1979 WORKOVER OPERATION SOUTH BARROW WELL NO. 6

# PERTINENT DATA

WELL NAME: South Barrow Well No. 6

API NO .: 50-023-10015

LOCATION: 2483' FWL, 1337' FNL,

NW 1/4, protracted Section 14, T22N, R18W,

2354.5

Umiat Meridian, Alaska

**ELEVATION:** 22.2' GL; 24' Casinghead; 42.2' (Est.) KB

PRESENT TOTAL

DEPTH: 2365.5' Est. KB

-2323.5' Subsea Datum

PHYSICAL MARKERS:

MARKER EST. DEPTH KB Casinghead 18.2 Casing ID Restriction 1019.5 (ID≈ 5-7/8") 5-1/2" Liner Top 2211.5 ΤD 2365.5 2-7/8" Tubing Shoe 2194.5 2-3/8" Tubing Shoe

**PROPOSED** 

TESTING PROGRAM: Section I

WORKOVER PROGRAM: Section II

FINAL RESULTS: Section III

#### SECTION I

# PROPOSED TESTING PROGRAM

Four point backpressure tests are to be performed both before and after the workover of South Barrow Well No. 6 in order to evaluate the formation impact of the workover operation. Pressures are to be measured at the wellhead and flow rates at the flare via critical flow prover and dead weight tester.

- 1. The well is to be shut in and isolated from the gathering system. A flare line will be run to the flare pit and cribbed for positive drainage and staked to prevent movement. The well should remain shut in at least 48 hours before testing. A standard four point flow after flow backpressure test will be run, limiting drawdown as much as possible while obtaining adequate pressure spread.
- 2. After completion of the workover procedure and cleanup of the well, a second test will be made. This test may be terminated after two rates if the data are in close agreement with the results of the first test.

#### SECTION II

# WORKOVER PROGRAM

#### INTRODUCTION

A letter written on January 1, 1978 by Andy Crane detailed suspicious noises which were coming from the South Barrow Well No. 6 and which were speculated to be caused by parted tubing. A decision was made to implement a workover program on the well in order to determine the nature of the "noises" coming from the wellbore. Husky Oil NPR Operations, Inc. was designated as the operator for the workover program.

Husky prepared an engineering program for the workover, moved the Brinkerhoff Signal, Inc. Rig No. 31 on the site and began operations on April 10, 1979 by rigging up to kill the well.

#### OPERATIONS HISTORY

DATE AND FOOTAGE DRILLED AS OF 6:00 A.M.	ACTIVITY
4/10/79	Rig up to kill well.
4/11/79	Kill well with 9.0 ppg CaCl <sub>2</sub> workover fluid.
4/12/79	Set wireline tubing plug. Remove old tubing tree. Install new tubing head. Install blowout preventer. Test rams to 3,000 psi, Hydril to 1,500 psi. Pulled and laid down old tubing. Laid down two 2-7/8" x 10" pup joints, 70 joints 2-7/8" tubing, 2-7/8" x 2-3/8" cross over, one 2-3/8" x 5' pup joint, and five joints 2-3/8" tubing.
4/13/79	Run 7" casing scraper to 800'. Set retrievable bridge plug at 750'. Test tubing head flange seals to 2,000 psi. Pulled and plugged outlets on old tubing head. Retrieved bridge plug. Ran Schlumberger Borehole Geometry log. Log indicated casing ID restriction to 5.4" from 1052' to 1072'. Ran in hole with 2-7/8" tubing and circulate to condition hole.
4/14/79	Ran 78 joints 2-7/8" tubing with six centralizers and

Ran 78 joints 2-7/8" tubing with six centralizers and two 1/4" chemical injection lines. Landed tubing at 2353.94'; centralizers at 1210', 1514', 1805', 1983', 2193', and 2339'; and injection lines at 1500' and 2000'. Nippled down blowout preventer and nippled up tubing

tree. Tested tree to 3,000 psi.

4/15/79	Displaced workover fluid from well with nitrogen.
4/16/79	Nippled up to flow well. Flowed to clean up well.
4/17/79	Flow to clean well.
4/18/79	Rigged down and released rig.
4/19/79 to 5/9/79	Prepared location for well house. Installed house, SSV, production connections, power lines, etc.
5/10/79	Returned well to production.

# SECTION III

# FINAL RESULTS

The South Barrow Well No. 6 was placed back into production on May 10, 1979. The AOF was 2.100 MMCFGPD with a Productivity Index of 5.217 MCF/D/psi. The pre-workover AOF was 5.850 MMCFGPD with a Productivity Index of 14.44 MCF/D/psi. A 64% decrease in deliverability resulted from the workover operation (see attached memo by Stephen K. Lewis).

# MEMORANDUM

Nov. 22, 1978

TO: FILE

Further considerations with respect to the supply and demand situation in the South Barrow Gas Field in consideration of the proposed workover of well no. 6.

When the decision to work Well # 6 over was made it was assumed that the tubing in Well # 6 was parted and that this would prevent liquid removal by blowdowns. The well was expected to experience a decline in deliverability and to eventually water off.

It was also assumed that the remaining wells could make up for the loss of Well No. 6 while it was being worked over and that the winter demand would follow normal patterns.

Since early spring there have been several developments which create some doubt as to the validity of these assumptions.

First, Well # 6 does not appear to be watering off and the tubing might in fact not be parted. The well has been blown down twice since the initial incidence of "subterranean rumbling." The first blowdown on April 15, 1978 recovered water for seven seconds. The blowdown of October 14, 1978 recovered water for six seconds. These recoveries were in keeping with the wells past performance and would be hard to explain the case of parted tubing.

From October 1977 to October 1978, the average shutin wellhead pressure of the field declined 33.493 psi. The shut in well head pressure of Well No. 6 declined 30.235 psi. During the same period the average wellhead flowing pressure declined 43.511 psi while that of Well No. 6 declined 35.0 psi. These declines are in keeping with past field performance and indicate that there has been no unusual build up of fluids in Well No. 6. The field average shutin pressure of October 1978 was 748.75 psia. The shutin wellhead pressure of Well No. 6 was 756.86 psia.

In October 1977 Well No. 6 produced an average of 472 McF/d. The October 31,1977 rate was 554 McF/d flowing at 750 psig on an 18/64" choke. The February 1978 rate was 465 McF/d at 740 psig against a 18/64" choke. The October 1978 average daily rate was 464 McF/d. The October 31, rate was 412 McF/d at 715 psig against a 20/64 choke.

Thus, there is no evidence of radical change in the pressure, flow, or fluid production in Well No. 6 and sudden failure is doubtful.

The assumption that the demand normally supplied by Well No. 6 could be evenly distributed to the remaining wells has proven false. This is due to both the mechanics of the gathering system and the behavior of the individual wells.

Figure I is a generalized schematic of the gathering system. Wells 5,7,8, & ll flow against positive chokes under critical flow conditions. Flow rate is a function of upstream pressure and choke size and is insensitive to fluctuations in line pressure. Wells 6, 9, and 10 also have positive chokes. These chokes are not in critical flow and rate is sensitive to downstream pressure. Operationally the primary controller senses line pressure at point A and is set to maintain 220 psig at A. Pressure drop at A will cause the controller to open and lower the pressure at B and C. Pressure drop at B will not impress the flow rate from wells 5,7, 8, and 11 as they are in critical flow across the positive chokes. The

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secondary controller is set to sense and maintain 220 psig at point C. When it senses the pressure drop at C it will open and drop the line pressure down stream of the chokes on wells 6, 9, & 10. This will result in an increase in the flow from these wells as their chokes are not in critical flow. If this increase is unsufficient to increase the pressure at C to 220 psig the secondary controller will continue to drop the pressure at D and the rate will increase until critical flow is achieved at the chokes. At this point the rate will stabilize as controlled by choke sizes and flowing wellhead pressures.

If this rate is less than demand the distribution system pressure will fall.

Figure II is the gathering system flowing pressure with the demand and flow balanced. Figure III represents the system when demand exceeds supply.

Wells 5, 7, 8, and 11 are currently producing at rates close to their operational maximum. Well No. 5 is constantly on the verge of failure by watering off, and Wells 7, 8, and 11 are already close to a 10 percent drawdown. The choke size on these wells should not be increased to any large amount. Thus the production loss from shutting in Well #6 will be born primarily by wells 9 & 10. If this is the case and 10% drawdown is not exceeded on any well the system deliverability without Well No. 6 would be 2625 McF/d. This value is less than the projected December demand by 554 McF/d and less than the projected peak demand by 843 McF/d.

Previous demand projections have assumed that major construction in Barrow does not occur during the winter. This year this is not the case. There are currently eight, twelve-unit apartment buildings and thirteen single family dwellings under construction. The combined furnace input ratings of these buildings is 14,870,000 BTU/HR. Assuming an 80% efficiency and 75% load the projected consumption of these new buildings is 214.128 McF/d This is an increase of 8.89% over the average 1977 daily consumption due to these projects alone. As the previous projected rate of increase in peak demand has been 5.5% per year it becomes apparent that the village is engaged in a rate of growth which may well invalidate previous demand projections.

Considering the facts that Well No. 6 does not appear to be in a state of failure, that the swing capacity of the field is limited primarily to wells 9 & 10, and that demand projections may be conservative, it becomes questionable whether a work over of Well No. 6 during the peak demand season is indeed prudent operational procedure.

& Lenny

S. K. Lewis

cc: Jack McCarthy w/attachment

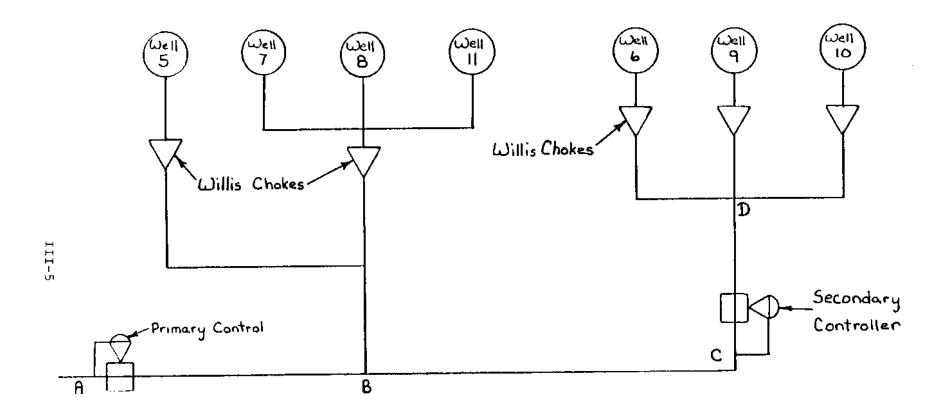


Figure I

General Gathering

System Schematic

South Barrow Gas Field

SKL 11/22/78

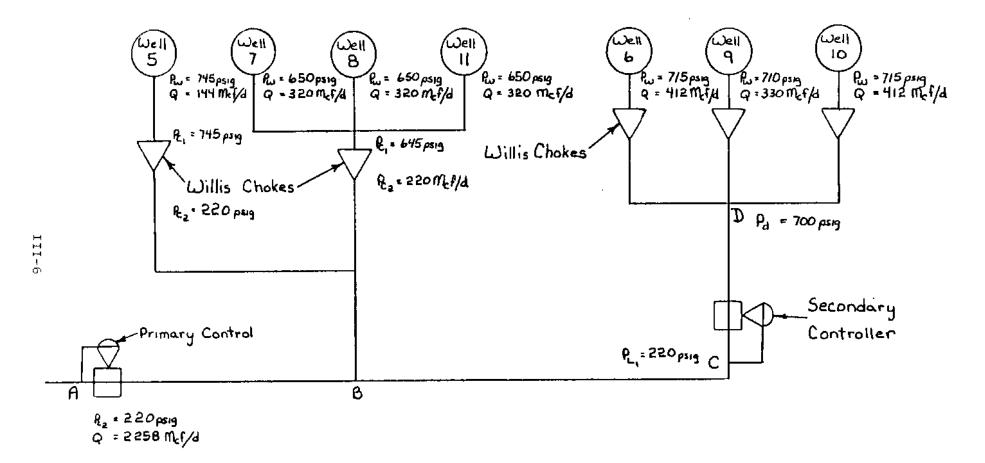


Figure II

Generalized Gathering

System Schematic

South Barrow Gas Field

Production Equal Demand

SKL 11/22/78

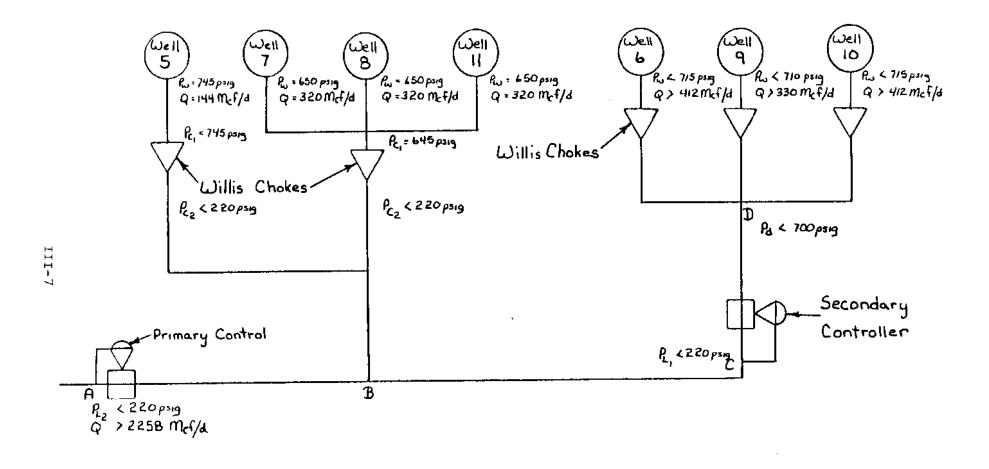


Figure III

Generalized Gathering

System Schematic

South Barrow Gas Field

Production Is Less Than Demand

SKL 11/22/78

# SOUTH BARROW WELL NO. 6 LOSS OF DELIVERABILITY DUE TO WORKOVER PROCEDURE

South Barrow No. 6 was tested before and after being killed for the replacement of tubing. Stabilized Four Point tests were performed with surface pressures recorded and flow measured by Critical Flow Prover.

The pre-workover AOF was  $5.850~\text{M}^2\text{cF/d}$  with a Productivity Index of 14.44~McF/d/psi. Post-workover AOF was  $2.100~\text{M}^2\text{cF/d}$  with a Productivity Index of 5.217~McF/d/psi. Based on the ratio of Calculated Productivity Indices, South Barrow No. 6 suffered a 64% decrease in deliverability due to the workover operation.

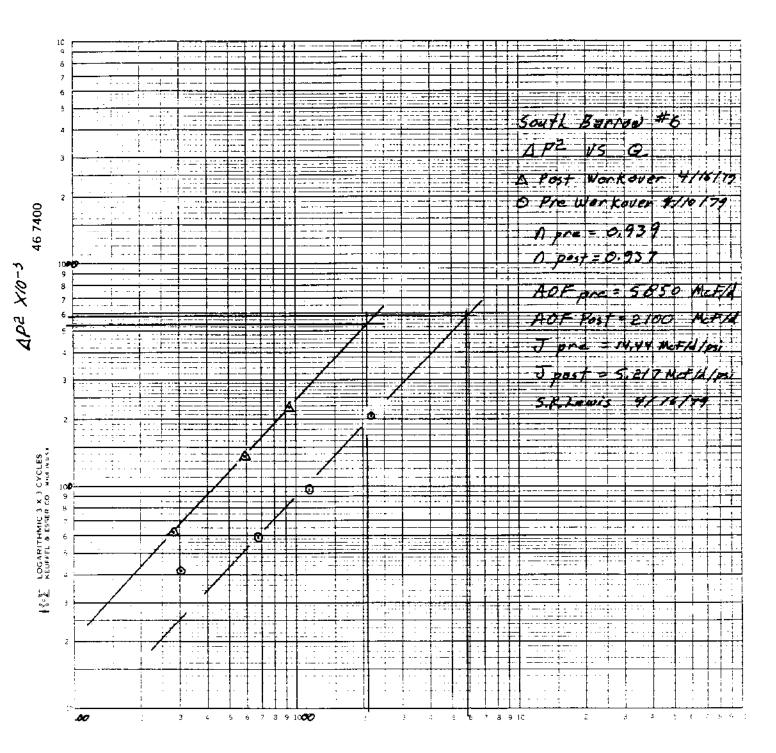
The loss of deliverability is primarily attributable to the loss of 60 bbls of workover fluid to the formation during the workover operation.

The risk of such loss of fluid and resultant formation damage was documented by Husky and brought to the attention of the USGS prior to the implementation of workover operations.

Backpressure data are attached.

S. K. Wewis Senior Engineer

Copy to: J. McCarthy



a (McF/d)

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2308	2308	2.56	5 0.0	8	0.84	_	7.11		
	,	LOW DATA			TUBIN	G DATA	CASHC	DATA	   Duration
Prover	Chake Orifles	Procs.	Diff.	Tomp.	Press.	Totap.	Press.	Tamp.	of Flow,
NO. Size	Sine	geo ing	h.	F	paig	F	paig	F	P#.
SI 2"		745				<del> </del>		7-	<u> </u>
1.	12/64	717	<del></del>	20		<del></del>	727	29	
3	16/64	679		22		<u> </u>	683	26	
	24/64	594		18	<del></del>		607	24	ļ
5.	1							<u> </u>	<u> </u>
			Pressure	Flow	· !	Gravity	Saper Current		te of Flow
NO. (24-No.	1 7	h_P_	₽	Fec		Fazier, F	Factor F .pv		Q, Mefd
1. 0.27/			732,33	1.0		4.330	1.0795	300	0.659
2. 0.623	7		720,37	1.05		4330	1.0704		5.8/8
3. /./S			609.37	4.0		/ <u>: 330</u> /: 330	1,0664		9.709
3.							1,44		
	-			· 5	_levid Hydroc				Mcf/bbl
NO. P,	Tamp. !	t T,	Z	1	-	uraan kunta Japid Hydrocus		· · · · · · · · · · · · · · · · · · ·	
1. 1.090	469	1,388				Soperator Gas		1	
2. 1.072	480	1.420	0.8725		ific Gravity cui Process		2		
3. 1.037 4. 0.907	479	11.417			asi Tampan	-7-2			R
5.	<u></u>								
								_	
760.37	+ 2 <u>5 7 6</u>	102			_	P	í!	·, <sup>2</sup>	
NO. P.	P.2	P,2-P,	2 P_		2	P <sub>c</sub> <sup>2</sup> -P <sub>a</sub> <sup>2</sup>	P	F. 2	P,2_P,2
1. 782.37	53630	1				-	-	<u> </u>	<del>                                     </del>
2. 720.33	5/88	75 5922	6					·· •	
3. 694.37 4. 609.37	7970	94 9600 2 20677		<del>-  </del>	<del></del>		+	<del> </del>	1
5. 607.37	37.73	26 600 7							
	0-11	14				Commissi			•
_									
AOF 5	850 39	McH					5.K. L. 00	is	

	•	FIE	D DAT	TA SHEE	T			Post Workover
Type Test:	Initi	- le	Amus	st [5		<u>-</u> -	76/	
Company Husky	Oil NP	R OP	erati		Trac.		, <u>, , , , , , , , , , , , , , , , , , </u>	Allattee
South 1	Barrou	/R.	Bervoir	UEY 152	•	Lucetter Sand		Unit
Completion Date 3/24/6	4	19101 Depth 2365.5	•	2369	H TD	ع ب4 ج	leverion Z' <i>6</i> L	422' KB
Ceg. Size	°**. 29 ₩ ∠,	184	Sel Al 2278.5	- 5-4	" 5/0 H	ed line	· 22//	To Well No. #6
Thy. Size	8.5 E	d .44/	Set At 2353'		10/5	: From 727	_	To Sec. Twp-Alk Rge-Sur 2336 14 722N RIBW UM
Type Completion		inaled	ONS				_	har Sor At County or Porish
Producing Thru	Reset	7901/ Temp. 2_@ Z 3/	F/		mual Temp.	F	Berg.	Press -Pa Sage 52" 73 - Now Alaska
L	н	0,568		* co,	%	N <sub>2</sub>		HaS Prover Mater Ren Tax
DATE ELAP.	Z30R	O,565 WORKING F		0.18 - ME	0.8			REMARKS
Time of TIME	Ting. Paig	Cag. Palg	Tomp.	Prossure Paig	Diff.	Temp.	Ori-	(Include liquid production date:)
Heading   frs.	}		<u> </u>	,	Diff.	-	IFE	Type API Gravity Amount
14:30 0	7/5	7/5		0			8/64	
15:15 .75	683	679	3.4	676		/7:	$+\leftarrow$	
16:00 1.5	681	675	34	673		15	1	
16:30 2.0	681	678	35	67/		-11	8/64	Shut in to Change Choke
	<del> </del>	<del> -</del>					-	
16:42 0	700	697	28	0			12/64	Open to New Choke
17:12 .5	625	620	<u> </u>	6/8		17	-	
18:15 1.5	625	619	27	6/4	<del></del>	15	<del>   </del>	
18:42 2:0	6 25	6/9	27	6/4		9	12/4	Shut is to Change Cloke
10.440								
19:49 0	558	550	28	545		q	16/64	Open to New Choke
19.4 1.0	555	546	26	540		8	$+\leftarrow$	
20:/9 1/5	553	544	27	540		θ		
20:49 2.0	555	548	27	539		7.	16/61	Shut 1a
	<u> </u>							Test terminated as
		-					<del> </del>	Next available Choke
-	<del>                                      </del>	-						
					<u>-</u>			site of 24/64 Would
	<u> </u>			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,				have Resulted in
								drawdown in exess of
								75 %
	<u> </u>	1	P,	 \G₹ 1 (	OF / 0	ATA RY		Lowis

		um Tipa	INT BACK	_90 #55111	PF TFS	T REPO	रा	Post	Worke	er	
		MOLTIFO	MAI BACK					Equa	1trac	4 Point	
Type	Test;	Initial			<b>X</b> 5	:14	16 179	L'5 8 2 4	han, mr Sari	ai ha.	
Comp	78 2.0	1 1/00	Operati	Con	nection		<del> </del>	Alietres			
Field		<del>,, </del>		. 1 .		- Langer		Unit			
Sou	14 Barr	Tet	Upper + A	* inter-	Seet ID	E1	evetien		r Lease Me	pho <sub>0</sub>	
3/ Cag.	24/64		365.5- Set		65.5	er for	Te.	Vall N	<b>.</b>		
	<u>フ" . ユ</u>	6.)	84 277	8.5	54136	offed Line	1211-7	3655 Sou	th Burn		
	3" 6	5# 2	.441 23			10 ts 22	79 23	36 14	_T22N	RIBUUM	
Type.	Completion	(Describe)	noted a	<b>a</b> c _			Won	e Non	or Period £1.5/02	ے ہے۔	
	verng Thru	Reserv	# 230B	Med	m Annual 7		Boro. Pres	15.22 A/2	-		
	1 ru/45	н	0.565	* 0	0,	7. N.,	* H25	Prover 2//	_Heter i	₹un - <del>Tupa</del>	
2	308	2308	O.565 LOW DATA	0.1	<i>B</i>	0.821 Tubi	ING DATA	CASING	DATA	<del>                                     </del>	
<u> </u>	Prever	Cheke							•	Duration	
NO.	Lina X Siza	Orlfice Size	Press. pelg	biff.	Tomp. F	Pross.	Tomp.	Press.	Tamp. F	al Fiam	
SI	3120		,			7/5	-	7/5			
1.	#ع	8/64	67/		_//_	68/		678	35	2	
2.		12/64	6/4 539			825	-	5-48	7.7 2.7	<u> </u>	
4.		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	337					2.72			
5.	· · · · · · ·			I		<u> </u>	İ	1			
				Pressure	Flor	w Temp.	Grevity	Super Compres	R.	ts of Flow	
HO.	Coefficient (24-Hour		h_P_	P <sub>m</sub>	F	F <sub>1</sub>	Factor, F	Factor	Q, mefd		
1.	0.2716			686.22		1.05/ 1.3		1,072		282	
2.	0.6227			629.27	_	253	/· 330 _/·330	1.067	586	.459 .2f2	
4.	1.115			554.73		055	1.30	1.059	7/5	<u> </u>	
5											
					Gar	Licuid Hydri	ecarbon Ratio			Mci/bbl	
NO.	Р,	Tump.		Z	^_	l Granty of	Limit Hydrac		1	4n g.	
1.	0.936	471	1.381				y Soperator Ga - Flancisco Flui	<u> </u>	******		
3,	0.825	467		2 0.870	-		<u>6</u>	72		pare	
4.					c,	Ital Tampa	- 3 3 - 3 3	8 R	<u> </u>	R	
5.	<u> </u>	<del></del>		<u> </u>							
	730.22	p 2 53	3221					°r	, <b>2</b>		
	P	<u> </u>	<del></del>	2		_ 2 T		<u> </u>			
NO.	<del></del>	P,*	P.2P.			P_2 2	Pc2-Pu2	P.	P. 2	P <sub>1</sub> <sup>2</sup> -P <sub>1</sub> <sup>2</sup>	
1.	686.77	37591	8 6232 B 15730	3							
3.	554.22	30716	0 255 0	1							
<u>د.</u> 5.											
<u> </u>	<u> </u>				i	<u> </u>				<u> </u>	
	ADF 2./6	2	Mcfd				Cammius				
	• <u>.93</u> 7	· · · · · · · · · · · · · · · · · · ·	<del></del>				Company Others	5. K. Low	15	· - · - · · · · · · · · · · · · · · · ·	
										from RDT 1	