DOE/CE/15609--T3

TECHNICAL PROGRESS REPORT

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Instrument No.: DE-FG01-94CE15609
Employer I.D.: 356-38-7828
DOE Officer: Glenn K. Ellis, EE-521
Report By: Michael C. Robertson

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STATEMENT OF WORK

The project's aim is to complete development of the Radial Cutting Torch, a pyrotechnic cutter, for use in all downhole tubular cutting operations in the petroleum industry. Project objectives are to redesign and pressure test nozzle seals to increase product quality, reliability, and manufacturability; improve the mechanical anchor to increase its temperature tolerance and its ability to function in a wider variety of wellbore fluids; and redesign and pressure test the RCT nozzle for operation at pressures from 10 to 20 ksi. The proposal work statement is included in the statement of work for the grant via this reference.

Task 1: Redesign nozzle seals.

- A. Research alternative seal materials, designs, and manufacturers.
- B. Make selection based on research findings.
- C. Make drawing changes per the proper Engineering Change Notice (ECN).
- D. Machine new parts per the new ECN and Q.C. parts.
- E. Assemble RCT with new parts, leaving out fuel load.
- F. Pressure test the RCT per Pressure Test Procedure.
- G. Load the tested RCT with fuel mixture.
- H. Retest loaded RCT and cut.
- I. Repeat steps A through H three more times to test for repeatability.
- J. Proceed to Task 2 if all tests are successful, otherwise, repeat testing.

Task 2: Redesign torch for operation at 20 ksi.

- A. Optimize sleeve design to hold pressure at 20 ksi without deformation.
- B. Make new drawings for the sleeve design.
- C. Build parts per new specifications.
- D. Design and build a test fixture to test the sleeve to 20 ksi then to failure to determine its upper limits.
- E. Optimize sleeve design to shift at 20 ksi.

STATEMENT OF WORK

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F. Make drawings and build parts.

G. Test design until tool dynamics are operational at 20 ksi.
(Note: this is a proprietary procedure, which cannot be discussed in detail.)

Task 3: Upgrade mechanical anchor.

- A. Investigate spring manufacturers for coil springs for high temperature, corrosive environments, and greater force constant.
- B. Correct the drawings with an ECN.
- C. Purchase/manufacture springs according to specification.
- D. Investigate the bow springs for optimum thickness vs. force requirement and use of carbide coated vs. non-carbide coated.

E. Correct drawings with an ECN.

F. Purchase bow springs per new specifications.

G. Redesign slip section to optimize the number, size, and angle of teeth as well as the angle of diverter at contact point.

H. Correct drawings with an ECN.

I. Build new slip sections and diverters per new specifications.

J. Investigate the J-latch travel mechanism design:

1. Select new materials for the pin to include higher strength, ability to be surface hardened, and high Izod characteristics;
2. Use of high-strength ball and locking stud vs. pin; and
3. Correct drawings/make new drawings to reflect the new specifications.

K. Build new J-latch mechanism per new specifications.

L. Test completed anchor assembly in 2-3/8" and 2-7/8" tubing for:

1. Force to lower anchor into the tubing/force to shift sleeve with the slips;
2. Ease of shifting from no-set to set;

STATEMENT OF WORK

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3. Ease of release from the set position; and
4. Force required to set and hold during torch operation.

Task 4: Reporting.

- A. Prepare quarterly and final reports outlining the tasks performed and their respective results -- with selective, proprietary details omitted. Submit pictures of test results.

II. TASK 1: REDESIGN NOZZLE SEALS

- A. Purpose: To redesign the seals and nozzle section to obtain a more effective sealing area for the improvement of operation of the RCT.
- B. Objective: Task 1 was undertaken upon issuance of the D.O.E. Grant on September 2, 1994. Completion of this task will allow for the present torch design to reliably function as a standard manufactured product for all down hole conditions at pressures to 10,000 psi.

C. Procedure:

a). Research of Alternative elastomeric compounds

The first part of this task was to investigate the market for an appropriate material which could reliably withstand the following criteria:

1. Withstand temperatures to 500 degrees F
2. Be of sufficient durometer so as not to extrude at pressures of 10,000 psi
3. Must be compatible with aqueous salt solutions at temperatures of 500 degrees F
4. Must be compatible with a wide variety of hydrocarbons at temperatures of 500 degrees F

Should a suitable compound not be found, then I would have to resort to qualifying each torch based upon the application of the torch. This would be a very undesirable situation which would require detailed tracking measures for special type applications. This problem could be further compounded if a torch was shipped to a wireline company for a special application, then not used for that application due to a change in plans for that well. This torch would then be subject to a possible misapplication due to poor record keeping or tracking methods of the wireline company. The above example is a very real world problem facing the RCT in the present market place.

My original selection of a Viton fluorocarbon compound showed a great deal of promise. It has the broadest range of chemical resistance than any other compound. Viton is also rated to 450 degrees F for continuous duty service making it my first choice. I quickly learned, however, that Viton performs poorly in aqueous environments. Since, the large majority of oil wells have aqueous salt solutions in the well, the Viton compound quickly loses appeal. A 1-3/8" RCT was damaged beyond repair due to o'ring failure caused by hot aqueous environment at 15,300 ft. well depth.

Further investigation of an appropriate compound was made by inquiry of a wireline company in Louisiana which faces these type of field problems on a daily basis. Mr. Bill Boelte who for many years managed the New Orleans district for N.L. McCullough, Inc., the premier provider of chemical cutters to the petroleum industry was

queried for information. He was charged with the task of investigating elastomeric compounds for use on their Chemical Cutters. His research led to a Nitrile compound known as C-67. This compound has been used in general application for many years by manufacturers of chemical cutters. However, for my purpose this compound lacks due to temperature limitations of the compound which are further aggravated by high pressures which will be experienced down hole. Since the chemical cutter itself is also limited by these same factors, further research of acceptable elastomeric compounds was unnecessary.

Not being satisfied with the "industry standard" compound, further investigation of an acceptable elastomeric compound was continued. My research led to a fairly new compound called Aflas. This is a new fluorocarbon compound with a greater range of chemical compatibility and a higher temperature range than other fluorocarbon compounds. Its published resistance to steam and hot water make it very attractive for use down hole. The compound also has a temperature rating of 500 degrees F working and 600 degrees intermittent. This compound exhibits all the necessary and desirable qualities for a universal down hole o'ring for use as the standard on all RCT's (see Results section).

b). Machining, Assembly, and Testing

The selection of a suitable o'ring compound paved the way to solving the sealing problem associated with the RCT nozzle. Torch bodies which were built during the SIE Geosource contract were selected for testing of this new compound. Concentricity checks were made on the RCT. The o'ring groove, the body O.D., and the internal surface of the nozzle area were checked for concentricity. From this data, it was learned that the machining process that was followed to manufacture these torch bodies would produce a torch that would not be concentric enough to allow the sliding sleeve to seal. This lack of concentricity would also cause the sleeve to drag on the side of the o'ring surfaces of the body and the cap. This drag force also increases the forces necessary to move the sleeve during operation of the torch.

The drawings for all RCT designs were changed to reflect concentricity requirements necessary to maintain acceptable clearances for final assemblies. The drawings were also changed to add a second o'ring on the body and a second on the cap; this reflects the desire of oil company engineers for adequate down hole protection.

Parts were manufactured per the above changes, assembled and checked for fit, clearances, ease of assembly, and for drag forces. Once the checks were made, the torches were loaded and tested (see Results section).

D. Results:

Section a).:

The final decision for an acceptable elastomeric compound is to use the 80 durometer Aflas fluorocarbon compound manufactured by Utex Corp. of Houston, Texas.

Section b).:

The assembly of the sleeve on all RCT designs was greatly improved. The addition of the second o'ring seemed to further stabilize the sleeve and aid during assembly. Not once were the o'rings found to be cut or damaged during the assembly process no matter how many times the sleeves were actuated. It appears that the lack of concentricity between the body and the cap played a very important part in obtaining a proper fit and a proper seal. Not one torch has leaked under pressure.

Once the mechanical torch assemblies were loaded, testing was begun. Trouble was experienced with the torches under pressures above 2000 psi. When fired the sleeve would either not slide clear or would slide only slightly enough to clear only one o'ring. This would cause a back flow in the torch which resulted in the bodies burning through or the nozzles would wash out due to an improper flow path. Many factors were weighed in this resulting phenomena before the answer was finally pin pointed. In order to add the second o'rings to the body and the cap, both o'ring sections had to be increased in length. Two problems were created with the addition of the second o'rings;

1. The increase in length of the o'ring section meant that the sleeve had to slide an additional 3/8" farther when fired; a 100% increase in travel distance.
2. The addition of two o'rings meant that the drag forces exerted on the sleeve by the o'rings were also doubled.

To overcome the adverse effects created by the addition of double o'rings on the sleeve, I had to resort to a redesign of either the chemical mix or the ignition system. I determined that the torch was not building internal pressure fast enough to overcome the external forces created by the well bore pressure, thus causing the sleeve to malfunction per the above described actions. I chose to

address the problem in the simplest fashion by increasing the output capacity of the thermal generator. This increase in the thermal generator would yield a much higher initial pressure pulse and produce a much faster initiation rate. Several torches were built and tested with the new design. All torches functioned properly and cut the tubing as designed. Not one failure of the torches due to improper initiation or sleeve malfunction has been reported.

E. Conclusion:

From the testing performed, the field data gathered, and the ease of assembly, it appears that a very functional and practical torch design has been achieved. This design is also cost effective to manufacture. Although some work is still required to refine the operational design configuration, it appears that the stage has been set to achieve acceptable results on a torch to operate at pressures to 20 ksi. Much of this work must be achieved through extensive field use and obtained at actual down hole conditions.

III. Task 2: Redesign Torch for Operation at 20 ksi

A. Purpose

In order for the Radial Cutting Torch to cut at pressures above the present rating of 10ksi, the torch design must be evaluated and verified for mechanical integrity and operation at the higher pressures. The thrust of this evaluation is to develop designs on six of the nine sizes of RCT's. The three sizes excluded from this evaluation (1", 4" & 5") were excluded because of the unlikely use of these sizes at the elevated pressures.

B. Objective

The objective is to obtain the necessary data by analytical means to develop designs for use in elevated pressures to 20ksi. Once the data is obtained, mechanical drawings will be made for the RCT's evaluated.

C. Procedure

Phase 1:

The numerical data generated in this task is highly confidential therefore none of the calculations or designs will be disclosed. The calculations for all six RCT's will be performed using the following points as a standard for mechanical integrity:

1. Collapse rating of the machined body
2. Collapse rating of the sliding sleeve
3. Column load on the nozzle.

A safety factor of 1.2 is to be maintained for all load bearing elements.

Phase 2:

Once the analytical data, which will provide a mathematically workable torch "shell", is obtained, the nozzle analysis for proper flow at elevated pressures will be performed. With this information a workable design will be developed and appropriate machine drawings will be made.

Phase 3:

Once the mechanical drawings are made, material sources will be done to acquire the desired materials. Sample torches of each size

will be made and pressure tested to 20ksi and held for 30 minutes. Pressure will then be increased at 500 psi increments and held for 5 minutes until the maximum pressure of 24ksi is achieved. If the torch fails the test then design changes will be made to alleviate the problem. If the torch passes the test then, Phase 4 testing will be performed.

Phase 4:

Torches from all six torch sizes will be loaded and tested to cut the appropriate tubing at pressures between 10ksi and 20ksi. Torch loads will be determined based upon test results. Tests will be performed until a cutting curve of Load vs Pressure is generated for each size of torch over the specified pressure range.

Results:

Phase 1:

Calculations of the six torch sizes evaluated all exhibited the same results. The torch bodies were insufficient to resist overburden pressures of 20Ksi with a 1.2 factor of safety. The sliding sleeves also proved unsatisfactory for the prescribed pressures. The column load characteristics were adequate provided the threaded section of the bodies could be increased in strength.

Phase 2:

With the data from Phase 1, the design for each was achieved and machine drawings were generated.

Phase 3:

Body material for several of the torch sizes was not available in the appropriate grade. In order to acquire this material a mill run would have to be purchased for each size. High pressure requirements from the field necessitated the manufacture of a couple of sizes which could be manufactured with available materials. Four torches of both sizes required by the field were built and sent to the field. I am awaiting results from these jobs.

Phase 4:

No work has been done in this phase, other than the work mentioned in Phase 3 above, due to the lack of funds. All funds have been exhausted

Conclusion:

The work performed in this task has proved invaluable in determining the necessary factors which have provided for the design and partial development of high pressure (20Ksi) torches. The two torch sizes built for field applications will provide very valuable information which can be extrapolated correspondingly to the other sizes of torches.

The D.O.E. funds provided for this project have proved vital to the success of the Radial Cutting Torch. The accomplishments achieved in Task 1. have increased the success rate of the RCT as follows:

Louisiana - Apex Wireline	1995 success rate	55%	
	1996 success rate	80%	this includes all jobs to date
Oklahoma - Star Jet(new customer)	92% success rate		
Texas - Weatherford Enterra	95% success rate		

The above success rates have caused my quarterly sales figures to more than double for each of the last two quarters of 1996. During the first two weeks of January 1997, I have received orders totaling 50% of my last quarters sales total. I am looking forward to doubling last years sales figures. I have included in an attached exhibit some of the field reports received this year.

IV. Task 3: Upgrade Mechanical Anchor

The source for high temperature coil springs for operation in corrosive environments has been found. The same source can also supply the appropriate bow springs.

The clip section has been redesigned and the parts manufactured and tested. Some refinement to the design is needed to obtain better results.

Procedure:

To upgrade the mechanical anchor to achieve a universal field worthiness is a truly a long and experience oriented process. Many factors affect use of this type of tool for the full range field needs; some of which are:

1. The ability of the tool to set in coated tubing including plastic lined, cement lined, fiberglass lined, corroded, etc.
2. The ability of the tool to pass through the same pipe restrictions such as nipples, valves, collapses, etc. and still set and hold the cutter in place.
3. The ability of the tool to remain in down hole conditions for extended periods of time and still function.

The initial design has undergone many improvements and has successfully functioned in some limited down hole jobs. The tool has also failed to function in other applications. It is these failures which point to the most notable areas of the tool which require design improvement and change. The areas of the anchor which require the most immediate attention are the following:

- A. The compression spring,
- B. The shifting pin,
- C. The slip section.

A. The compression spring:

This spring applies an adjustable compression force on the drag springs. The present spring is a standard spring steel material with a maximum load output of 100 lbs. This spring is insufficient in load output and most definitely loses much of this output as down hole temperatures rise. A decrease in this springs output will adversely affect the ability of the anchor to shift. A decrease in the shifting forces available will prevent the tool from setting and anchoring. The anchor must have available a sufficient force to set and release the tool. This coil spring is the source of this force.

The source for high temperature coil springs for operation in corrosive environments has been found. The same source can also supply the appropriate bow springs.

The original coil springs were an off the shelf item from a local supplier. The supplier did not have a spring of appropriate diametrical dimensions, so I used the closest size spring available which was a 1-1/2" diameter with a .162" diameter wire and 4" in length. The spring had a spring rate of 52 lb/in and a load of 73 lb. at the max. compression length of 2.6". The internal diameter of the spring was 1.176". The spring was housed on a shaft of 1" diameter which allowed for nearly 3/16" of play and distortion during compression of the spring. This particular spring was initially chosen because it was:

1. Of acceptable dimensional size,
2. Of tolerable force output,
3. A shelf item and readily available,
4. Very inexpensive compared to a custom manufactured spring.

A number of suppliers were investigated to find a standard size spring with the following specifications:

1. Outside diameter	1.688 max.
2. Inside diameter	1.06 governing dimension
3. Length	4.5" ground ends
4. Effective Length, L1	2.6" to 2.9"
5. Load	175 - 250 lbs.
6. Temperature rating	80% of load @ 350 deg F

A standard spring could not be located, neither could a close substitute be found. The majority of spring sizes were confined to wire diameters of approximately 3/16" or less and with Load P capacities of only 100 lbs. Heavy duty springs are available only in standard incremental sizes with controlled O.D./I.D. dimensions none of which are suitable for this application and Load P outputs far in excess of that desired.

A local manufacturer of compression springs was consulted. The above criteria was presented for evaluation and a spring with the following characteristics was recommended:

1.	O.D.	1-11/16"
2.	I.D.	1.250 "
3.	Length	5"
4.	Wire dia.	.218"
5.	Effective length, L1	2.83"
6.	Temp. rating	500 deg. F
7.	Load Rate	80.96 #/in
8.	Material	302 Stainless Steel
9.	Load	175 #
10.	Cost	\$ 7.29 ea. min. of 35 units

A smaller I.D. was requested, but the load would diminish to 120# with a travel length of less than 1.9 inches. An I.D. of 1.25 inches would allow the spring to oscillate on the 1" shaft; a very undesirable characteristic. Yet to obtain an appropriate yield from the spring, the I.D. of the spring would have to remain at 1.25 inches. This would require the top nut P/N MAS-1687-014 and the adjusting screw P/N MAS-1687-021 to be modified with a shoulder and inner sleeve to house the 1.25 I.D. spring. This could be accomplished by redesigning both parts or by designing a single spacer which would accommodate both ends of the spring. I opted to design and build a single spacer to fix this problem. This would be the cheapest and easiest solution to the problem.

B. The shifting pin:

The original shifting pin was crudely made from a standard 1/4"-20 x 1/2" long socket set screw modified by machining the end opposite the socket. Performing this type of machining process on a set screw will work satisfactorily, but is expensive and requires specialized tooling and fixtures to maintain tolerances.

An investigation of a stock manufactured part to fill this requirement, uncovered a set screw known as a dog-nose socket set screw. These screws can be purchased with both coarse and fine threads and in standard lengths appropriate for my needs. The 5/16" size had a dog-nose diameter of .225 inches. This would work satisfactorily in the 1/4" wide J-latch, and would allow for the outer sleeve to rotate slightly on the main shaft.

A closer tolerance fit could not be achieved, so the 5/16" dog nose set screw was selected for use. The outer shifting sleeve P/N MAS-1678-020 (ref. dwg. #1 Appendix A) was revised to accommodate the 5/16" set screw.

C. The slip section:

The original slip section (ref. dwg #2 Appendix A) used a Slip Holder to attach the Slip Arms to the outer sliding sleeve components. The Slip Holder held the Slip Arms in position with an internal grooved cavity which functioned as a "socket" for the Slip Arms and which allowed a minimum of travel of the slip arms. The slips were made of tubing which was lathe machined to specification, then slit into six equal pieces. This design worked well for small tubulars such as 2-1/16" and 2-3/8" where radial travel was held to a minimum. Although the anchor design did function in 2-7/8" tubing, the anchor did possess the characteristic of sticking when run in the lighter weight sizes. Another problem with this design of Slip Arm, occurred in heavy mud and scaled wells. The debris from the well would coagulate beneath the extended arms, thus preventing them from retracting back into position for easy removal from the well. Another problem associated with the original Slip Arm design was the small tooth configuration and the fixed profile of the tooth design which rendered the slip unable to fully engage the inside diameter of the various tubing sizes when extended. The result was anchoring ended up depending on the lower one or two slip teeth of each arm.

The first and foremost problem was to design a slip mechanism that could fully engage various tubing diameters when actuated. To accomplish this a lever arm with two pin joints was used (ref. dwg #3 Appendix A). The Slip Holder MAS-1688-015 Rev. A (ref. dwg #4 Appendix A) was redesigned to accommodate three pin joints for lever arms.

The Slips MAS-1688-017 (ref. dwg. #5 Appendix A) were redesigned to also accept a pin joint. To accomplish this design the number of slips were changed from six sections to three. This did not change the potential overall diametrical gripping area. Another important change in the slip design was made in the size of the slip teeth. The original design used a .062 deep x 60 deg. profile which yielded a .125 gap between slip teeth. The new design uses a .100 deep x 60 deg. profile which yields a .200 gap between the slip teeth. This larger

slip tooth design is far more effective in gripping the pipe and is much less likely to "plug up" with well debris. The larger tooth also provides a deeper cavity for the o'rings which are used as a stabilizing and return mechanism for the slips.

Results:

When all changes were completed and the parts were built and assembled on the anchor body , the new anchor design proved to be a marked improvement over the original design. Drag Spring adjustment was much improved with much higher drag forces available for setting and releasing the slips. The larger toothed slips with the lever arm attachments offered a great deal more holding force without compromising releasing ability.

Conclusion:

At this point, the anchor improvements seem to have provided a much improved anchoring tool which should aid in a greater success ration of cutting due to improved holding and operating forces.

DRAWING #1

SECTIONAL VIEW

MCR ENTERPRISES * P.O. Box 1465, Alvarado, Texas 76009

SCALE: 5X	APPROVED BY	DRAWN BY
DATE: 1-9-94		MCR
SHIFTING PIN		
5 16" - 24 UNF x 3 4 SDC SET		DRAWING NUMBER
		MPS-1638-020

DRAWING #2

MCR OIL TOOL CORP.			
SCALE	NONE	APPROVED BY:	DRAWN BY: MCR
DATE	8-1-95	REVISED	
ORIGINAL SLIP SECTION 1.688" ANCHOR			
DRAWING NUMBER			DWG # 2

DRAWING NUMBER

DRAWING #3

MCR OIL TOOL CORP.			
SCALE	NONE	APPROVED BY	DRAWN BY MCR
DATE	8-2-95	RECORD	
DOE - REVISED SLIP SECTION			
			DRAWING NUMBER
			DWG - # 3

DRAWING #4

MCR ENTERPRISES		P.O. Box 1465 Alvarado, Texas 76009	
SCALE: NTS	APPROVED BY:	DRAWN BY: M.E.P.	REVISIO
DATE:			
SLIP HOLDER 1-11/16"		DRAWING NUMBER	
ALLOY STEEL R. 45+		MRS-1633-D15	

DRAWING #5

SECTION A-A

.260 MILL SLOT
3 PLS. @ 120°
SAW CUT 3 PLS.
@ 120° AS SHOWN
MAX. WIDTH OF CUT .125

MCR ENTERPRISES * P.O. Box 1465, Alvarado, Texas 76009

SCALE: FULL

APPROVED BY:

DRAWN BY

MCR

DATE: 1-3-94

REVISED

SLIP

ALLOY STEEL Rc 45+

DRAWING NUMBER

MAS-1688-017

MCR ENTERPRISES P.O. Box 1465 Alvarado, Texas 76009

SCALE: NTS APPROVED BY

DATE: 1-4-94 DRAWN BY M. ROBERTSON

SLIP CONNECTING ARM

ALLOY STEEL 45-50 Rc DRAWING NUMBER MHS-1688-D16

MCR OIL TOOLS CORP.

P.O. Box 1465 Alvarado, Texas 76009 817 447-8878 Fax: 817 447-8877

Customer and Job Data List For the year 1994

Company	Date	Tubing Size	Cutter Size	Fluid	Depth
Conoco MP 296A	3-8	2-3/8", 4.9#	1-3/8"	water	9500
Conoco MP A4	3-8	2-3/8", 4.9	1-3/8"	water	9500
Conoco MP A9	3-8	2-3/8", 4.9	1-3/8"	water	9500
Conoco MP A9D	3-8	2-3/8", 4.9	1-3/8"	water	9500
Chevron Romere P	3-24	2-7/8" TK7	1-11/16"	water	1016
SWEPI Willbar236	4-4	2-3/8 Monel	1-11/16"	8.6 S.W.	12155
Toklan. OK.	12-3	2-3/8", 4.7	1-3/8"	water	15200

MCR OIL TOOLS CORP.

P.O. Box 1465 Alvarado, Texas 76009 817 447-8878 Fax: 817 447-8877

Customer and Job Data List For the year 1995

Company	Date	Tubing size	Cutter size	Fluid	Depth
Swift Eng.	1-5	2-7/8"-8.7	1-11/16"	S.W.	9716
Conoco	1-17	2-7/8"-6.5	1-11/16"	Diesel	11292
Chevron	2-2	2-7/8"-6.5	1-11/16"	S.W.-8.6	9025
Unocal	3-19	2-3/8"-5.5	1-3/8"	OB Mud	12957
Unocal	3-20	2-3/8"-5.5	1-3/8"	OB Mud10.5	12200
	3-20	"	"	"	10685
Unocal	3-21	2-3/8"-5.5	1-3/8"	OB Mud10.5	9202
Apache	3-23	2-7/8"-6.5	1-11/16"	S.W.+ Oil	7805
Apache	3-28	2-7/8"-6.5	1-11/16"	S.W.	----
Tx. Mer.	5-31	3-1/2"-13.3	2"	17.5 Mud	8337
Am. Exp.	5-17	2-7/8"-6.5	1-11/16"	8.4 S.W.	6151
Sante Fe	6-4	2-7/8"-7.9Cr	1-11/16"	10# Mud	17476
Tx. Mer.	6-9	3-1/2"-13.3	2"	17# Mud	11592
Badger	9-1	2-3/8"-4.7	1-11/16"	S.W.	10312
Badger	9-3	2-3/8"-4.7	1-11/16"	S.W.	10549
Sonat	9-12	2-3/8"-5.9	1-3/8"	S.W.	10908
Mobil	1-16	2-7/8"-11.7	1-11/16"	S.W.	9500

FIELD REPORT FOR THE RADIAL CUTTING TORCH

DATE: June 6, 1996

LICENSEE Apex Electric Wireline Service, Co.

WIRELINE CO. Apex

LOCATION Houma, La.

FIELD ENGINEER'S NAME DON

OIL COMPANY Petro Hunt, Inc

LOCATION POPLARVILLE, MISS.

ENGINEER'S NAME Chris Graves 601-795-8288

TOOL PUSHER'S NAME _____

WELL DATA:

WELL NAME Crown Zellerbach #1

LOCATION MISS.

FIELD Block 24-11

TYPE OF WELL:

OIL ✓

GAS _____

INJECTION _____

TYPE OF FLUID IN THE WELL 10 lb/gal Calcium Chloride

FLUID LEVEL Full

FLUID DENSITY 10 #/gal.

WELL TEMPERATURE 325 °F

PRESSURE AT THE CUT _____

WELL HEAD PRESSURE _____

TUBING SIZE 2 7/8"

TUBING WEIGHT 9.7 lb/ft.

TUBING GRADE 13 % Cr. w/ Ph 6 connections

CONDITION OF TUBING 1/8" of scale inside

DEPTH OF TUBING PLUGS _____

STUCK POINT OF TUBING (FREE POINT) _____

DEPTH OF CUT TO BE MADE 15,025'

SIZE OF RCT USED 1 11/16" -400 RCT

SIZE OF CASING _____

SET DEPTH OF PACKER _____

WELL CONDITIONS Scaled. Cut but could NOT pull
backed off above cut. Went back in & pulled
tubing at cut. Tubing was stuck above cut.
retrieved both sections of cut.

USE THE BACK OF THIS PAGE TO SKETCH WELL CONFIGURATION

FIELD REPORT FOR THE RADIAL CUTTING TORCH

DATE: 4-15-96

LICENSEE STAE Jet Service

WIRELINE CO. STAE Jet Service

LOCATION Hampa TX

FIELD ENGINEER'S NAME Leslie Sellers Pete Ramsey Mgr.

OIL COMPANY Kenneth W. Coory

LOCATION Houston TX

ENGINEER'S NAME Frank Padue

TOOL PUSHER'S NAME _____

WELL DATA:

WELL NAME Humphrey's A-1

LOCATION S. Canadian TX Big Bull Ranch, Ed.

FIELD Mathers Ranch.

TYPE OF WELL:

OIL _____

GAS ☒

INJECTION _____

TYPE OF FLUID IN THE WELL Gas Cut Brine

FLUID LEVEL 11.100

FLUID DENSITY 10.2

WELL TEMPERATURE 228°

PRESSURE AT THE CUT 2056

WELL HEAD PRESSURE 225 WHP

TUBING SIZE 2 7/8 Tail Pipe

TUBING WEIGHT 6.5

TUBING GRADE 80.80

CONDITION OF TUBING UNKNOWN

DEPTH OF TUBING PLUGS 14984

STUCK POINT OF TUBING (FREE POINT) _____

DEPTH OF CUT TO BE MADE 14978

SIZE OF RCT USED RCT-1688-300 1" ID OD

SIZE OF CASING 7 5/8

SET DEPTH OF PACKER 14,910

WELL CONDITIONS 2 3/8 L.80 Tubing From Surface To Top

PACKER. Tailpipe WAS Cut 5 Times & String Set Shot over Cut in

The year of 1982. Tail Pipe wasn't full so they Ref 10' 15" At

The bottom of the 30' Joint Tailpipe in 1982. So The Company Decide

14 years Later To attempt To Cut Tail Pipe Again so They Could Drop

Soap Stone. So we made Cut and chase it To Bottom 17,362.

Which made all Perforations open.

USE THE BACK OF THIS PAGE TO SKETCH WELL CONFIGURATION

FIELD REPORT FOR THE RADIAL CUTTING TORCH

DATE: Job Done 6-16-96

LICENSEE _____

WIRELINE CO. Weatherford Enterra

LOCATION Corpus Christi, Texas

FIELD ENGINEER'S NAME John L. Tiemann

OIL COMPANY EDC Operating

LOCATION Randado, Texas

ENGINEER'S NAME Clem Pierce

TOOL PUSHER'S NAME Monda Reyna - Pool well Service

Monty Montgomery + Harrell Elisk w/ Ponder Fishing Tools

WELL DATA:

WELL NAME Viejo #2

LOCATION Randado, Texas

FIELD Viejo

TYPE OF WELL:

OIL _____

GAS ✓

INJECTION _____

TYPE OF FLUID IN THE WELL Brine

FLUID LEVEL Full

FLUID DENSITY 10 #

WELL TEMPERATURE 394°

PRESSURE AT THE CUT 7200 # Hydrostatic

WELL HEAD PRESSURE 0

TUBING SIZE 2 7/8

TUBING WEIGHT 7.9 #

TUBING GRADE 22 % Chrome

CONDITION OF TUBING Good

DEPTH OF TUBING PLUGS 13940

STUCK POINT OF TUBING (FREE POINT) 13900

DEPTH OF CUT TO BE MADE 13860

SIZE OF RCT USED 1 1/16 RCT-1688-300

SIZE OF CASING 7"

SET DEPTH OF PACKER 13900

WELL CONDITIONS Rig Had Pulled 30' Seal Assy up Hole

Approx 20' we Ran Free Point and Found Pipe Free

To The Locator Sub. We made Cut in 1st Joint

Above Locator Sub. Rig had to work cut a few

Times because weight indicator was off by approx

16,000 #. Co. Rep. was well pleased with performance

of Cutter

USE THE BACK OF THIS PAGE TO SKETCH WELL CONFIGURATION

Weatherford

Mike Roberson:

Report on Wire Job EF 42520
9-12-95

For Scout Exploration Co.

Kulawik No. 3 2 3/8 5.5 13% csm pi
Dewitt County

1. Depth at cut 10,908'
2. Hydrostatic 5,672
3. Fuld in hole, inside and Back side
10.15 Brin
4. Pull on pipe 10,000 over, But cutting
Below Packer in 10' pup 5.5.
so no cut at cut point
5. Rig released, Mechanical Gun Release
sub. so, little to no torque apply
to cut.
6. Rig pulled 10' pup out of hole intact
Not sure when cut broke, sometime
after Rig hayed pup joint out the
next day

Mike Jacobson 512-576-01

FIELD REPORT FOR THE RADIAL CUTTING TORCH

DATE: 12-15-87

LICENSEE Petra Technologies, Inc.

WIRELINE CO. Schlumberger Technology Corp.

LOCATION Rosharon, TX

FIELD ENGINEER'S NAME Klaus Huber

OIL COMPANY Mobil Green Canyon field

LOCATION _____

ENGINEER'S NAME _____

TOOL PUSHER'S NAME _____

WELL DATA:

WELL NAME Schlumberger Test chamber

LOCATION _____

FIELD _____

TYPE OF WELL:

OIL _____

GAS _____

INJECTION _____

TYPE OF FLUID IN THE WELL H₂O

FLUID LEVEL _____

FLUID DENSITY _____

WELL TEMPERATURE 430°F held for 1.5 hrs

PRESSURE AT THE CUT 11,000 psi

WELL HEAD PRESSURE _____

TUBING SIZE 3 1/2" x 2.975 ID.

TUBING WEIGHT _____

TUBING GRADE Hastalloy

CONDITION OF TUBING New

DEPTH OF TUBING PLUGS _____

STUCK POINT OF TUBING (FREE POINT) _____

DEPTH OF CUT TO BE MADE _____

SIZE OF RCT USED 2 1/2" , - 300 RCT

SIZE OF CASING _____

SET DEPTH OF PACKER _____

WELL CONDITIONS complete cut. Took 10 hrs to

come to temp. held at 430 °F for 1.5 hrs.

brought tool to 11,000 psi and fired.

USE THE BACK OF THIS PAGE TO SKETCH WELL CONFIGURATION

TOLCAN
MCR OIL TOOLS CORP. date 12/3/94

OKLAHOMA TEST

1-3/8 diameter RC

P.O. Box 1465 Alvarado, Texas 76009 817 447-8878 Fax: 817 447-8877
from the desk of Steve Hash

Depth. 15,200 ft.

Jim - got your msg +
tried to return your call.
looks like ECT made $\pm 80\%$
cut - we twisted off rest
on next trip in hole.

Glad to know you're available
and in spreading the word
as fisherman & machine co's.
Good luck

Steve

Will serve as reference if you like

FIELD REPORT FOR THE RADIAL CUTTING TORCH

DATE: 04 April 1994

LICENSEE Apex Electric Wireline

WIRELINE CO. Apex

LOCATION Houma, La

FIELD ENGINEER'S NAME Clif Liner

OIL COMPANY SWEPI 60300 Shell Oil Field Road

LOCATION White Castle, La. 70788 Iberville Parish

ENGINEER'S NAME Felix G. Medine III

TOOL PUSHER'S NAME _____

WELL DATA:

WELL NAME Willbar # 236

LOCATION White Castle, La.

FIELD _____

TYPE OF WELL:

OIL ☒

GAS _____

INJECTION _____

TYPE OF FLUID IN THE WELL Salt water

FLUID LEVEL Full

FLUID DENSITY 8.6 #/gal.

WELL TEMPERATURE _____

PRESSURE AT THE CUT 5500 psi

WELL HEAD PRESSURE _____

TUBING SIZE 2 3/8" x 1.995 ID.

TUBING WEIGHT 4.7 lb/ft.

TUBING GRADE 400 MONEL

CONDITION OF TUBING _____

DEPTH OF TUBING PLUGS _____

STUCK POINT OF TUBING (FREE POINT) _____

DEPTH OF CUT TO BE MADE 12,900' cut at 12,155'

SIZE OF RCT USED 1 11/16" - 300 RCT

SIZE OF CASING _____

SET DEPTH OF PACKER _____

WELL CONDITIONS cut below packer, between packer and

wire wrapped G.P. Screen. Made complete cut.

Tool stuck from pressure and sand on the back side

of tubing. Pulled out of rope socket. Pulled tubing.

USE THE BACK OF THIS PAGE TO SKETCH WELL CONFIGURATION

FIELD REPORT FOR THE RADIAL CUTTING TORCH

DATE: Job Done 6-16-96

LICENSEE _____

WIRELINE CO. Weatherford EnTerra

LOCATION Corpus Christi, Texas

FIELD ENGINEER'S NAME John L. Tiemann

OIL COMPANY EDC Operating

LOCATION Randado, Texas

ENGINEER'S NAME Clem Pierce

TOOL PUSHER'S NAME Monda Reyna - Pool well service

Monty Montgomery + Harrell Elzik w/ Ponder Fishing Tools

WELL DATA:

WELL NAME Viejo #2

LOCATION Randado, Texas

FIELD Viejo

TYPE OF WELL:

OIL _____

GAS ✓

INJECTION _____

TYPE OF FLUID IN THE WELL Brine

FLUID LEVEL Full

FLUID DENSITY 10 #

WELL TEMPERATURE 394°

PRESSURE AT THE CUT 7200 # Hydrostatic

WELL HEAD PRESSURE 0

TUBING SIZE 2 7/8

TUBING WEIGHT 7.9 #

TUBING GRADE 22 % Chrome

CONDITION OF TUBING Good

DEPTH OF TUBING PLUGS 13940

STUCK POINT OF TUBING (FREE POINT) 13900

DEPTH OF CUT TO BE MADE 13860

SIZE OF RCT USED 1 1/16 RCT-1688-300

SIZE OF CASING 7"

SET DEPTH OF PACKER 13900

WELL CONDITIONS Rig Had Pulled 30' Seal Assy up Hole. Approx 20' w/o. Ran Free Point and Found Pipe Free To The Locator Sub. We made cut in 1st Joint Above Locator Sub. Rig had to work cut a few times because weight indicator was off by approx 16,000#. Co. Rep. was well pleased with performance of cutter

USE THE BACK OF THIS PAGE TO SKETCH WELL CONFIGURATION

FIELD REPORT FOR THE RADIAL CUTTING TORCH

DATE: 4-15-96

LICENSEE STAC Jet Service

WIRELINE CO. STAC Jet Service

LOCATION Lampa TX

FIELD ENGINEER'S NAME Freddie Sellers Pete Kearney Msgr.

OIL COMPANY Kenneth W. Coory

LOCATION Houston TX

ENGINEER'S NAME Frank Padue

TOOL PUSHER'S NAME _____

WELL DATA:

WELL NAME Humphrey's A-1

LOCATION S. Canadian TX Big Bull Ranch. Ed.

FIELD Matners Ranch.

TYPE OF WELL:

OIL _____

GAS ☒ _____

INJECTION _____

TYPE OF FLUID IN THE WELL Gas Cut Brine

FLUID LEVEL 11,100

FLUID DENSITY 10.2

WELL TEMPERATURE 228°

PRESSURE AT THE CUT 2056

WELL HEAD PRESSURE 225 WHP

TUBING SIZE 2 7/8 Tail Pipe

TUBING WEIGHT 14.5

TUBING GRADE API 80

CONDITION OF TUBING UNKNOWN

DEPTH OF TUBING PLUGS 14984

STUCK POINT OF TUBING (FREE POINT) _____

DEPTH OF CUT TO BE MADE 14978

SIZE OF RCT USED RCT-1688-300 1 1/4" ID

SIZE OF CASING 7 5/8

SET DEPTH OF PACKER 14,910

WELL CONDITIONS 2 3/8 1.80 Tubing From Surface To Top
Packer. Tailpipe WAS CUT 5 Times & String Shot over Cut in
The year of 1982. Tail Pipe was not full so they ran 10' 1 1/2" at
The bottom of the 30' Joint Tailpipe in 1982. So the Company decide
14 years later to attempt to cut Tail Pipe again so they could drop
Soap Stone. So we made cut an chase it to Bottom 17,362.
Which made all Perforation open.

USE THE BACK OF THIS PAGE TO SKETCH WELL CONFIGURATION