CHAPTER 23 VISALIA PLANT ATTACHMENTS

Attachment A - VIS - 16938 1 (Cost Breakdown)

Attachment - VIS - 20971 1 (COV delay request letter)

Attachment - VIS - 62221, 62235 1 (AWWA Journal Article)

Attachment - VIS - 62221, 62235 2 (Revised Cost Estimate)

VIS 16938 1

PID 16938 (New well VIS 3010-01, originally project for new well VIS 28-01)
Project Year 2008

Table below shows current charges and estimated cost to complete VIS 301-01 well construction.

	A	B
Well Drilling Contractor	**Boart Longyear**	**De La Grange**
Paid to date	$0	$172,305
Proposal to complete well	$383,661	$0
Total (A+B)	$555,966	
Original Bids, Nov 2011	$507,234	$475,270

Project Capital Budget	$731,800	
Budget spent for VIS 28-01	$41,000	(spent before VIS 301-01 project start)
Project Budget at VIS 301-01 start	$690,800	
Current Total Project Charges	$454,000	
Remaining Budget	$236,800	
Proposed Cost to Complete VIS 301-01	$383,661	
Estimated Field Management Cost	$10,000	
Estimated Well Consultant Cost	$40,000	
Misc. Cost	$10,000	
Estimated Balance at Project Closeout	-$206,861	

City of Visalia
315 E. Acequia Ave., Visalia, CA 93291

Founded 1852

Community Development
Engineering Division

June 1, 2011

California Water Service
216 N. Valley Oaks Drive
Visalia, CA 93292

Attn: Tom Brassfield

Re: Birdland Public Improvements

The City of Visalia requests that California Water Service Co. delay their phase I water line installation project in the Birdland subdivision area. This delay is requested to allow the installation of a new sanitary sewer line prior to the water line installation to alleviate potential conflicts.

The sanitary sewer installation is tentatively scheduled to begin by end of August 2011. You would then be encouraged to install your water line immediately after the sewer installation so that the City Public Works Department can overlay the entire street before winter weather.

Your consideration is greatly appreciated. Thank you.

Sincere Regards,

Adam B. Ennis, P.E.
Assistant Community Development Director
Engineering
City Of Visalia
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Visalia, CA 93291
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RECYCLED PAPER

AOC Associated With Oils for Lubricating Well Pumps

Dawn R. White and Mark W. LeChevallier

Several types of oil for lubricating well pumps were examined to assess their relative contribution to assimilable organic carbon (AOC) in groundwater. The objective of the study was to determine whether the use of an oil-lubricated well-pump system could contribute to the growth of bacteria in water distribution systems. A modified van der Kooij procedure was used to test the AOC concentration in sterile tap-water samples before and after the addition of various types of pump-lubricating oil. The results showed that certain lubricating oils could release substantial levels of bacterial nutrients (AOC) into the water. The choice of lubricating oil could be related to bacterial growth problems in some systems.

Oil-lubricated line-shaft well pumps are widely used in potable water wells in the United States. Oil-lubricated systems may be recognized by the oil storage tank and the adjustable-rate drip feeder. Systems without such equipment usually have water-lubricated column bearings. The main purpose of lubrication is to separate the moving parts and thus reduce friction, carry off heat, dampen shock, and reduce wear.

The western region of the American Water System has 17 operating oil-lubricated wells. Five of these wells are located at the Paradise Valley Water Company in Arizona. Testing of these wells in 1987, before the installation of chlorinators, showed unusually high levels of heterotrophic plate count (HPC) bacteria (Table 1). All wells are approximately 1,500 ft deep and located beneath two layers of impervious rock. The wells are not affected by recharge or runoff. Given that the wells were protected, plus the very old age of the water, such high bacterial levels would not be expected.

In the California–American Water Company's Los Angeles Division, sampling showed that HPC levels in oil-lubricated wells were, on average, almost four times higher than in water-lubricated wells (HPC levels of 270 cfu/mL compared with 70 cfu/mL, respectively). For two wells across the street from one another, the oil-lubricated well had plate counts averaging 260 cfu/mL, whereas the water-lubricated well averaged 64 cfu/mL. Several of these wells have also been subject to intermittent occurrences of coliform bacteria.

The higher incidence of elevated HPC and coliform bacterial counts in the oil-lubricated wells prompted examination of the possibility that the oil may be contributing to bacterial growth. Talley and Alexander[1] have previously suggested that oil used to lubricate shaft bearings could, if it entered into the distribution system, support the growth of opportunistic bacteria. van der Kooij and Hijnen[2] have reported that lubricants used in some pipe joints could promote growth of coliform organisms.

Trace levels of assimilable organic carbon (AOC) are becoming widely recognized as important for stimulation of bacterial growth in distribution networks.[2,3] Along with temperature, rainfall, and disinfectant residual, the concentration of AOC in water is an important parameter in regulating growth in distribution system biofilms.[3] Limiting the amount of available nutrients may be a more effective means of controlling bacterial

TABLE 1
Heterotrophic plate counts at the Paradise Valley Water Company from March to July 1987

Oil-Lubricated Well	HPC Bacteria *cfu/mL**	
	Average	Range
Well 11	1,600	10–5,000
Well 12	9,900	630–20,000
Well 13	8,000	10–16,000
Well 14	8,200	1,200–27,000
Well 15	5,800	10–28,000
Average in Distribution System	4,700	

*HPC bacteria were enumerated on *Standard Methods* plate count agar incubated at 35°C for 48 h. Values represent plate counts collected once a month from March 1987 to July 1987.

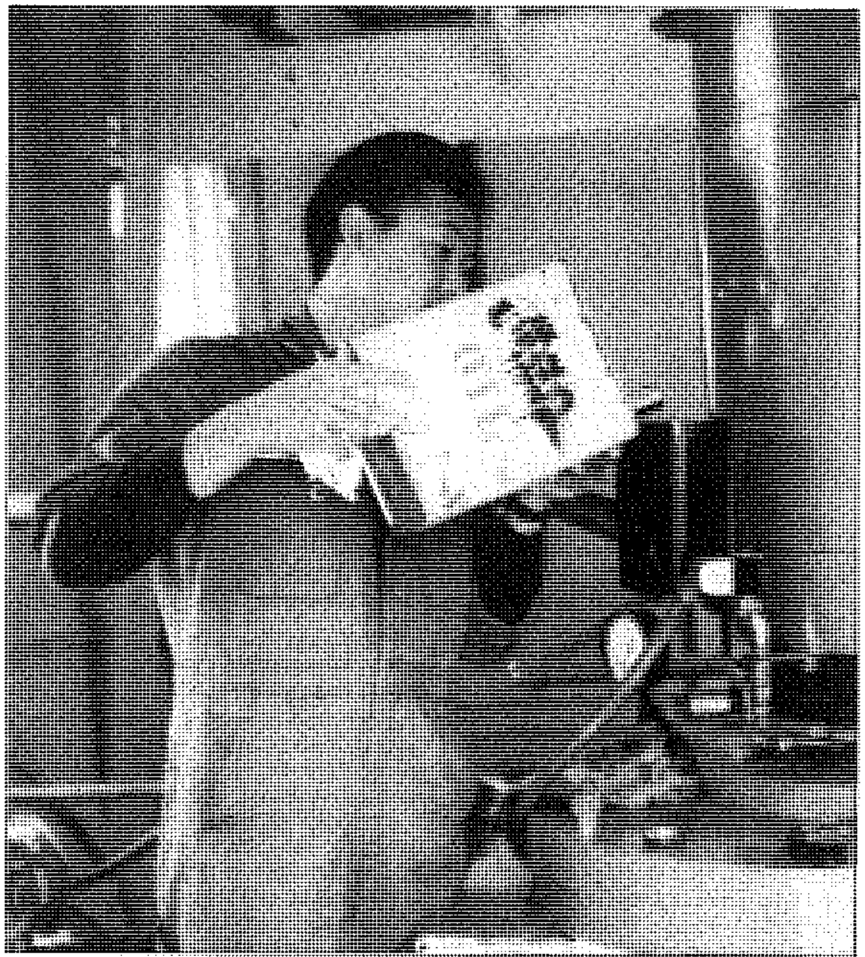
TABLE 2
*Effect of oil on AOC levels in water**

Parameter	AOC of Water	Tap Water Amended With Acetate	AOC of Tap Water and Oil	AOC due to Oil
Negative control	<1			
Tap water	46 ± 7			
Tap water + 50 μg acetate/L		88 ± 12		
Tap water + oil 1			60 ± 18	14
Tap water + oil 2			38 ± 7	–8
Tap water + oil 3			1,933 ± 284	1,887
Tap water + oil 4			117 ± 9	71

*All values are expressed as micrograms AOC per litre ± standard deviation.

*Obtained from D. van der Kooij, KIWA, the Netherlands growth than increasing disinfectant concentrations. van der Kooij and Hijnen[2] have suggested that AOC levels <10 µg/L will limit the growth of HPC bacteria in unchlorinated water systems. AOC levels >50–100 µg/L have been associated with growth of coliform bacteria in chlorinated water systems.[3]

The objective of this project was to assess the effect of lubricating oil on the AOC content of well water. Several commonly used lubricating oils were examined to determine the appropriate choice for oil-lubricated wells.



Oil-lubricated well pumps are commonly used in the water industry, but certain lubricants could release bacterial nutrients into the water.

Materials and methods

Glassware preparation. To remove all traces of growth-supporting compounds, glassware was washed in a 10 percent solution of potassium dichromate in concentrated sulfuric acid, rinsed in hot tap water followed by a rinse of 10 percent nitric acid solution, and then rinsed with hot tap water. Finally, glassware was baked overnight at 300°C. The only materials that were not acid-treated were the pipette tips used for making colony counts. The same type of sterilized pipette tips were used for both test and control bottles.

Inoculum. A culture of *Pseudomonas fluorescence*, strain P17,* was adapted to grow in tap water (low-nutrient conditions) by inoculating an isolated colony into sterile tap water containing 100 mg acetate carbon/L (sodium acetate), 1 mg nitrogen/L (ammonium chloride), and 1 mg potassium phosphate/L. Once the maximum concentration of organisms was reached, this solution was used to inoculate sterile tap water with no added nutrients. After incubation, the unamended tap water (containing adapted bacteria) was used as an inoculum in subsequent AOC assays.

Sample preparation. The tap water used for all samples was collected at one time and sterilized by autoclaving. Acid-washed 250-mL biochemical oxygen demand (BOD) bottles containing 100 mL of autoclaved tap water were inoculated with 1 mL of lubricating oil and 200–300 cfu/mL of the adapted *P. fluorescence* P17. The solution was mixed for 10 s using a vortexer. Four oil types,* as well as a growth control containing 50 µg/L additional acetate-carbon (sodium acetate), a blank containing sterilized tap water but no addition of carbon, and a negative control using AOC-free water† were tested. Three of the oil types chosen for this assay are being used by California–American Water Company's Monterey and Los Angeles divisions and by Paradise Valley Water Company. Oil 4, a totally synthetic lubricating oil, was chosen because it was being considered as a potential candidate for oil-lubricated wells. All of the oils are approved for use in food processing and in water and wastewater treatment plants.

Analysis. All controls and samples were incubated statically at room temperature (22–23°C) until N_{max} (maximum cell concentration) was reached. The concentration of organisms in each culture was determined by performing triplicate plate counts from the first day after inoculation until the fifth day. Plate counts were performed using the spread plate method on R_2A agar. The plates were incubated at room temperature for about five days or until colonies were clearly visible. The plate count results for each test culture can be plotted against time and the N_{max} can be determined easily as the high point on the growth curve. The maximum growth for each sample and standard was expressed as colony forming units per litre and divided by the empirically derived yield factor of 4.1×10^6 cfu/µg of acetate carbon (AOC) to produce results in micrograms AOC per litre.[4]

Statistics. Statistical comparisons were performed by the unpaired *t*-test using a statistics program.‡

Results

The results of the oil-amended tap-water samples along with the negative, blank, and growth controls are shown in Table 2. The negative control (AOC-free water) contained less than 1 µg/L AOC, indicating insignificant nutrient contamination from glassware or pipette tips. The average AOC concentration in the unamended tap water (blank sample) was 46±7 µg/L. When 50 µg/L of acetate carbon was added to the tap water, an AOC value of 88±12 µg/L was obtained. The difference between the unamended-tap and acetate-amended water was 42 µg/L, not statistically significant (p = 0.137) from the expected value of 50 µg/L.

Addition of the lubricating oil was shown to have a significant effect on AOC levels in certain circumstances. Oils 1 and 2 had a statistically insignificant effect on AOC levels (p ranged between 0.342 and 0.15). Oils 3 and 4, however, did significantly contribute to the AOC of the tap water (p = <0.001 and 0.002, respectively). Oil 4 added an average of 71 µg AOC/L to the tap water. For oil 3, AOC

*Oil 1—Chevron GST68; oil 2—Texaco Regal R&O 46; oil 3—Chevron FM32X; oil 4—Husky 15A14 (Husk-itt Corp, Signal Hill, Calif.)

†HPLC-grade water, J.T. Baker Co., Phillipsburg, N.J.

‡Stat-Pac, Northwest Analytical, Portland, Ore.

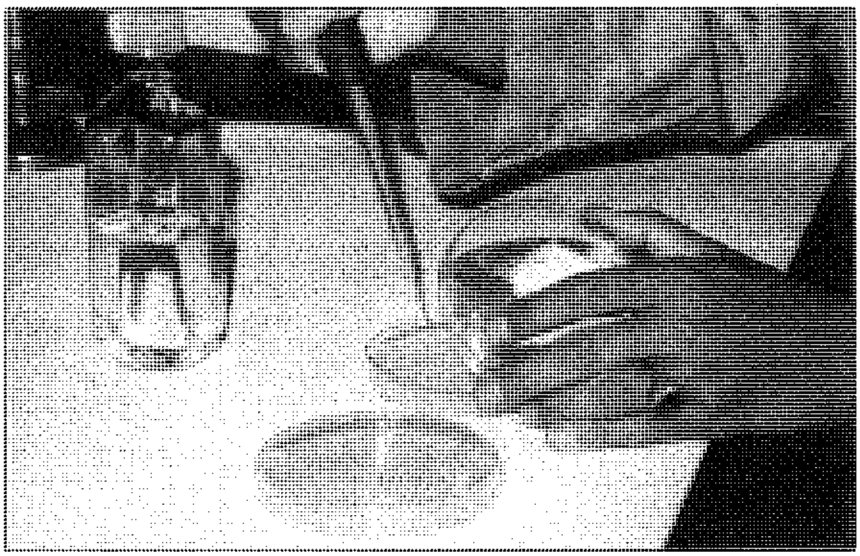


Plate counts showed that levels of heterotrophic bacteria were higher in oil-lubricated well pumps than they were in water-lubricated well pumps.

levels were increased an average of 1,887 µg AOC/L, more than 40 times higher than the background level.

Discussion

Given the growing concern about ever more stringent microbiological drinking water standards, all materials in contact with drinking water need to be examined for their potential to stimulate bacterial regrowth. The results of this study show that certain pump-lubricating oils can, under laboratory conditions, contribute AOC to the water. Not all of the oils available on the market were tested, and to truly evaluate the total effect of these oils on distribution system water, it would be necessary to determine the exact fate of the oil throughout the pipe network. The results do show, on a comparative basis, that certain oils may be better suited for use in drinking water systems.

In an oil-lubricated well, oil is typically added on a continuous basis and accumulates on top of the water column. Although there is obviously some contact between oil and water, this was historically thought to be minimal. During periods of nonuse, however, enough contact may exist to produce initial discharges with elevated concentrations of AOC. Because oil is added continuously, over the years it would be expected that oil levels would accumulate to a great height. For example, approximately 130 L of oil were used in 1990 to lubricate a single pump in the California–American Water Company's Los Angeles Division. This amount would, in one year, create a 7-ft column of oil. When last serviced, only 10 ft of oil was found, despite the fact that the oil had been added for the previous seven years. The conclusion is that some of the oil does mix with water and enters the distribution system. In this case, approximately 730 L of oil has entered the system from one well during the past seven years. Although the volume of oil compared with the volume of water leaving the well is small (estimated at 1–2 µL/L), it could have a significant effect, particularly if it accumulated in sections of the distribution system.

Although all the oils tested were labeled as "food-grade" and approved for use in food-processing and water and wastewater plants, experience has shown that some oil-lubricated wells can experience high HPC bacteria and sporadic coliform counts. Oil 3, for example, had previously been used in the Paradise Valley Water Company wells (Table 1). Some manufacturers even advertise the biodegradability of their product as an advantage. Given that high HPC counts can lead to violations of the maximum contaminant level specified in the Total Coliform Rule, it is recommended that certain precautions be taken by systems served by oil-lubricated wells to limit the effect of the oil on distribution system water quality.

- Select a food-grade lubricating oil with minimal effect on AOC. If manufacturers cannot provide this information, the utility can perform the test outlined in the "Materials and methods" section.
- Monitor the oil consumption of each well. Inspect and service wells with unusually high consumption levels.
- When possible, operate oil-lubricated wells constantly to prevent high levels of AOC from entering the distribution system. It is thought that repeated startups may help mix the oil into the water column. Future research should evaluate the optimum operation to limit passage of oil into the distribution system.
- An aggressive and systematic flushing program should be scheduled to eliminate accumulated oil in the distribution system. Reservoirs and storage tanks should be inspected for oil films.
- Routine microbiological and chemical monitoring of each well can spot problem situations before contamination of the distribution system. Future research should evaluate the effect of oil droplets on disinfection efficiency.

In some situations it may be advisable to change from oil lubrication to water lubrication whenever a pump needs to be replaced. This may not be applicable in all situations, however. Use of a water-lubricated system for deep thermal wells, for example, would shorten equipment life. Knowing that differences exist between oils allows the alternative solution of changing oil types to minimize the effect on water quality. Most important is the awareness that substances used in day-to-day operations can affect water quality.

Acknowledgment

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References

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3. LECHEVALLIER, M.W.; SCHULTZ, W.; & LEE, R.G. Bacterial Nutrients in Drinking Water. *Appl. & Environ. Microbiol.*, 57:3:857 (1991).
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*To whom correspondence should be addressed

VIS 62221_62235 2

Work Order Estimates

Work Order: 00062221
Company: California Water Service Comp
Revision: 2

VIS 18-01 (motor + column only)

Additions

3240 - PUMPING EQUIPMENT [270]

Equip Number: **Est In-Service:** 6/15/2014

Est Chg Type	Business Segment	Sub. Acct.	Property Group	Asset Location	Unit Description	Quantity	Amount
Contractor Cost	Water - Regulated	3240	PUMPS	STA. 018-01-WOODLAND S/O VASSAR <VISALIA>	Install new: ~~pump,~~ motor, column ~~and dischare head~~ pull/install	0.00	~~$55,000.00~~ $10,400 $5,000
Contractor Cost	Water - Regulated	3240	PUMPS	STA. 018-01-WOODLAND S/O VASSAR <VISALIA>	Install well elvel transducer	1.00	$1,800.00
Labor	Water - Regulated	3240	PUMPS	STA. 018-01-WOODLAND S/O VASSAR <VISALIA>	Engineering Labor	24.00	$2,384.16
Labor	Water - Regulated	3240	PUMPS	STA. 018-01-WOODLAND S/O VASSAR <VISALIA>	Field Labor	30.00	$2,470.50
Other	Water - Regulated	3240	PUMPS	STA. 018-01-WOODLAND S/O VASSAR <VISALIA>	5% contingency, typical for pump replacement.	1.00	~~$3,000.00~~ $1,100
Overhead	Water - Regulated	3240	PUMPS	STA. 018-01-WOODLAND S/O VASSAR <VISALIA>	20%	0.00	~~$12,930.93~~ $4,600
					Total Act/Ret	56.00	~~$77,585.59~~
					Total Additions	56.00	~~$77,585.59~~ $27,788

Retirements

3240 - PUMPING EQUIPMENT [270]

Equip Number: **Est In-Service:** 6/15/2014

Est Chg Type	Business Segment	Sub. Acct.	Property Group	Asset Location	Unit Description	Quantity	Amount
Labor	Water - Regulated	3240	PUMPS	STA. 018-01-WOODLAND S/O VASSAR <VISALIA>	Remove and dispose of existing pumping equipment	1.00	~~$3,900.00~~ $2,800
Overhead	Water - Regulated	3240	PUMPS	STA. 018-01-WOODLAND S/O VASSAR <VISALIA>		0.00	~~$780.00~~ $560
					Total Act/Ret	1.00	~~$4,680.00~~
					Total Retirements	1.00	~~$4,680.00~~ $3,360
					Work Order Total	57.00	~~$82,265.59~~ $31,148

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VIS 62221_62235 2

Work Order Estimates

Work Order: 00062235
Company: California Water Service Comp
Revision: 2

VIS 50-01 (motor + column only)

Additions

3240 - PUMPING EQUIPMENT [270]

Equip Number: **Est In-Service:** 6/30/2015

Est Chg Type	Business Segment	Sub. Acct.	Property Group	Asset Location	Unit Description	Quantity	Amount	
Contractor Cost	Water - Regulated	3240	PUMPS	STA. 050-01-MAPLE & MAGNOLIA <VISALIA>	install new: ~~pump~~, motor, column ~~and discharge head~~	0.00	~~$57,500.00~~ $5,000	$10,400
Contractor Cost	Water - Regulated	3240	PUMPS	STA. 050-01-MAPLE & MAGNOLIA <VISALIA>	pull/install Install well level transducer	1.00	$1,800.00	
Labor	Water - Regulated	3240	PUMPS	STA. 050-01-MAPLE & MAGNOLIA <VISALIA>	engineering labor	24.00	$2,384.16	
Labor	Water - Regulated	3240	PUMPS	STA. 050-01-MAPLE & MAGNOLIA <VISALIA>	field labor	30.00	$2,470.50	
Other	Water - Regulated	3240	PUMPS	STA. 050-01-MAPLE & MAGNOLIA <VISALIA>	5% contingency, typical for a pump replacement	1.00	~~$3,100.00~~	$1,100
Overhead	Water - Regulated	3240	PUMPS	STA. 050-01-MAPLE & MAGNOLIA <VISALIA>	20%	0.00	~~$13,450.93~~	$4,000
					Total Act/Ret	56.00	~~$80,705.59~~	
					Total Additions	56.00	~~$80,705.59~~	$27,788

Retirements

3240 - PUMPING EQUIPMENT [270]

Equip Number: **Est In-Service:** 6/30/2015

Est Chg Type	Business Segment	Sub. Acct.	Property Group	Asset Location	Unit Description	Quantity	Amount	
Contractor Cost	Water - Regulated	3240	PUMPS	STA. 050-01-MAPLE & MAGNOLIA <VISALIA>		1.00	~~$3,900.00~~	$2,800
Overhead	Water - Regulated	3240	PUMPS	STA. 050-01-MAPLE & MAGNOLIA <VISALIA>		0.00	~~$780.00~~	$560
					Total Act/Ret	1.00	~~$4,680.00~~	$3,360
					Total Retirements	1.00	~~$4,680.00~~	
					Work Order Total	57.00	~~$85,385.59~~	$31,148