Fresh Water Seal Flush for Water Injection Pumps

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I. BACKGROUND

This study was performed at Mobil Salt Creek Field Unit in Kent County, TX and consisted of mechanical seal failures for Bingham split case centrifugal injection pumps. For individuals who are unfamiliar with the operation or function of mechanical seals, a reference is included in the study (see Appendix A - Fundamentals of Mechanical Seals). Due to the injection of $CO2$, in addition to water, into the Mobil Salt Creek reservoir for increased oil production, the associated composition of the reservoir water changed greatly. The total suspended solids (TSS), total dissolved solids (TDS), pH, and entrained gases in the produced water changed dramatically from the former water flood or water driven reservoir. Consequently, when there were any changes in pressure or increases in temperature, solids, scaling, or "salting" was occurring. This increase in temperature or pressure drop can be quite common when dealing with the mechanical seal system. The mechanical seal system consists of three (3) items. Those items are water composition, seal material selection/design, and seal flush system. This brought to light the complexity of the mechanical seal issue.

This "salting" was causing the seals to leak and thus having to be replaced. Unfortunately seal failures were taking place at the frequency of one seal per month. As one can imagine this associated cost can build quite rapidly.

II. SCOPE

To increase the mean time to failure/mean time between failures (MTTF/MTBF) of the mechanical seals for the Bingham injection pumps. This would thus reduce the total system cost of the water injection process which is greatly increased by mechanical seal failures.

III. ANALYSIS

A breakthrough team was formed to find a solution to the mechanical seal failures. The first meeting went over team breakthrough protocol (see Appendix B - Breakthrough Facilitator Handbook), strategy, and the process. The objective of the team was to "REDUCE THE TOTAL COST ASSOCIATED WITH BINGHAM PUMP SEAL FAILURES."

The urgency of a solution for the mechanical seal failures can be seen by the following pareto chart which reveals the large role mechanical seals play in the injection pump failures. In our study, seal failures consisted of approximately 85% of the total failures.
With the results of the attachment 1 (end of text), we were able to visualize the importance of seal reliability to the overall pump efficiency. Several periodicals supported the impact seal reliability had on pump efficiency (see Appendix C - Chemical Engineering Feature Report). In addition to this periodical another extremely useful piece of literature that was found utilizing the internet was a seal reliability program initiated at Chevron refineries (see Appendix D - Plant Profile: Seal Reliability at Chevron).

With this information, trouble shooting and failure analysis techniques (see Appendix E - Mechanical Seal Troubleshooting & Failure Analysis) were utilized. From visual analyses, we were able to conclude that there was substantial coking or salting occurring around the atmospheric side of the seals. An inspection of the seals showed no serious signs of seal face damage. The seal spring, however, was caking up with scale and losing the spring tension. From that information, a systematic approach was taken to solve the mechanical seal problem. Action steps were agreed upon and consisted of

1.) Review mechanical seal schematic drawing for existing seal design (see Appendix F - Schematic Drawing for Type 8B Mechanical Seal)
2.) Benchmark Pennzoil SACROC unit in Snyder to see what seal type, seal flush system, and chemical injection they utilize.
3.) Determine number of workorders for seal replacements year to date.
4.) Determine total system cost associated with seal failures.
5.) Contact Sulzer-Bingham representative concerning pump and seals.
6.) Contact seal manufacturer to discuss seal type and design.
7.) Perform water analysis on water to Water Injection Station 10.

Kyle Carnahan visited the Pennzoil unit and spoke with the mechanic who worked on the injection pump seals. They were utilizing a different seal than we were using at Mobil Salt Creek. They also had a somewhat different seal flush design that we use on our injection pumps. The seals they used, however, are flushed through the pump case and not the gland on the seal. In effect, to use the seals that Pennzoil uses it would require tapping a hole in our pump case and running the seal flush through the case. Due to the expense and uncertainty of the success of this procedure, it was decided not to pursue this option at this time. Their seal flush came off of the first stage of their pumps, much like our pumps, however their return line off the cyclone separator tied back into an existing tap in the pump case. This design would eliminate the trap where the solid-ladened fluid could collect and cause a potential blockage of the line. Their seal flush, as mentioned above, was not supplied from an external source but was produced water. This led us to believe that we could operate with produced water being our seal flush media. Their seal flush system did use cyclone separators to help filter or clean the produced water prior to applying the produced water to the mechanical seal faces. Pennzoil also used strainers to the suction of the pumps to help remove large particles from entering into the pump suction. Their chemical injection composition and quantity were not described in quantitative means, however, the mechanic alluded to the associated expense with the chemical injection program.

Pennzoil did have a luxury that we at Salt Creek did not. That item was residence or retention time. This is due to the fact that at one time the Pennzoil SACROC field injected one (1) million barrels of water a day and now presently only inject 200,000 barrels of water a day. This large injection volume required a lot of tankage and subsequently allowed for the current fluid volume to sit in the tanks for a longer duration prior to being pumped. This time, which is far greater than Mobil Salt Creek, would allow a lot of the suspended solids to drop out of the water in the suction tanks and not enter into the pump suction and ultimately the mechanical seal faces. Consequently, SACROC water has much more time to reach equilibrium.

Another benefit that the Pennzoil unit had was spare pumps, we at Salt Creek run all of the injection pumps available and have no true "spare" pumps. As a result, they can take down a unit more frequently for preventative maintenance without losing water injection capacity. Due to Pennzoil's operating philosophy, they also have a dedicated mechanic to maintain the seals, where Mobil has taken the approach to "farm" that responsibility out to an alliance partner. In our opinion there is no real ownership with this non-company personnel maintaining the equipment. The visit was very informative and a lot of dialogue and swapping of ideas was taken away from the meeting.

As for the number of workorders generated for seal failures the list was quite long. The workorders existed for both the 3" seals that are run in the Bingham MSD-B injection pumps as well as the 3 1/2" seals that are run in the Bingham MSD-C injection pumps. These pumps are quite large pumps and consist of 13 stages to increase the pressure of the water from 7 psig suction to 2350 psig discharge. The mechanical seals, however, are subject to only about 35 psig of pressure.

The MSD-B injection pumps, of which there are four (4) of, house the 3" mechanical seals are driven by 1320 hp/720 rpm high speed White/Superior gas driven engines coupled through a gear box to step up the rpm on the gas driven engines. The MSD-C injection pumps, which there are eight (8), house the 3 1/2" mechanical seals are powered by 1750 hp/3600 rpm induction electric motors. A correlation between seal failures and drivers and/or seal size could not be found. Consequently, it was concluded that the seal failures were independent of pump driver or seal size.

The workorders for the mechanical seals, both the 3" and the 3 1/2", are listed in attachment 2. In an effort to determine total system costs associated with mechanical seals failure, the following information was included:

1. the replacement seal,
2. labor associated with removing the old seal and installing the new seal,
3. and lost oil production due to the injection pump being shutdown for seal replacement.

The lost incremental oil shut in for an injection pump was provided by reservoir engineering at an estimated 100 barrels. Therefore, the cost associated with seal failures through nine months was $216,250 or an estimated annual cost of $288,333, rationale listed in attachment 3 (end of text).

Due to the severity and quantity of failures at one particular water injection station, the team decided to attack the problem and focus their attention to the scale problem at Water Injection Station 10. As a result the team changed the name of the breakthrough team to the Scale Reduction Breakthrough Team. When this breakthrough team was successful, they would then resume the Seal Breakthrough Team but until that time the Seal Breakthrough Team would be put on hold. <u>Both issues could not be worked simultaneously, for the fact that if both processes were changed it would be difficult to determine which alteration proved successful</u>.

Consequently, the first action of the Scale Reduction Breakthrough Team was to initiate a pilot chemical injection program at "A" Battery, which is the battery that provides the water for Water Injection Station 10. This action was based on the chemical findings made by Petrolite in their January 1997 report (see Appendix G - Petrolite Scale Report). Based on the water analysis at water injection station 10, calcium carbonate scale appeared to be the culprit of our seal failures. Therefore, it was thought that if we could keep the $CaCO4$ in solution and not let it drop out it would eliminate the seal failures. The seal failure analysis appendix detailed abrasives as a cause for seal failures. With this information in mind, we were quite hopeful that the chemical injection would eliminate or greatly reduce the abrasive problem.

In an effort, to optimize the amount of chemical being utilized during the pilot program at "A" Battery, phosphate residual sampling was performed at Water Injection Station 10 with the results listed in attachment 4 (end of text). The scale inhibitor, Tretolite ® SCW0026R, (see Appendix H - Material Safety Data Sheet) that was injected at "A" Battery, is high in phosphates and what is injected at the battery minus what is consumed is what is measured at the water injection stations. This sampling approach is to be utilized at the other water stations, (i.e. 8, 9, and 11) as well, for optimizing chemical injection.

Due to the high water volumes at "A" Battery and subsequently Water Injection Station 10, frequent water samples are to be taken to find an acceptable ppm injection of chemical to control the scale problem. Initially, per a recommendation from Tretolite Chemical, a 20 ppm scale inhibitor injection rate will be used. Then based on phosphate residual monitoring and visual inspection of scale forming on pump mechanical seals the ppm rate will be increased or decreased. The chemical cost to treat this large volume of water (100,000 barrels/day) at 20 ppm is approximately $480/day, rationale of expense is detailed in attachment 5 (end of text).

As the phosphate residual monitoring program continued for a period of three months, it was concluded that the chemical was not solving the seal failure problem. The chemical injection appeared to have slowed down the seal failures and did help reduce some control valve and turbine meter problems associated with scale, however, it did not resolve the mechanical seal failures. It was determined that the chemical injectant necessary to reduce the control valve and turbine meter problems was 15 ppm. Therefore, this is the concentration of scale inhibitor injected at "A" Battery, with an associated annual cost of $131,400.

The unsuccessful nature of the chemical caused the group to refocus on the mechanical seal selection. In an effort to select the best seal for this application an extensive review was conducted (see Appendix I - Fundamentals of Mechanical Seals: Selection and Application). From this appendix several factors were reviewed.

- Equipment Size
- Equipment Type and Design
- Shaft Speed
- Seal Cavity Pressure

- Product Fluid Characteristics
    - corrosiveness
    - temperature
    - specific gravity
    - vapor pressure
    - viscosity
    - **abrasiveness**
    - safety and environmental

From this appendix unit load, net load or net seal closing force, and seal stability can be calculated. These items are critical in determining the hydraulic loading and the mechanical spring forces. If these items are not correct, the seals can either leak or will burn up due to the fact that the mechanical spring force is much greater that the hydraulic force trying to move the seal faces apart.

The existing seal design and seal metallurgy were reviewed, with the group decision being to try a new seal type. The older style mechanical seals were equipped with several smaller type springs which became covered with scale and lost the mechanical spring force and the seal faces were tungsten carbide and appeared to be scratched by the abrasives in the produced water. To aid in the proper selection of the mechanical seal American Petroleum Institute has issued a standard to help end users in seal selection. Background information for API 682 is supplied. (see Appendix J - Introduction to API 682). After everyone was familiar with the API standard, the seal selection procedure (see Appendix K - Mechanical Seal Selection Procedures) was used and the path taken is highlighted in the respective appendix. The selection procedure revealed that a single seal with a silicon carbide vs. tungsten carbide hard faces minimum and perfluoroelastomer o-rings - suitable for product and contaminants. For a further understanding of the material selection needed for the product the seals would encounter (see Appendix L - Material Selection for Mechanical Seals).

As a result of the in depth study of seal selection, the seal chosen was the 1B cartridge seal with silicon carbide vs silicon carbide for face materials, viton elastomers, and 316SS for all metal parts. Our selection of a replacement mechanical seal for the split case Bingham injection pumps was consistent with Sulzer-Bingham (Pump Manufacturer), John Crane Company (Mechanical Seal Manufacturer), and by Pennzoil, an end user. Cost of replacement seals are listed in attachment 6 (end of text).

As a result of our recommendation, three pumps out of the twelve were equipped with 1B pusher mechanical seals. Schematic drawings of the seals, both 3" and 3 1/2", are included (see Appendix M - Schematic Drawing for Type 1B Mechanical Seal). In addition to the schematic drawings, mechanical seal vendor information is included (see Appendix N - Type 1B Seal Information Bulletin).

Unfortunately, during the test period of three months no measurable increase in the MTTF/MTBF was observed. There were, however, some problems which skewed our information. First, John Crane Seal Company miscalculated the balance ratio on the seal. This miscalculation drastically effects the mechanical and hydraulic forces acting on the seal faces. Secondly, the coiled spring was not welded on the end. This is the spring which provides the mechanical force on the rotating seal face. This resulted in a catastrophic failure of the seal. John Crane Seal Company replaced the seal at their cost due to the fact that in Chart 7. Speed Limits for Coil Springs, it indicates that the coil spring at the rpm the pumps run at warrant the welding of the spring. Lastly, one seal had the primary silicon carbide seal face cracked, which caused immediate leakage at startup. This led us to review installation procedures with our contract personnel (see Appendix O - Mechanical Seals: General Installation Instructions). From information supplied in Appendix O, we discovered that on average 22.2% of single cartridge seal failures were caused by misinstallation. This was second only to environmental controls at 26.6%. We also spoke to John Crane Company regarding the quality of their packaging of the seals for delivery.

The lack of increase in MTTF/MTBF of our new seals led us once again to review the total system around the mechanical seals in a brainstorming session. The end result of the brainstorming session was to concentrate on the seal flush. The seal flush consists of a liquid to wash off the seal faces and also to carry away the heat caused by the mechanical seals. Currently, the seal flush came off the first stage of the injection pump, through a cyclone separator, and through a restricting orifice to the mechanical seals. This utilization of produced water, in our opinion, added to the "salting" of the seals. We were merely compounding the problem by trying to remove the solids built up around the seals with water that was saturated with solids.

Consequently, we installed an extraneous water line to the pumps and utilized the attached piping design (see Appendix P - Seal Flush Piping Design). This is in accordance with API 682 seal selection procedure which suggests that for the application that our mechanical seals are exposed to a certain flush system should be utilized (see Appendix Q - API 610 Plan 32). This appendix instructed for the flush fluid to be from an external source of clean liquid. The nice feature with the Mobil Salt Creek design is that if the extraneous water supply is lost, the produced water automatically takes over. This provides a safeguard for the mechanical seals, for if the flush water is not applied to the seals they will overheat and could possibly cause some pump damage. This retrofitting of the pumps cost an approximate $15,000 per water injection station or approximately for three (3) pumps, however, we are optimistic for an increase in the MTTF/MTBF of our mechanical seals. In an effort to forecast the success of the seal flush design, reliability engineering calculations were performed. These calculations are based upon the exponential distribution, which is a special case of the Weibull distribution. All failures that occur are "chance" failures, therefore, we are in the useful period of the reliability bathtub curve. It is somewhat difficult to forecast reliability on mechanical equipment, however, we needed some basis to support our findings. This tool was the one selected to base the results against.

Two different seal life run times were used to run the calculations. Seal lives utilized in the equations were one year and secondly nine months. The nine months was used due to the fact that the industry "rule-of-thumb" for seal life is nine months. The assumption made in these reliability calculations was that no failures would occur during the testing period. A second set of calculations were made if a failure was to occur. These equations assumed that there would be a failure, however, a replacement seal, equal in quality, would be installed and the testing would continue. These calculations are made the best as possible given the fact that unfortunately our sample size is quite small at merely 24 seals. The reliability equations can be found in attachment 7 (end of text).

From the set of reliability equations it can be determined that with a 0.95 probability that if no failures occur on the test size of 24 seals with 46 days the MTTF/MTBF for the mechanical seals should be one year and accordingly if the 24 seals run for 34 days without a failure the MTTF/MTBF for the mechanical seals should be nine months. Other percent confidence levels were listed for reference purposes, and as one can tell the required run time declines with the lower confidence level required. This would also be the same if the sample size could be increased, however, in this study it is not feasible. As could be expected, if failures do occur, the required test time required to achieve the MTTF required with a 0.95 probability increase greatly.

IV. RESULTS

After installation of the flush system was complete at water injection station 9, the run times reflected that with a 0.93 probability the seals would have a MTTF/MTBF of one (1) year and a 0.98 probability the seals would have a MTTF/MTBF of nine (9) months, results are depicted in attachment 8 (end of text).

V. CONCLUSIONS

This study was quite exciting and challenging. It revealed a systematic approach could resolve the complex issue associated with the mechanical seal problem. With a cost of approximately $60M-$80M, the total system cost per failure of $3600 with an annual cost of $288,333 will be eliminated. This savings has a payback period of 0.3 years. This can be seen in attachment 9 (end of text). The rapid payback period for this project helps to heighten the importance of the mechanical seal flush system. In addition to increasing the MTTF/MTBF of the mechanical seals, key learnings were obtained during the project. These key learnings are as follows:

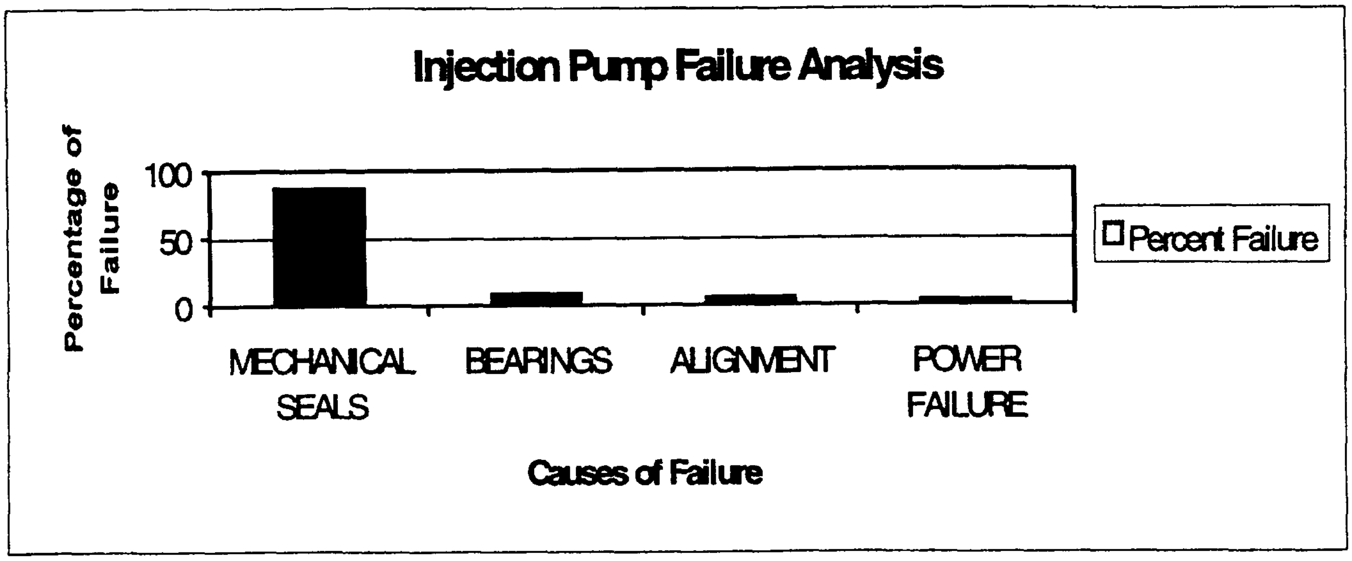
* Phosphate residuals tests can be run in the field. This saves valuable time in waiting for results from the laboratory. This "real time" data, however, does not provide laboratory accuracy.

* Brought Pump Manufacturer into discussion of pump mechanical seal problem.
* Brought Seal Manufacturer into discussion of pump mechanical seal problem.
* Utilized Mobil Corrosion Specialist to help troubleshoot scale problem.
* Benchmarked Pennzoil SACROC unit for type and service life of mechanical seals on Bingham split case centrifugal pumps.
* Utilized experienced mechanical systems engineer concerning mechanical seal problem.
* Utilized accelerated testing in estimating MTBF/MTTF for mechanical seals.

These items, as well as the study itself, were captured and documented to help other breakthrough teams take a systematic approach to problem solving.

VI. APPENDICES

Available upon request.



Attachment 1 - Injection Pump Failure Analysis

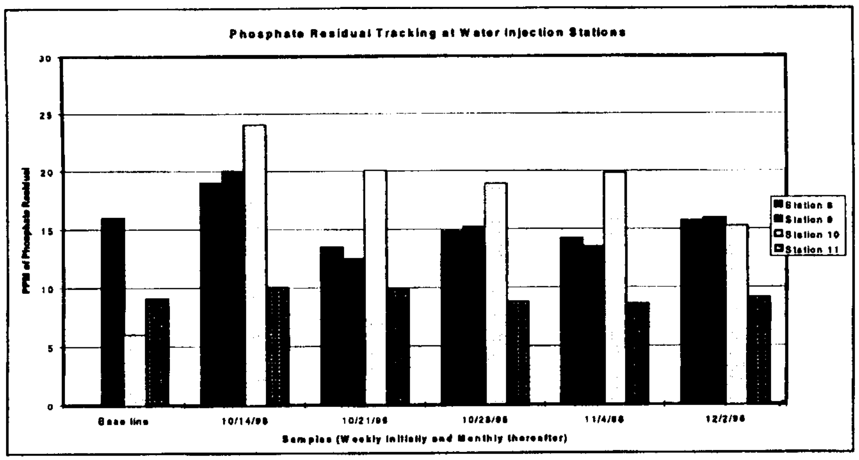
Mechanical Seal Information for Injection Pumps						
Seal No.	Number of Seal Failures	Seal Size		Seal No.	Number of Seal Failures	Seal Size
1203	1	3"		1301	1	3 1/2"
1204	1	3"		1302	1	3 1/2"
1205	2	3"		1303	1	3 1/2"
1206	2	3"		1304	1	3 1/2"
1207	2	3"		1306	1	3 1/2"
1208	1	3"		1307	1	3 1/2"
1209	1	3"		1310	3	3 1/2"
1211	1	3"		1311	2	3 1/2"
1212	2	3"		1312	2	3 1/2"
1213	1	3"		1313	2	3 1/2"
1214	1	3"		1314	3	3 1/2"
1215	1	3"		1315	1	3 1/2"
1216	1	3"		1316	2	3 1/2"
1217	1	3"		1317	1	3 1/2"
1218	1	3"		1318	1	3 1/2"
1219	1	3"		1319	1	3 1/2"
	20			1320	2	3 1/2"
Total number of 3" seal failures				1321	4	3 1/2"
				1322	1	3 1/2"
				1323	1	3 1/2"
				1324	1	3 1/2"
				1325	2	3 1/2"
				1326	1	3 1/2"
				1327	2	3 1/2"
				1328	1	3 1/2"
					39	
				Total number of 3 1/2" seal failures		
	59			**Total number of seal failures**		

Attachment 2

Cost Estimate Associated with seal failures			
Item	Amount 3" Seal	Amount 3 1/2" Seal	
Replacement Seal	$ 1,100	$ 1,350	
Labor to remove old seal and install new seal	$ 400	$ 400	
Lost oil Production	$ 2,000	$ 2,000	
	$ 3,500	**$ 3,750**	**Total Cost per Seal Failure**
Timeframe	Number of seal Failures	Number of seal failures	
January 96-September 96	20	39	
	$ 70,000	**$ 146,250**	**Total Cost for 3" and 3 1/2" Seals**
Total System Cost of Seal Failures		**$ 216,250**	

Attachment 3

Monitoring Frequency for Measuring Phosphate Residuals						
at Water Injection Stations						
		Phosphate Residual Readings in PPM for Scale Inhibitor				
Water Injection Stations	Base line	10/14/96	10/21/96	10/28/96	11/4/96	12/2/96
Station 8	0	19	13.5	14.8	14.2	15.7
Station 9	16	20	12.5	15.2	13.5	15.9
Station 10	6	24	20	18.9	19.8	15.2
Station 11	9.1	10	9.8	8.8	8.6	9.1
Samples should be drawn initially one per week and from then on, should be sampled monthly						
This information should be tracked and subsequently charted as a potential KPI.						



Attachment 4

Estimated Chemical Costs to Treat for Scaling of Mechanical Seals				
Daily Chemical Cost	**PPM Injected of Chemical**	**Barrels of Water Treated**	**Cost of Chemical per PPM**	**Total Annual Chemical Cost**
$ 480	20	100000	$ 0.00024	$ 175,200
$ 456	19	100000	$ 0.00024	$ 166,440
$ 432	18	100000	$ 0.00024	$ 157,680
$ 408	17	100000	$ 0.00024	$ 148,920
$ 384	16	100000	$ 0.00024	$ 140,160
$ 360	15	100000	$ 0.00024	$ 131,400
$ 336	14	100000	$ 0.00024	$ 122,640
$ 312	13	100000	$ 0.00024	$ 113,880
$ 288	12	100000	$ 0.00024	$ 105,120
$ 264	11	100000	$ 0.00024	$ 96,360
$ 240	10	100000	$ 0.00024	$ 87,600
$ 216	9	100000	$ 0.00024	$ 78,840
$ 192	8	100000	$ 0.00024	$ 70,080

Attachment 5

Cost of new (1B) Cartridge Seal complete for MSD Bingham				
Pump w/ Viton Elastomers, Silicon Carbide vs Silicon Carbide				
for face materials, all metal parts are 316 SS				
Water Injection Stations	Pump Number	Size of Seal	Cost/Seal	2 seals/Pump
Station 8				
	G- A	3"	$ 2,999	$ 5,998
	G- B	3"	$ 2,999	$ 5,998
	G- C	3"	$ 2,999	$ 5,998
	G- D	3"	$ 2,999	$ 5,998
Station 9				
	G- A	3 1/2"	$ 3,359	$ 6,718
	G- B	3 1/2"	$ 3,359	$ 6,718
	G- C	3 1/2"	$ 3,359	$ 6,718
Station 10				
	G- A	3 1/2"	$ 3,359	$ 6,718
	G- B	3 1/2"	$ 3,359	$ 6,718
	G- C	3 1/2"	$ 3,359	$ 6,718
Station 11				
	G- A	3 1/2"	$ 3,359	$ 6,718
	G- B	3 1/2"	$ 3,359	$ 6,718
		Totals	$ 38,866	$ 77,731

Attachment 6

RELIABILITY ANALYSIS ON MECHANICAL SEALS

Subject to equation:

P[MTTF(TEST)>=MTTF(REQUIRED)] = 1-e[-nT/MTTF(REQUIRED)]

Assumption: No failures occur

n: Number of seals to test

T: Days of run need without failure

Confidence Level	N	MTTF(required) days	T days
0.95	24	365	46
0.9	24	365	35
0.85	24	365	29
0.8	24	365	24
0.95	24	274	34
0.9	24	274	26
0.85	24	274	22
0.8	24	274	18

RELIABILITY ANALYSIS ON MECHANICAL SEALS

Subject to equation:

P[MTTF(test)>=MTTF(required)] = 1-(N!/r(i)![N-r(i)]!)*(1-e[-T/MTTF(req)]^r(i))*(e[-T/MTTF(req)]^N-r(i))

Assumption: Failure(s) occur, testing with replacement

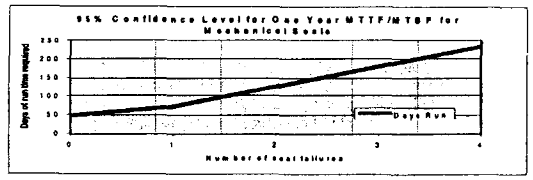
n: Number of seals to test

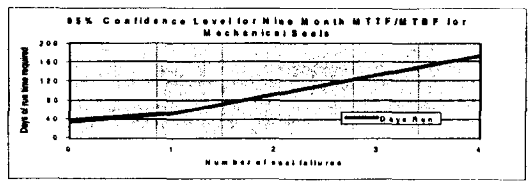
T: Days of run need without failure

r: Number of observed failures

N: Effective sample size [n+r(i)]

r	n	N	MTTF(required) days	T days	Confidence Level
1	24	25	365	70	0.95
2	24	26	365	135	0.95
3	24	27	365	185	0.95
4	24	28	365	235	0.95
1	24	25	274	52	0.95
2	24	26	274	100	0.95
3	24	27	274	140	0.95
4	24	28	274	175	0.95

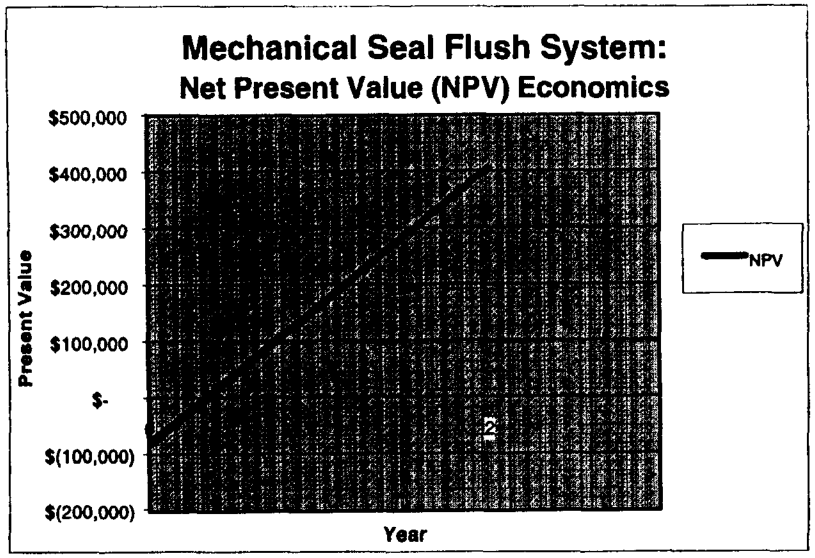




Attachment 7

API 31 Modified Seal Flush System @ Salt Creek Field Unit					
Actual Run Time Data					
Subject to equation:					
P[MTTF(test)>=MTTF(required)] = 1-(N!/r(i)![N-r(i)]!)*(1-e[-T/MTTF(req)]^r(i))*(e[-T/MTTF(req)]^N-r(i))					
Assumption: Failure(s) occur, testing with replacement					
n: Number of seals to test					
T: Days of run need without failure					
r: Number of observed failures					
N: Effective sample size [n+r(i)]					
r	n	N	MTTF(required)	T	Confidence
			days	days	Level
1	24	25	365	65	0.93
1	24	25	274	65	0.98

Attachment 8



Mechanical Seal Flush System Addition Economics		
Yr	Cashflow	Present Value
0	$ (80,000)	$ (80,000)
1	$ 288,333	$ 177,440
2	$ 288,333	$ 407,297
NPV	$407,297	
Simple Payback Period (Years)	0.3	
MARR = 12%		
* Reduction in outflows (expenses) is listed as positive cashflow.		

Attachment 9