	1075444	<0.02
KM10311	383120	1075918	<0.02
KM14311	382632	1075136	<0.02
QD13111	382547	1075748	<0.02
QM02211	384540	1075918	0.02
QM03212	384540	1075605	0.02
QM03311	384450	1075555	<0.02
QM05111	383913	1075805	0.02
QM08311	383516	1075624	<0.02
QM09111	383512	1075404	0.02
QM10111	383135	1075615	<0.02
QM10211	383235	1075707	<0.02
QM15311	382538	1074740	0.02
QR01211	384457	1080529	0.02
QR02211	384614	1080026	<0.02
QR02311	384604	1080210	<0.02
QR08321	383329	1075826	<0.02
QR11111	383017	1075506	0.03
QT05211	384041	1080116	<0.02
QT06311	384141	1075358	0.03
QT07111	383350	1075615	<0.02