

BIOLOGICAL ACTIVITY REACTION TEST RESULTS
CHAVERS WELL
FORT LUPTON, COLORADO
May 23, 2014

Terracon Consultants, Inc. (Terracon), under direction of the Colorado Oil and Gas Conservation Commission (COGCC), conducted a Biological Activity Reaction Test (BART) at the Chavers Well, Receipt Number 268941, located at 14211 County Road 22 in Fort Lupton, Colorado. Samples were collected on May 5, 2014. The BART test detects three types of bacteria: iron related bacteria (IRB), sulfate reducing bacteria (SRB), and slime forming bacteria (SLYM). Each container was observed and photographed over an eight day time period to determine if bacteria are present in the water sample. Observational notes and daily photographs are summarized in Tables 1 and 2, respectively. The estimated colony forming units per milliliter (cfu/mL) are summarized in Table 3. At the end of the eight day observation period, the following results were observed.

Iron Related Bacteria

During the observation period, the color of the water went from a green base to a yellow-green color by the fourth day. A green-gray layer of foam formed on the base on the first day, but dissipated by the third day. Foam was not observed during the observation period. A high to moderate level of effervescence was observed for the entire eight day period. Due to the formation of slime on the first day of observation, an aggressive population of IRB and pseudomonads is present. The estimated population is approximately 140,000 cfu/mL.

Sulfate Reducing Bacteria

During the observation period, the water remained clear. A layer of white slime appeared on the first day and turned black by the eighth day. No slime was observed during the observation period. A high to moderate level of effervescence was observed throughout the entire eight days. Based on the formation of black slime on the eighth day, a moderately aggressive SRB consortium is present. The estimated population is approximately 1,200 cfu/mL.

Slime Forming Bacteria

During the observation period, the water went from an orange base, to a light yellow color throughout by the fourth day. No foam was observed and a thin layer of orange slime was observed at the base for the first two days before dissipating. A moderate to low level of effervescence was observed throughout the observation period. Based on the lack of color change, formation of a thick foam, or a cloudy growth, a non-aggressive, limited background level of SYLM bacteria is present. The estimated population is less than 500 cfu/mL.

Attachments:

Table 1: BART Summary Tables

Table 2: BART Photographic Table

Table 3: BART Population Table

Attachment 1: Site Photographs

TABLE 1
 IRB - IRON RELATED BATERIA
 BART SUMMARY TABLES
 CHAVERS WELL
 COLORADO OIL AND GAS CONSERVATION COMMISSION

Date:	Color: green base	Effervescence: high	Comments
5/5/2014	Transparency: Clear	Nutrients:	
Name:	Slime: green-gray base	Positive Test: yes	
SB	Foam: none	Advanced Test Code: BG, GC	
Date:	Color: green base	Effervescence: high	Comments
5/6/2014	Transparency: Clear	Nutrients:	
Name:	Slime: green-yellow base	Positive Test: yes	
SB	Foam: none	Advanced Test Code: BG, GC	
Date:	Color: green-yellow	Effervescence: moderate	Comments
5/7/2014	Transparency: clear	Nutrients:	
Name:	Slime: none	Positive Test: yes	
SB	Foam: none	Advanced Test Code: GC	
Date:	Color: yellow-green	Effervescence: moderate	Comments
5/8/2014	Transparency: Clear	Nutrients:	
Name:	Slime: none	Positive Test: yes	
SB	Foam: none	Advanced Test Code: GC	
Date:	Color: yellow-green	Effervescence: moderate	Comments
5/9/2014	Transparency: Clear	Nutrients:	
Name:	Slime: none	Positive Test: yes	
SB	Foam: none	Advanced Test Code: GC	
Date:	Color: yellow-green	Effervescence: moderate	Comments
5/12/2014	Transparency: Clear	Nutrients:	
Name:	Slime: none	Positive Test: yes	
SB	Foam: yes	Advanced Test Code: GC	
Date:	Color:	Effervescence:	Comments
	Transparency:	Nutrients:	
Name:	Slime:	Positive Test:	
	Foam:	Advanced Test Code:	
Date:	Color:	Effervescence:	Comments
	Transparency:	Nutrients:	
Name:	Slime:	Positive Test:	
	Foam:	Advanced Test Code:	
Date:	Color:	Effervescence:	Comments
	Transparency:	Nutrients:	
Name:	Slime:	Positive Test:	
	Foam:	Advanced Test Code:	
Advanced Test Codes		FO : Foam Around Ball BR : Brown Slime, Ball BG : Brown Slime, Base BC : Brown Clouds	GC : Solution Green-Cloudy RC : Solution Red-Cloudy CL : Solution Cloudy BL : Solution Black

TABLE 1, CONTINUED
 SRB - SULFATE REDUCING BATERIA
 BART SUMMARY TABLES
 CHAVERS WELL
 COLORADO OIL AND GAS CONSERVATION COMMISSION

Date:	Color: clear	Effervescence: high	Comments
5/5/2014	Transparency: clear	Nutrients:	
Name:	Slime: white slime at base	Positive Test: no	
SB	Foam: none	Advanced Test Code:	
Date:	Color: clear	Effervescence: high	Comments
5/6/2014	Transparency: clear	Nutrients:	
Name:	Slime: white slime at base	Positive Test: no	
SB	Foam: none	Advanced Test Code:	
Date:	Color: clear	Effervescence: moderate	Comments
5/7/2014	Transparency: clear	Nutrients:	
Name:	Slime: white slime at base	Positive Test: no	
SB	Foam: none	Advanced Test Code:	
Date:	Color: clear	Effervescence: moderate	Comments
5/8/2014	Transparency: clear	Nutrients:	
Name:	Slime: white slime at base	Positive Test: no	
SB	Foam: none	Advanced Test Code:	
Date:	Color: clear	Effervescence: low	Comments
5/9/2014	Transparency: clear	Nutrients:	
Name:	Slime: white slime at base	Positive Test: no	
SB	Foam: none	Advanced Test Code:	
Date:	Color: black base	Effervescence: moderate	Comments
5/12/2014	Transparency: cloudy	Nutrients:	
Name:	Slime: black at base	Positive Test: yes	
SB	Foam: none	Advanced Test Code: BB, CL	
Date:	Color:	Effervescence:	Comments
	Transparency:	Nutrients:	
Name:	Slime:	Positive Test:	
	Foam:	Advanced Test Code:	
Date:	Color:	Effervescence:	Comments
	Transparency:	Nutrients:	
Name:	Slime:	Positive Test:	
	Foam:	Advanced Test Code:	
Date:	Color:	Effervescence:	Comments
	Transparency:	Nutrients:	
Name:	Slime:	Positive Test:	
	Foam:	Advanced Test Code:	
Advanced Test Codes		BB : Black Slime at Base BT : Black Slime at Ball BA : Black Slime at Base and Ball CL : Cloudy Solution	

TABLE 1, CONTINUED
 SLYM - SLIME FORMING BATERIA
 BART SUMMARY TABLES
 CHAVERS WELL
 COLORADO OIL AND GAS CONSERVATION COMMISSION

Date:	Color: orange base	Effervescence: moderate	Comments
5/5/2014	Transparency: clear	Nutrients:	
Name:	Slime: some at base	Positive Test: no	
SB	Foam: none	Advanced Test Code: DS	
Date:	Color: orange base	Effervescence: moderate	Comments
5/6/2014	Transparency: clear	Nutrients:	
Name:	Slime: some at base	Positive Test: no	
SB	Foam: none	Advanced Test Code: DS	
Date:	Color: tan base	Effervescence: low	Comments
5/7/2014	Transparency: clear	Nutrients:	
Name:	Slime: none	Positive Test: no	
SB	Foam: none	Advanced Test Code:	
Date:	Color: light yellow	Effervescence: low	Comments
5/8/2014	Transparency: clear	Nutrients:	
Name:	Slime: none	Positive Test: no	
SB	Foam: none	Advanced Test Code:	
Date:	Color: light yellow	Effervescence: low	Comments
5/9/2014	Transparency: clear	Nutrients:	
Name:	Slime: none	Positive Test: no	
SB	Foam: none	Advanced Test Code:	
Date:	Color: light yellow	Effervescence: low	Comments
5/12/2014	Transparency: cloudy	Nutrients:	
Name:	Slime: none	Positive Test: no	
SB	Foam: none	Advanced Test Code: CL	
Date:	Color:	Effervescence:	Comments
	Transparency:	Nutrients:	
Name:	Slime:	Positive Test:	
	Foam:	Advanced Test Code:	
Date:	Color:	Effervescence:	Comments
	Transparency:	Nutrients:	
Name:	Slime:	Positive Test:	
	Foam:	Advanced Test Code:	
Date:	Color:	Effervescence:	Comments
	Transparency:	Nutrients:	
Name:	Slime:	Positive Test:	
	Foam:	Advanced Test Code:	
Advanced Test Codes		DS : Slime at Base SR : Slime at Ball CL : Cloudy Growth	CP : Layered Plates BL : Blackened Liquid TH : Thread-Like Strands

TABLE 2
BART PHOTOGRAPHIC TABLE
CHAVERS WELL
COLORADO OIL AND GAS CONSERVATION COMMISSION

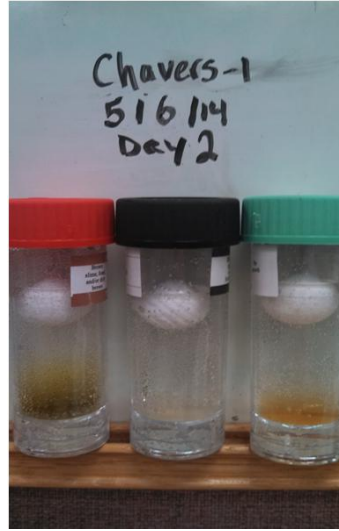
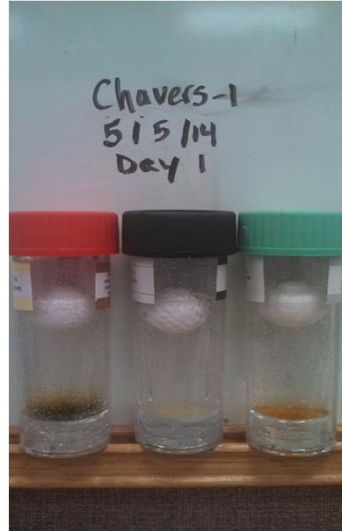


TABLE 3
BART POPULATION TABLE
CHAVERS WELL
COLORADO OIL AND GAS CONSERVATION COMMISSION

BART Analysis	Approximate Population (cfu/mL)
Iron Related Bacteria (IRB)	140,000
Sulfate Reducing Bacteria (SRB)	1,200
Slime Forming Bacteria (SLYM)	<500

Notes:

cfu/mL : Colony forming units per milliliter

< : Less than

ATTACHMENT 1
SITE PHOTOGRAPHS
CHAVERS WELL
COLORADO OIL AND GAS CONSERVATION COMMISSION

Well and Sample Location

