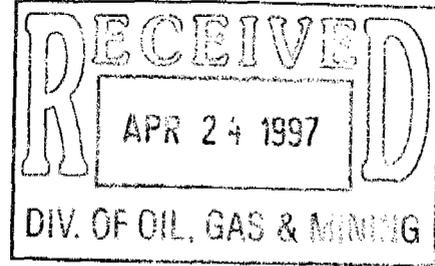




**Canyon Fuel Company, LLC**  
SUFCO Mine  
397 South 800 West  
Salina, Utah 84654  
(801) 637-4880 Fax: (801) 636-4499



April 17, 1997

Mr. James W. Carter  
Utah Coal Regulatory Program  
Division of Oil, Gas and Mining  
1594 West North Temple, Suite 1210  
P. O. Box 145801  
Salt Lake City, UT 84114-5801

Re: Annual Report for Canyon Fuel Company LLC, SUFCO Coal Mine

Dear Mr. Carter:

Attached herewith is a copy of the annual report for the Canyon Fuel Company, SUFCO coal mine for 1996. The information included is thought to be complete as requested. Questions should be referred to Wess Sorensen at (801) 637-4880.

Sincerely,  
CANYON FUEL COMPANY  
SUFCO Mine

Kenneth E. May  
Vice President and General Manager

Enclosures

KEM/WKS:kb

**ANNUAL REPORT**

**CANYON FUEL COMPANY, LLC  
SUFCO MINE**

**1996**

## GENERAL INFORMATION

1. Permit Number	ACT/041/002
2. Mine Name	SUFCO Mine
3. Permittee Name	Canyon Fuel Company, LLC
4. Operator Name (if other than Permittee)	
5. Permit Expiration Date	May 20, 1997
6. Company Representative, Title	Kenneth E. May, General Manager
7. Phone Number	(801) 637-4880
8. Fax Number	(801) 636-4499
9. Mailing Address	Canyon Fuel Company, LLC SUFCO Mine 397 South 800 West Salina, UT 84654
10. Resident Agent, Title	CT Corporation Systems
Mailing Address	50 West Broadway Salt Lake City, Utah 84104

## IDENTIFICATION OF OTHER PERMITS

Identify other permits which are required in conjunction with mining and reclamation activities.

Permit Type	ID Number	Description	Expires on
1. MSHA Mine ID(s)	4200089	Minesite	
	1211UT090 008901	Waste Rock Disposal Site	
2. MSHA Impoundment(s)			
3. NPDES/UPDES Permit(s) (water)	UT0022918	Minesite Sediment Pond Major Industrial	April 30, 2001
4. PSD (Air ) Permit(s)	BAQE89189	Minesite Air Quality Approval Order	
5.			
6.			

**CERTIFIED REPORTS**

List the certified inspection reports as required by the rules and under the approved plan which must be periodically submitted to the Division. Specify whether the information is included as APPENDIX A to this Annual Report or currently ON FILE with the Division.

Certified Reports:	Reports Required?		INCLUDED or ON FILE w/DOGM?			Comments
	YES	NO	YES	NO	ON FILE	
1. Excess Spoil Piles		X				
2. Refuse Piles	X		X			Included in Appendix A
3. Impoundments	X		X			Included in Appendix A
4.						
5.						

**REPORTING OF OTHER TECHNICAL DATA**

List other technical data and information as required under the approved plan which must be periodically submitted to the Division. Specify whether the information is included as APPENDIX B to this Annual Report or currently ON FILE with the Division.

Technical Data:	Reports Required?		INCLUDED or ON FILE w/DOGM?			Comments
	YES	NO	YES	NO	ON FILE	
1. Climatological Data	X		X			Included on disk in Appendix B
2. Subsidence Monitoring Data	X		X			Included in Appendix B
3. Vegetation Monitoring Data	X		X			Stan Welsh Report Included in App. B
4. Soils Monitoring Data		X				
5. Water Monitoring Data						
First Quarter Report	X				X	Data Previously Submitted
Second Quarter Report	X				X	Data Previously Submitted
Third Quarter Report	X				X	Data Previously Submitted
Fourth Quarter Report	X				X	Data Previously Submitted
6. Geological/Geophysical Data		X				
7. Engineering Data		X				
8. Other Data						
<i>Refuse Analyses</i>	<i>+</i>		<i>+</i>			<i>Appendix E PPS</i>



# APPENDIX A

## Certified Reports

Refuse Piles  
Impoundments

as required under R645-301-514

### CONTENTS

Annual Certification Waste Rock Site  
Annual Certification Waste Rock Site Sediment Pond  
Annual Certification Mine Site Sediment Pond



**Coastal**

*The Energy People*

December 18, 1996

Ms. Mary Ann Wright  
Associate Director of Mining  
Utah Coal Regulatory Program  
1594 West North Temple, Suite 1210  
Box 145801  
Salt Lake City, Utah 84114-5801

Dear Ms. Wright:

Enclosed are annual certification reports for Southern Utah Fuel Company's Minesite Sedimentation Pond, Waste Rock Disposal Site and the associated Waste Rock Sedimentation Pond.

These certifications are being submitted prior to SUFCO's Annual Report as required by R645-514.

Sincerely,  
SOUTHERN UTAH FUEL COMPANY

Wesley K. Sorensen, P.E.  
Technical Services Manager

WKS:kb

FA\WORK\GOVT\1996\DOGMANNLCERT.LTR

**Southern Utah Fuel Company**

A SUBSIDIARY OF THE COASTAL CORPORATION  
137 SOUTH 800 WEST • SALINA UT 84654 • 801 637-4880

ANNUAL MINESITE SEDIMENTATION POND  
CERTIFICATION -- 1996

An inspection of Southern Utah Fuel Company's Minesite Sediment Pond was conducted by Wesley K. Sorensen, P.E. on December 12, 1996.

No signs of structural weakness of the dam or surrounding slopes were observed.

The fill slope above the pond has minor erosion gullies in several locations. No signs of instability of the fill slope were noted.

The water in the pond was froze during the inspection at an elevation of 7417.79 ft, which is 0.36 ft below the standpipe spillway elevation. An additional 0.002 acre-ft of storage volume was available in the pond above the current water level. The sediment level in the pond was at less than 7407 ft, which was below the 60% sediment level (7408.9 ft). A total of 1.6 acre-ft of storage volume is available above the 7407 ft level.

A copy of the field notes is attached.

I certify that the above description accurately represents the condition of the Minesite Sediment Pond as observed during my inspection on December 12, 1996.



*Wesley K. Sorensen*  
Wesley K. Sorensen, P.E.  
Registration No. 159457  
State of Utah

WKS:kb

Attachment

**ANNUAL WASTE ROCK SEDIMENTATION POND  
CERTIFICATION -- 1996**

An inspection of Southern Utah Fuel Company's Waste Rock Sediment Pond and associated Decant Impoundment was made on December 12, 1996 by Wesley K. Sorensen, P.E.

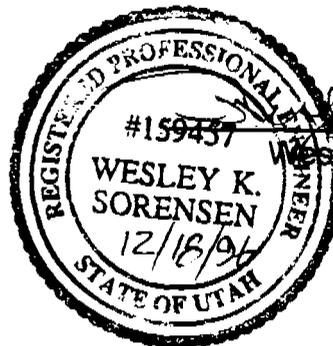
No signs of structural weakness of the sediment pond dam or decant impoundment dam were observed.

The diversion ditches, spillways and decant devices are in as-constructed condition and are functional.

A small amount of water was present in the pond, about 0.1 ft in the south end consisting mostly of ice. The sediment level near the center of the pond was at 7883.7 ft. The 60% sediment level for the pond is at 7885.15 ft. About 0.72 acre-ft of storage volume was available in the pond. No sediment or water was observed in the decant impoundment.

A copy of the field notes of the inspection is attached.

I certify that the above description accurately represents the condition of the Waste Rock Sedimentation Pond and Decant Impoundment observed during the inspection.



Wesley K. Sorensen, P.E.  
Registration No. 159457  
State of Utah

WKS:kb

Attachment

**ANNUAL WASTE ROCK DISPOSAL SITE  
CERTIFICATION -- 1996**

An inspection of Southern Utah Fuel Company's Waste Rock Disposal Site was made by Wesley K. Sorensen, P.E. on December 12, 1996.

The active area pad of the third cell has approximate dimensions of 200 ft x 75 ft. A pad of about 40 ft x 50 ft did not have piles of development waste at the time of the inspection. Underground development waste is dumped from 10 wheel end-dump trucks in piles about 3.5-4 ft high. These piles are leveled with a D-6 Cat dozer or a 988 Cat loader. The resulting lift thickness is 18-24 inches. The dozer/loader and loaded trucks are routed over the pad to compact the lift.

Final and intermediate construction slopes were at or less than the designed 1v:2h with the exception of the intermediate west slope which was slightly over at 30°. Slopes are constructed such that water cannot collect against the toe.

No fires have occurred at the site since it was constructed and none were observed during the inspection.

No significant erosion was observed.

A copy of the field notes is attached.

I certify that the above description accurately represents the conditions observed at the Waste Rock Disposal Site during my inspection on, November 12, 1996.



*Wesley K. Sorensen*  
Wesley K. Sorensen, P.E.  
Registration No. 159457  
State of Utah

WKS:kb

Attachment

SOUTHERN UTAH FUEL COMPANY

Minesite Sediment Pond ~~Quarterly~~ <sup>Annual</sup> Inspection Report

Inspector Wesley K Sarason P.E. Date 12/12/96

1. Dam Structural Weakness

A. Cracks or scarps on crest  Yes  No

None observed

B. Cracks or scarps on slope  Yes  No

None observed

C. Sloughing or bulging on slope  Yes  No

None observed

2. Major Erosion Problems  Yes  No

Minor erosion on slope above pond

3. Surface Movements of Surrounding Slopes  Yes  No

None observed

4. Visible Sumps or Sinkholes in Slurry Surface  Yes  No

Ice on surface Pond was water

5. Clogging

A. Spillway channels and pipes  Yes  No

None observed

B. Decant System  Yes  No

Locked and closed. Dig A weir  
right over top surface

C. Diversion ditches  Yes  No

None observed

6. Seepage (Specify Location, Color and Approx. Volume)  Yes  No

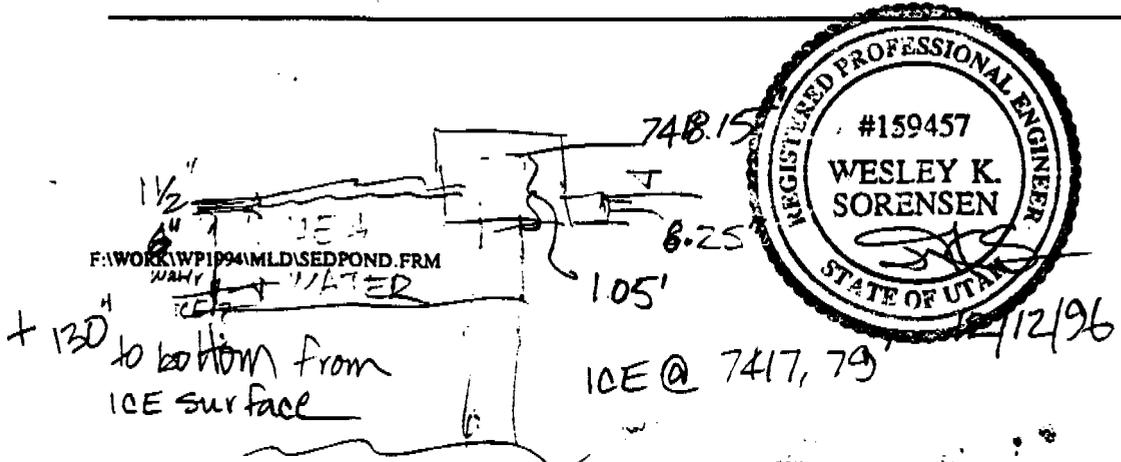
None observed

7. Any appearance of instability, structural weakness, or other hazardous conditions  Yes  No

8. Weir level  Yes  No

9. Other Comments

Sun shining. Thawing conditions. Bare slopes  
some snow in riprap.



SOUTHERN UTAH FUEL COMPANY

Rock Waste Sediment Pond <sup>Annual</sup> ~~Quarterly~~ Inspection Report

Inspector Wesley K Sarason Date 12/12/96

1. Dam Structural Weakness

A. Cracks or scarps on crest  Yes  No

B. Cracks or scarps on slope  Yes  No

C. Sloughing or bulging on slope  Yes  No

2. Major Erosion Problems  Yes  No

3. Surface Movements of Surrounding Slopes  Yes  No

4. Visible Sumps or Sinkholes in Slurry Surface  Yes  No

Pond has 3" snow in bottom  
1/2" ice & 1" water in south end about 1/2" ice in  
MIDDLE

5. Clogging

A. Spillway channels and pipes  Yes  No

None observed

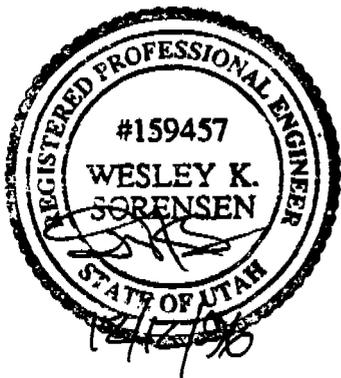
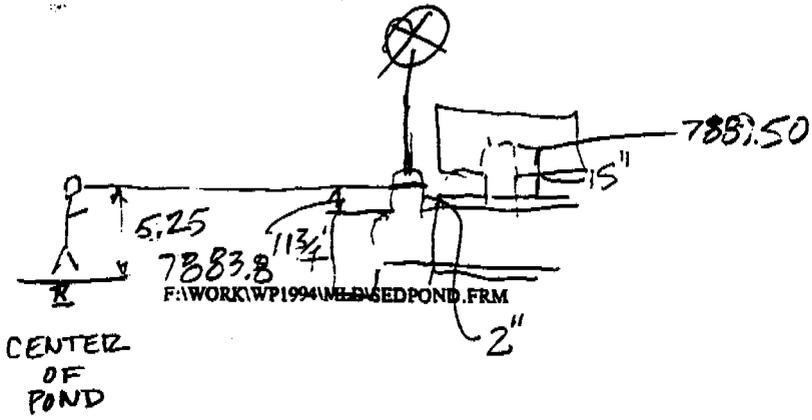
B. Decant System  Yes  No  
closed & worked

C. Diversion ditches  Yes  No  
OK

6. Seepage (Specify Location, Color and Approx. Volume)  Yes  No  
None observed

7. Any appearance of instability, structural weakness, or other hazardous conditions  Yes  No  
None observed

8. Other Comments  
DECANT POND OKAY STRUCTURALLY SOUND  
NO EROSION  
EIK & DEER in area



SOUTHERN UTAH FUEL COMPANY

Coal Refuse Piles <sup>Annual</sup> ~~Quarterly~~ Inspection Report

Inspector Wesley K Sorensen P.E. Title Tech Services Manager

Date 12/12/86 Permit # ACT/041/002

1. Foundation Preparation (vegetation, topsoil removal?)  Yes  No

2. Lift Thickness (inches) 18-24

3. Compaction  Yes  No

4. Burning (specify extent and location)  Yes  No

None observed

5. Angle of Slope (degrees) EAST 27° South 27° West 30°

6. Seepage (specify location, color, & appr. volume)  Yes  No

None observed

7. Cracks or Scarps (location and size)  Yes  No

None observed

8. Major Erosion Problems (location and extent)  Yes  No

None observed

9. Water Impounding Against Toe  Yes  No

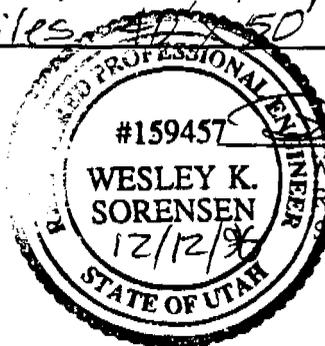
None observed

10. Any appearance of instability, structural weakness or other hazardous conditions  Yes  No

Piles need to be spread & compacted

Active pad w/o piles 40' x 50'

3-4" snow on flat areas w/ open patches.



Wesley K Sorensen  
Wesley K. Sorensen, P.E.  
Registration No. 159457  
State of Utah

## APPENDIX B

### Reporting of Technical Data

including monitoring data, reports, maps, and other information  
as required under the approved plan  
or as required by the Division

in accordance with the requirements of R645-301-130 and R645-301-140.

### CONTENTS

Climatological Data on Disk

Vegetation Report

Subsidence Report

Vegetation Monitoring  
of the  
Waste Rock Disposal

Prepared for:

Southern Utah Fuels Company  
P.O. Box 719  
Helper, Utah 84526

Attention: Mr. Keith Zobell

Prepared by:

Stanley L. Welsh and Ronald J. Kass  
Endangered Plant Studies, Inc.  
129 North, 1000 East  
Orem, Utah 84057

10 August 1996

## INTRODUCTION

This report describes the 5 August 1996 sampling and monitoring of Southern Utah Fuels Company (SUFCO) waste rock disposal (WRD) site and Demonstration Plot (DEM). The WRD site was sampled previously during 1992, 1994, and 1995. This year represents the fourth year of monitoring the WRD as described in the SUFCO Waste Rock Mining and Reclamation Plan (MRP) Table 4.6.3-1. The current investigation of the DEM is the first year of such activity.

The 1995 monitoring schedule sampled two treatment methodologies, the smooth east side first lift of the WRD and a pitted second lift contiguous to the west. In 1994 the second lift was treated by pitting using a range-improvement technique, with the first lift east side left in the smooth condition. Comparison data for the two treatment methodologies are included in Table 1 and Table 2 respectively. Comparison data for 1992, 1994, 1995, and the 1992 reference site are included in Table 3.

### Methods

Sampling was conducted according to Division of Oil Gas and Mining (DOGGM) vegetation guidelines (February 1992). Percent cover was estimated by the ocular method separately for both the smooth and pitted treatment areas (i.e., lifts 1 and 2 respectively). Sampling procedures were discussed with Paul Baker (Reclamation specialist DOGM) in 1992.

Percent cover was estimated by the ocular method for all plots. A 75 m tape was stretched across the longest axis of each treatment type on the WRD. Random numbers were generated and the corresponding numbers were used to locate the 1m<sup>2</sup> quadrats along the 75 m transect. After sampling a minimum of 15 quadrats, sample adequacy was computed; minimal sample size for the each WRD treatment was N=15. A t-value=1.645 and d-value=0.1 were used as coefficients to calculate sample adequacy.

### Results

#### WRD-First Lift-Smooth

Total mean plant cover was 46.1% (s=5.47). Grasses accounted for 44.9% or 97.4% of the species composition. Forbs accounted for 20.9% of the cover and represented 34.9% of the species composition. Shrubs contributed 1.2 of the cover and 2.6% of the species composition (Table 1).

#### WRD-Second Lift-Pitted

Total mean plant cover was 52.9% (S=4.04). Grasses accounted for 41.9% of total cover representing 79.1% of the species composition. Forbs accounted for 8.1%, representing 15.2% of the species composition, and shrubs contributed a mere 3.3% of the remaining live plant cover (Table 2).

#### DEM-Demonstration Plot

Total mean plant cover was 49.0% (S=6.63). Grasses accounted for 39.8% of the cover, and represented 81.2% of the species composition. Forbs accounted for 4.9% of the cover and 10% of the species composition. Shrubs accounted for 4.3% of the cover and 8.8% of the species composition (Table 3).

Table 1. Percent cover and species composition of WRD first lift, smooth.

	% cover	% composition
Bare ground	21.0	
Litter	32.9	
<b><u>Grasses</u></b>		
<i>Elymus cinereus</i>	3.7	8.0
<i>Elymus lanceolatus</i>	3.7	8.0
<i>Elymus smithii</i>	28.3	61.3
<i>Elymus spicatus</i>	9.3	20.1
Grass totals	44.9	97.4
<b><u>Forbs</u></b>		
<i>Machaeranthera canescens</i>	0.8	1.7
Forb totals	0.8	1.7
<b><u>Shrubs</u></b>		
<i>Chrysothamnus nauseosus</i>	0.4	0.86
Shrub totals	0.4	0.86
Live Cover Total	46.1	99.9

Table 2. Percent cover and species composition for WRD second lift, pitted.

	% cover	% composition
Bare ground	26.7	
Litter	20.4	
<b><u>Grasses</u></b>		
Bromus inermis	5.3	10.0
Dactylis glomerata	6.9	13.0
Elymus cinereus	3.5	6.6
Elymus lanceolatus	8.3	15.7
Elymus smithii	8.8	16.6
Elymus spicatus	9.1	17.2
Grass totals	41.9	79.3
<b><u>Forbs</u></b>		
Achillea millefolium	2.3	4.3
Gayophytum ramosissimum	t	
Heliomeris multiflora	t	0.8
Linum perenne	3.3	6.2
Penstemon palmeri	2.5	4.7
Forb totals	8.1	15.2
<b><u>Shrubs</u></b>		
Artemisia tridentata	2.0	3.8
Chrysothamnus nauseosus	0.9	1.8
Shrub totals	2.9	5.7
Live Cover Totals	52.9	100

Table 3. Percent cover and species composition for DEM–Demonstration plot.

	% cover	% composition
Bare ground	15.0	
Litter	36.0	
<b><u>Grasses</u></b>		
Agropyron cristatum	6.5	13.3
Bromus inermis	1.5	3.1
Elymus cinereus	4.5	10.9
Elymus lanceolatus	25.7	52.4
Elymus smithii	1.0	2.0
Elymus spicatus	0.5	1.0
Grass totals	39.8	81.2
<b><u>Forbs</u></b>		
Achillea millefolium	0.5	1.0
Malcolmia africana	3.5	7.1
Melilotus officinale	0.5	1.0
Penstemon palmeri	0.4	0.8
Forb totals	4.9	10.0
<b><u>Shrubs</u></b>		
Chrysothamnus nauseosus	1.7	3.5
Eriogonum corymbosum	2.6	5.3
Rosa woodsii	t	
Symphoricarpos oreophilus	t	
Shrub totals	4.3	8.8
Live Cover Totals	49.0	100

Table 4. Percent cover and species richness for 1992, 1994, 1995, and 1992 reference site.

Variables	Years	1992	1994	1995 2nd li	1995 1st li	1996 2nd li	1996 1st li	reference site
Bare ground		35.4	28.6	31.8	16.7	26.7	21.0	8.8
Litter		8.3	12.2	8.3	12.3	20.4	32.9	24.0
Grasses		45.1	30.3	36.7	68.7	41.9	44.9	30.1
Forbs		11.2	27.0	20.9	1.1	8.1	0.8	0.2
Shrubs		0.0	2.0	2.3	1.0	2.9	0.4	36.8
Totals		56.3	59.4	59.7	71.0	52.9	46.1	67.2
Species richness		14	16	20	19	13	6	7

### Discussion

Prolonged drought conditions, especially through the winter of 1995–1996, influenced growth of both grasses and forbs in the plots on the WRD, despite the methodology of preparation of the plots prior to planting. The east portion, i.e., Lift 1, was graded to a smooth surface prior to planting before 1992—that of Lift 2, was treated to a basin–lifting technique that resulted in a dimpled surface. Effects of the drought were especially apparent on the smooth surface of Lift 1. Occupied principally by grasses, vegetative growth was essentially nil, and few plants showed evidence of having flowered this year. The dimpled surface of Lift 2 responded best to the drought conditions, concentrating what water was available into the small basins. Growth of plants was at least moderate, and most of the grasses and forbs flowered during the season. Percent cover for forbs in 1996 for the dimpled lift was 8.1% compared to 0.8% for the smooth lift, and 2.9% for shrubs in the dimpled versus 0.4% for the smooth.

Cover for grasses and forbs in the lifts, regardless of treatment, exceeds that of the reference site, but shrub cover continues to be less by an order of magnitude. The Waste Rock Disposal Area revegetation is progressing, but has not yet approached the cover and composition of the reference area. Rubber rabbitbrush (*Chrysothamnus nauseosus*) is present along the margin of the lifts near the roadside. It is probable that this species will spread into the entire lift area, adding to the shrub cover.

A possible solution to increasing shrubs in the long term, as emphasized in the 1995 report, might involve harvesting of mature inflorescences of big sagebrush and perhaps rabbitbrush from below the reference site and broadcasting them on both lifts one and two. That should provide an abundant seed source on site. Substantial germination of sagebrush seeds might increase the potential for shrub intermix among the other grass and forb vegetation.

The demonstration site, on a steep slope (58%) immediately east of the loadout area in Convulsion Canyon, was measured this year for the first time. Despite the steepness of the slope and the use of very raw substrate, the success of the revegetation attempt is apparent. There is evidence of creep of the soil mantle at the upper edge of the slope, but general stability of the remainder is encouraging. Establishment of the native buckwheat, *Eriogonum corymbosum*, is likewise encouraging. This plant is evident as a dominant on the adjoining, untreated, slope. It is a common component of vegetation along the coal measures in Utah.

**1996 SUBSIDENCE REPORT**

**CANYON FUEL COMPANY**

**SUFCO MINE**

by

JOHN M. BLACK

CHIEF SURVEYOR

## INTRODUCTION

Canyon Fuel Company LLC, SUFCO Mine's 1996 subsidence report is an update of annual subsidence data which has been accumulated since 1976 as the former Southern Utah Fuel Company. Prior to 1985, the data was derived from conventional survey methods. Since then, photogrammetric surveys have been employed to monitor the ground movement.

During 1985, the entire SUFCO Mine property was flown to establish a set of baseline photography and a grid of surface elevations. Where possible, an elevation was photogrammetrically determined on an approximate 200 foot grid. These original x, y and z locations serve as a comparative base for determining ground movement in the succeeding years.

Once each year, another set of aerial photography is obtained. A new elevation is then found at the same x and y coordinates as all the originals. The new, or current, elevations are compared to the originals and the difference between the two is used to generate a contour map. The result is the subsidence contour map included with each annual subsidence report.

The mine subsidence map accompanying this report shows surface control monuments, overburden contours, subsidence contours, surface tension cracks, a current outline of the mine, a one year mining projection and other miscellaneous items as explained in the legend.

## SUBSIDENCE HISTORY

SUFCO Mine began operations which cause surface subsidence in June, 1976. Continuous miners were used to extract coal from pillars which were developed as part of a retreating panel. The panels were approximately 650 feet wide and varied in length up to 2,500 feet. The average mining height approached 11 feet and the extraction ratio averaged about 80%.

The resulting subsidence from these continuous miner panels averaged 4 feet in the plateau areas where overburden was 900 feet thick. In areas where panel boundaries were outside the escarpment and beyond the Castlegate Sandstone, subsidence increased with decreasing overburden thickness. The maximum subsidence measured to date, 8.5 feet, occurred in one of these areas. The overburden was only 600 feet thick.

Retreat mining continued in this manner until October, 1985, when a retreating longwall system was added. Longwall panels have ranged from 550 feet to 930 feet wide and up to 14,150 feet in length. Mining heights have varied from 9.5 feet to 12 feet.

Subsidence above the longwall panels has averaged 4 feet; but the overburden thickness has been as much as 1,800 feet. The Maximum measured subsidence caused by longwall mining is seven feet. This occurred in an area outside the escarpment very similar to the one mentioned above for the continuous miner panel.

## 1996 SUBSIDENCE

The 1995 subsidence map (Map 1) was updated using data from current photogrammetric monitoring. Each subsidence area is labeled as an independent block. A brief description of each follows:

### AREA 1

This was SUFCO Mine's first subsidence area. Undermining began in June, 1976, and continued into 1979. The area is composed of five continuous miner panels which averaged 650 feet in width. Mining height averaged 11 feet with about an 80% extraction ratio.

Maximum subsidence ranged from 4.5 feet to 8.5 feet. It was first detected in 1976 and continued until 1985. No surface movement was detected in this entire area from 1986 to 1989. Area 1 was not monitored for the 1990 subsidence report and will remain dormant unless a need arises. Photographic coverage, however, has been maintained so that the area can be monitored if necessary.

### AREA 2

This is another continuous miner area. The panels here were irregular shaped and the extraction ratio was modest. Undermining ceased in 1984.

Maximum subsidence has been measured at 2 feet. The area has been stable since 1985 and has not been monitored since 1989. The same condition as mentioned in Area 1 applies here.

### AREA 3

This area is another continuous miner section, but the extracted area is a portion of mains with protective barriers instead of a panel. Coal recovery was moderate with mined areas which were subcritical. Undermining ceased in 1983.

Maximum subsidence was measured at 2 feet. Because of the limited extraction and subcritical areas, the subsidence occurred slowly with small changes noticeable until 1987. The area appeared stable in 1988 and 1989. It has not been monitored since 1989.

#### AREA 4

This subsidence area is comprised of three continuous miner panels. The mining height averaged 11 feet with a good extraction ratio. Undermining ceased in 1985.

Maximum subsidence was 5 feet with no detectable change in 1989. This area was monitored again in 1993, 1994 and 1995 with no detectable changes. This area has now been monitored for ten years since undermining ceased. The last detectable subsidence was in 1988. Therefore, this area will be considered dormant with the same stipulations as other dormant areas.

#### AREA 5

The four continuous miner panels which make up this area were mined from September, 1978, to November, 1981. Mining height averaged 11 feet with an 80% extraction ratio.

Maximum subsidence was 5 feet with no detectable changes from 1985 through 1989. This area has not been monitored since 1991, and will also remain dormant. As with Areas 1 through 4, photographic coverage has been maintained so that monitoring can be done if necessary.

#### AREA 6

Area 6 is SUFCO Mine's first longwall induced subsidence area. It is comprised of nine longwall panels varying from 540 feet to 700 feet in width and 1,700 feet to 3,900 feet in length. Also, there is a section of recovered mains between two of the longwall blocks. Undermining began in Area 6 during October, 1985, and continued through the mains recovery in March, 1990.

Maximum subsidence measured in areas bounded by the plateau is five feet. There is a location on the map which shows seven feet; but this area is outside the escarpment where the overburden is only 600 feet thick. The subsided escarpment is intentional and is part of a study agreed upon by SUFCO Mine, the Division of Oil, Gas and Mining, the Bureau of Land Management and the U. S. Forest Service. This particular section of escarpment was removed from the "no subsidence zone" to study the effects of longwall mining on the escarpment.

Area 6 will be monitored for several more years. No changes have been detected since 1992.

### AREA 7

Area 7 was originally planned for no subsidence. Pillars were made to support the overburden but began to fail in the north end in 1984 when the underground workings were flooded. The failures progressed towards the south and by 1986, subsidence was detected over the area.

The map shows up to seven feet of subsidence. There has been no additional subsidence movement detected since 1988. Therefore, this area will also be considered dormant.

### AREA 8

Undermining this area began in June, 1983, and was sporadic until 1992. Continuous miners were used with extraction ratios over 80% and average mining heights of 10 feet. This is still an active area and will be for several more years. Maximum subsidence to date is five feet. No noticeable vertical movement has been detected since 1993.

### AREA 9

This area is a longwall mining area which is composed of four panels. The first began in June, 1989 and the block was finished in January 1992. The mining height averaged about 11 feet and the maximum subsidence shown to date is five feet.

### AREA 10

Area ten is a new longwall mining block which began in January 1992. The entire surface area above this block was digitized for base-line elevations during 1991. Maximum subsidence shown to date is five feet. This area will be active for several more years.

The experimental mining practice area discussed under "Area 6" was extended, with regulatory approval, to the east side of the canyon under the Southwest corner of "Area 10". An extensive pre-mining survey of this location was conducted late in 1992. A detailed survey of the post-mining subsidence effects was provided in the 1993 report.

## DRAW ANGLE SURVEYS

Several draw angle surveys have been performed during the past years. Completed surveys have been over continuous miner areas and have been oriented both parallel and perpendicular to the long axis of the panel. The average of all measurements is 15°. Individual measurements ranged from 10° to 21°.

Longwall draw angle data was obtained in 1995. Draw angle points were installed in May 1986, on the southern end of the first panel in "Area 6". As shown on the subsidence map, survey lines were placed parallel and perpendicular to the axis of the panel. Undermining of this panel was completed in June 1986. Measurements were taken in 1995 and indicate an angle 15.25° for the perpendicular line. An angle for the parallel line was not obtained because the mains underlying the survey line were partially extracted. These findings coincide with the average of 15° as stated above.

## SUBSIDENCE TENSION CRACKS

Tension cracks have occurred above most of the subsidence areas. Most have been located by survey and are shown on the map. Their lengths vary from a few feet to five hundred feet. Most are oriented either parallel to the natural jointing pattern or to the boundaries of the underground excavation. Vertical displacement along the cracks is uncommon and horizontal displacement varies from hairline to several inches in width.

The U. S. Forest Service completed a tension crack study in 1978. They monitored twenty-two different cracks (located in Area 1) with widths varying from 1/8 inch to six inches. Results show that most cracks self-heal, or close, from 13% to 100% of their original width.

## CONCLUSION

Areas 1, 2, 3, 4, 5 and 7 are all considered to be dormant. Photographic coverage will be maintained but yearly digitizing will not be done unless necessary. Yearly monitoring of Areas 6, 8, 9 and 10 will continue until subsidence has been determined to have ceased on an area by area basis.

Additional tension cracks were added to the map in "Area 10" where active mining is taking place.

JMB:kb

## **APPENDIX C**

Legal, Financial, Compliance and Related Information

Annual Report of Officers

as submitted to the Utah Department of Commerce

and other changes in ownership and control information

as required under R645-301-110.

### **CONTENTS**

None. This information was included in the January 20, 1997 submittal for permit renewal.

## APPENDIX D

Mine Maps

as required under R645-301-525.270.

### CONTENTS

Mining Progress Map 1996

## APPENDIX E

### Other Information

in accordance with the requirements of R645-301 and R645-302.

### CONTENTS

#one



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Lab No.	Location	Depths	pH	EC mahos/cm @ 25°C	Satur- ation %	Calcium meq/l	Magnesium meq/l	Sodium meq/l	SAR	Total Sulfur %	T.S. AB t/1000t	Neut. Pot. t/1000t	T.S. ABP t/1000t
138274	WRDS 3QTR 96		6.9	5.63	44.2	32.6	32.2	12.6	2.21	0.42	13.1	136.	123.

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Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur,  
 Neut. Pot.= Neutralization Potential  
 Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage, Exch= Exchangeable, Avail= Available



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Lab No.	Location	Depths	Boron ppm	Selenium ppm	Alkalinity PE meq/l
138274	WRDS 3QTR 96		4.58	<0.02	2.07

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Lab No.	Location	Depths	pH	EC mmhos/cm @ 25°C	Satur- ation %	Calcium mg/l	Magnesium mg/l	Sodium mg/l	SAR
135056	WRDS 2QTR 96		7.3	7.38	42.4	33.4	23.4	29.6	5.56

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Lab No.	Location	Depths	Total Sulfur %	T.S. AB t/1000t	Neut. Pot. t/1000t	T.S. ABP t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	PyrS AB t/1000t	PyrS ABP t/1000t	Boron ppm	Selenium ppm	Alkalinity PE meq/l
135056	WRDS 2QTR 96		0.61	19.1	129.	110.						4.51	0.02	1.86

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Abbreviations for extractants: PE= Saturated Paste Extract, H2OSol= water soluble, AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate  
 Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur,  
 Neut. Pot= Neutralization Potential



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Lab No.	Location	Depths feet	Total Sulfur %	T.S. AB t/1000t	Neut. Pot. t/1000t	T.S. ABP t/1000t	Boron ppm	Selenium ppm	Alkalinity PE meq/l
132297	WRDS 1QTR 96	0.0-0.0	1.25	39.0	93.4	54.3	3.84	0.04	2.48

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 Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur,  
 Neut. Pot. Neutralization Potential



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April 16, 1996

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Lab No.	Location	Depths feet	pH	EC mmhos/cm @ 25°C	Satur- ation %	Calcium meq/l	Magnesium meq/l	Sodium meq/l	SAR
132297	WRDS 1QTR 96	0.0-0.0	7.1	4.06	49.5	27.7	20.1	6.30	1.29

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