



Installation of Downhole Heaters to Prevent Paraffin Blockages

TUBING - ANNULUS HEATER

**CONTINUOUS HEAT IN THE PRODUCTION TUBING ELIMINATES
PARAFFIN SOLIDIFICATION**

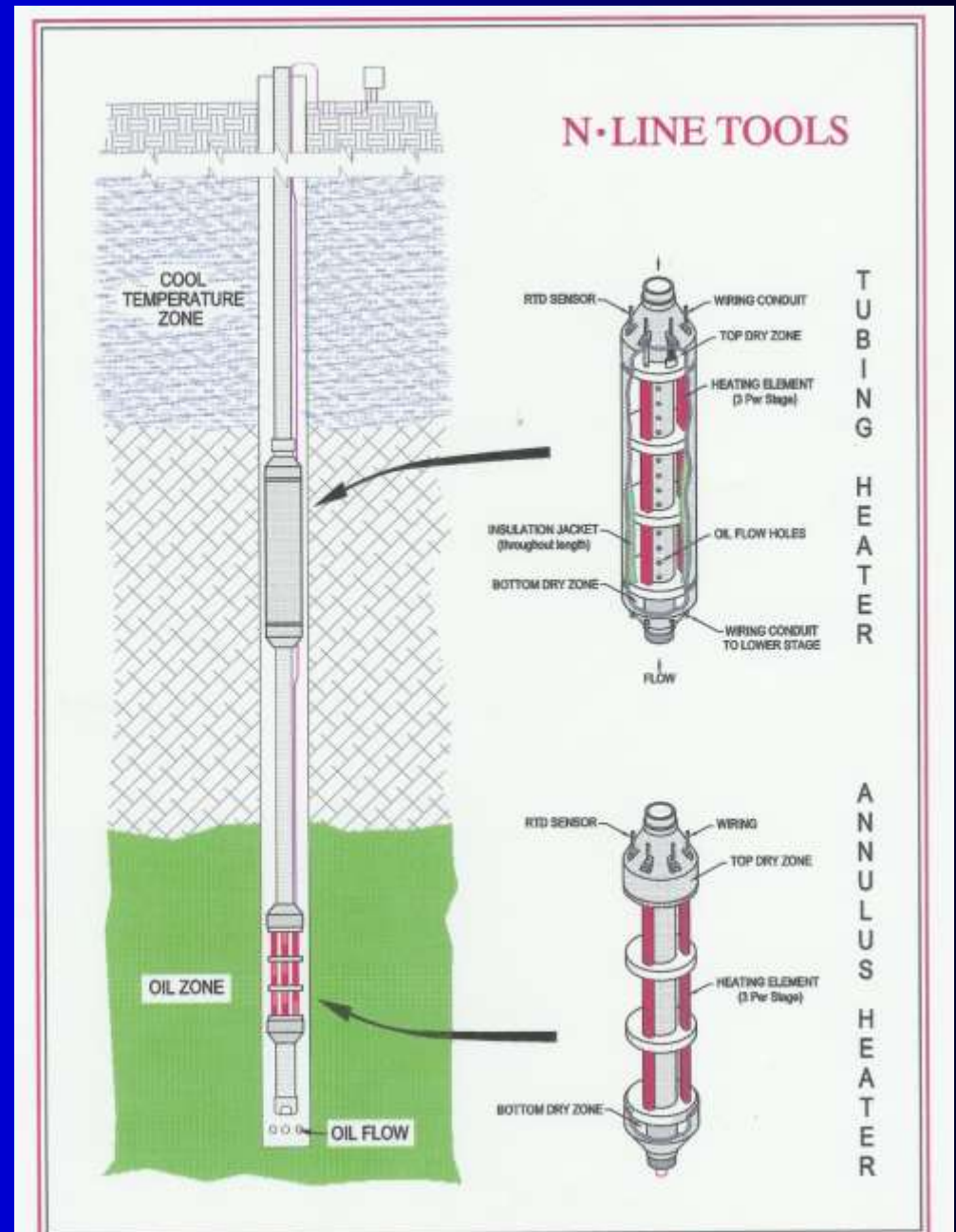
OPERATION

INSTALLATION

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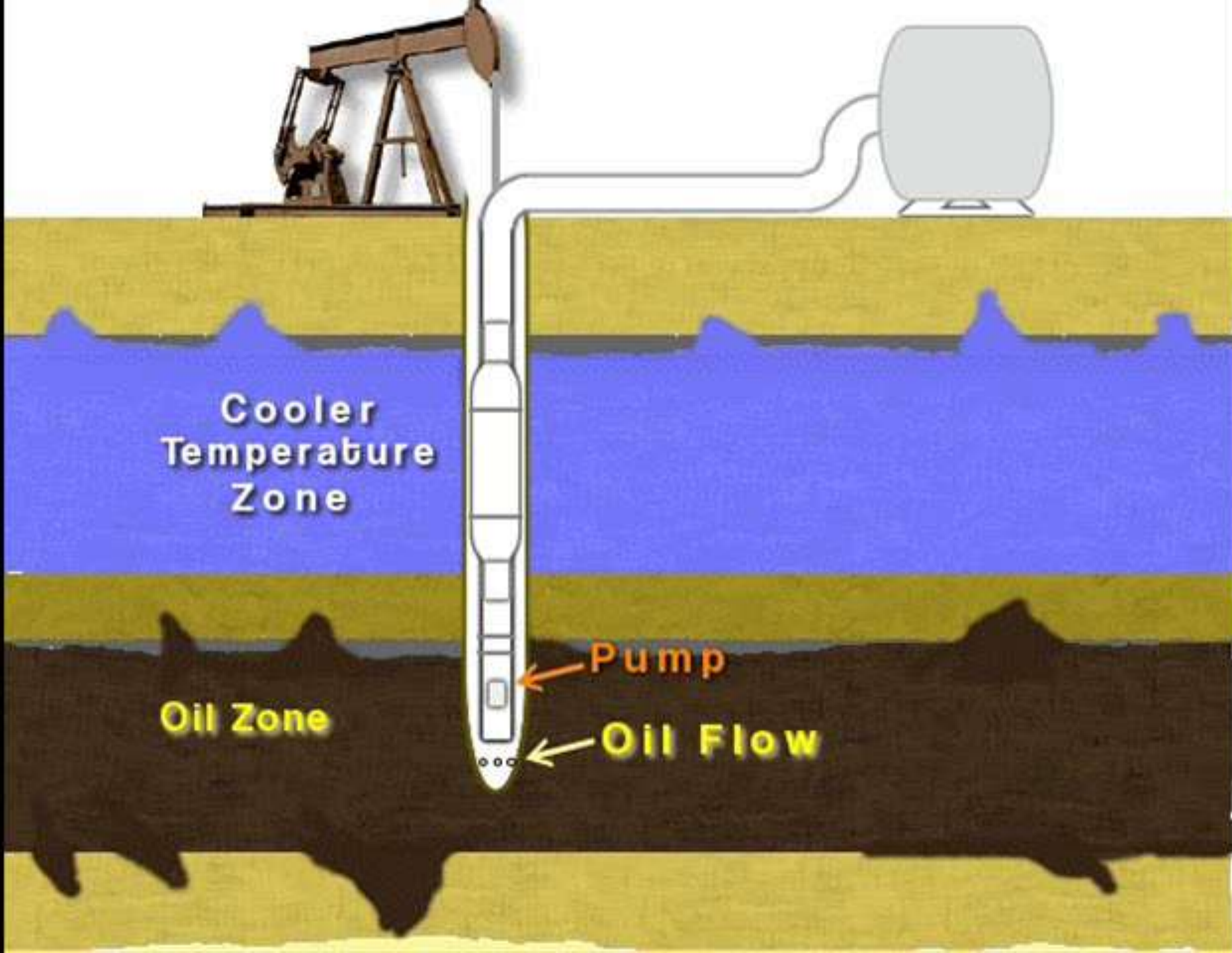
US PAT: 7.509.036 B2 & 8.265.468 B2/ CHINA PAT: ZL200780052309.3/KAZ PAT: 21889/BRAZIL PAT PEND/MEX PAT PEND/
COL PAT PEND/ VENZ PAT PEND
TRADEMARKED: MEXICO/VENEZUELA/COLUMBIA

Tubing or Annulus Heaters



Downhole Sensor & Carrier





N-Line Paraffin Heater Treater

PROJECT DESCRIPTION

N-Line installed its downhole paraffin heater treater in a producing well with known paraffin problems. The well has been on production for three months.

PURPOSE

The purpose of the test was to verify the effectiveness of a new downhole heater treater to reduce paraffin buildup in downhole production equipment, flowlines and production facilities.

RESULTS

Following installation of the downhole heater, production increased 100%+. There is no evidence of paraffin buildup in flowlines.

BENEFITS

Reducing paraffin buildup will reduce operating costs and increase production, thereby increasing field economics.



FUNDING

Total Project Costs—\$211,595

Industry Cost Share—77%

CONTACT: Lorri Kirby (888) 599-2200, x 5011

**N- Line
Paraffin Heater Treater Test at RMOTC
June 2005**

PROJECT DESCRIPTION

N-Line installed its downhole paraffin heater treater in a producing well at Teapot Dome Field (NPR-3) in Wyoming operated by the Department of Energy. The well was chosen by two petroleum engineers because of its severe problems with paraffin and its low reservoir temperature of about 74° F. Before the test began the well, which was producing from the Shannon Sandstone on rod, pump at less than 800 feet had been in production for over three months.

PURPOSE

The purpose of the test was to verify the effectiveness of a newer generation of digital downhole heaters designed to reduce or eliminate paraffin buildup in perforations (when placed close to the perforation), downhole production equipment including tubulars and rod string, surface flowlines and production facilities.

RESULTS

Prior to the installation of the downhole heater device, the well was making less than 15 barrels of fluid per day of which 1.5 to 2.0 barrels was oil. Following the proper installation of the digital downhole heater, and after several days of production, the well had a surface fluid temperature of about 110° F and a downhole temperature of 160° F. This resulted in an over 300% increase of total fluid production, 44.8 BFPD with an oil cut of about 17-18%, or about 4.5 BOPD that is an over 300% increase in oil production.

There was no evidence of paraffin in the flow lines, or on the rods or pump. When used with a rod pump, I would recommend using a pump that can tolerate the higher temperatures generated by the heater which will result in flawless long-term proper operation of the producing well.

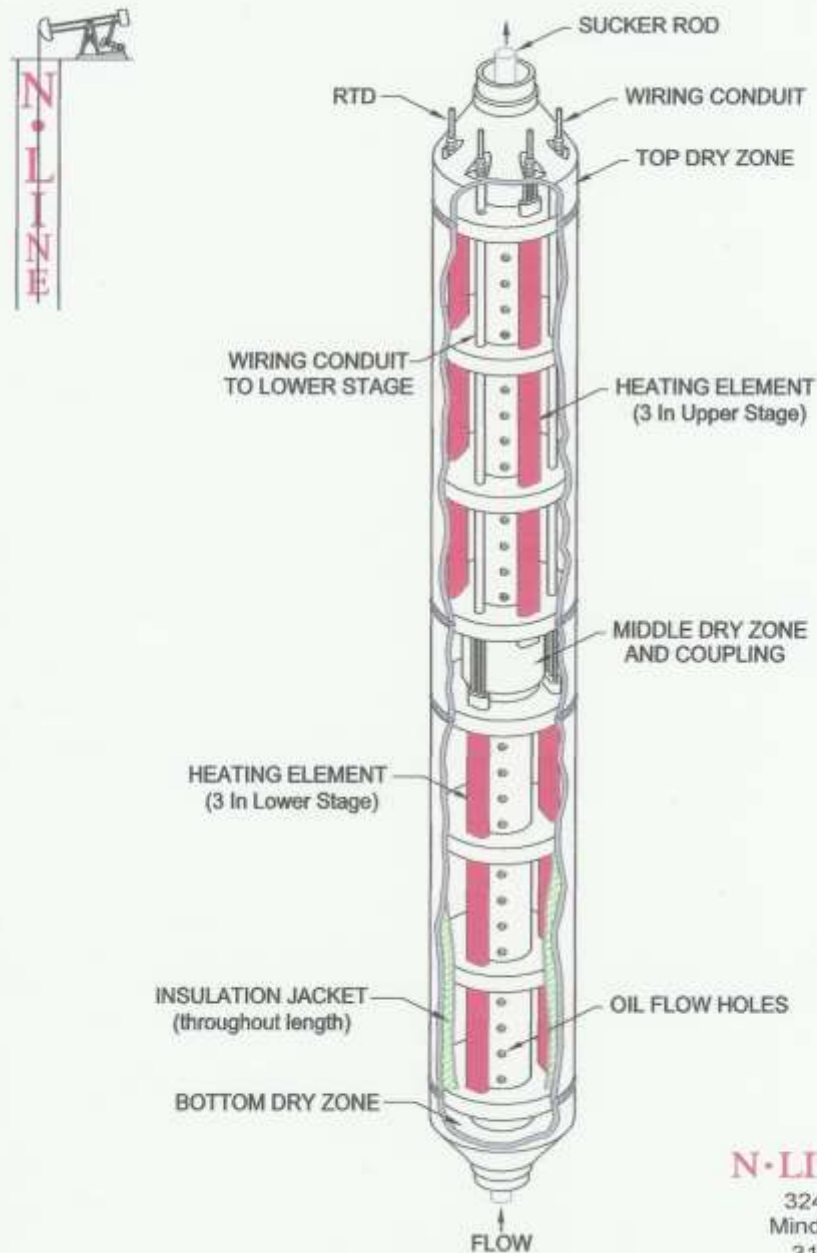
BENEFITS

This equipment should be used in other similar type well and I believe, based on the recorded data that the increase in production was due to at least three factors. 1) continued proper operation of the insert type pump due to no paraffin buildup, 2) the higher down hole temperatures resulted in the clogged perforations being opened to their original aperture, and 3) the heater generated enough heat to prevent paraffin precipitation at some distance from the perforation resulting in a larger productive surface area and higher total production.

While the test was being run, I was the project manager for this project at RMOTC. Please feel free to contact telephone or email me if you have any questions.

**Bryant Mook, B.S., M.E.
Petroleum Engineer and Geologist
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Tubing Heater



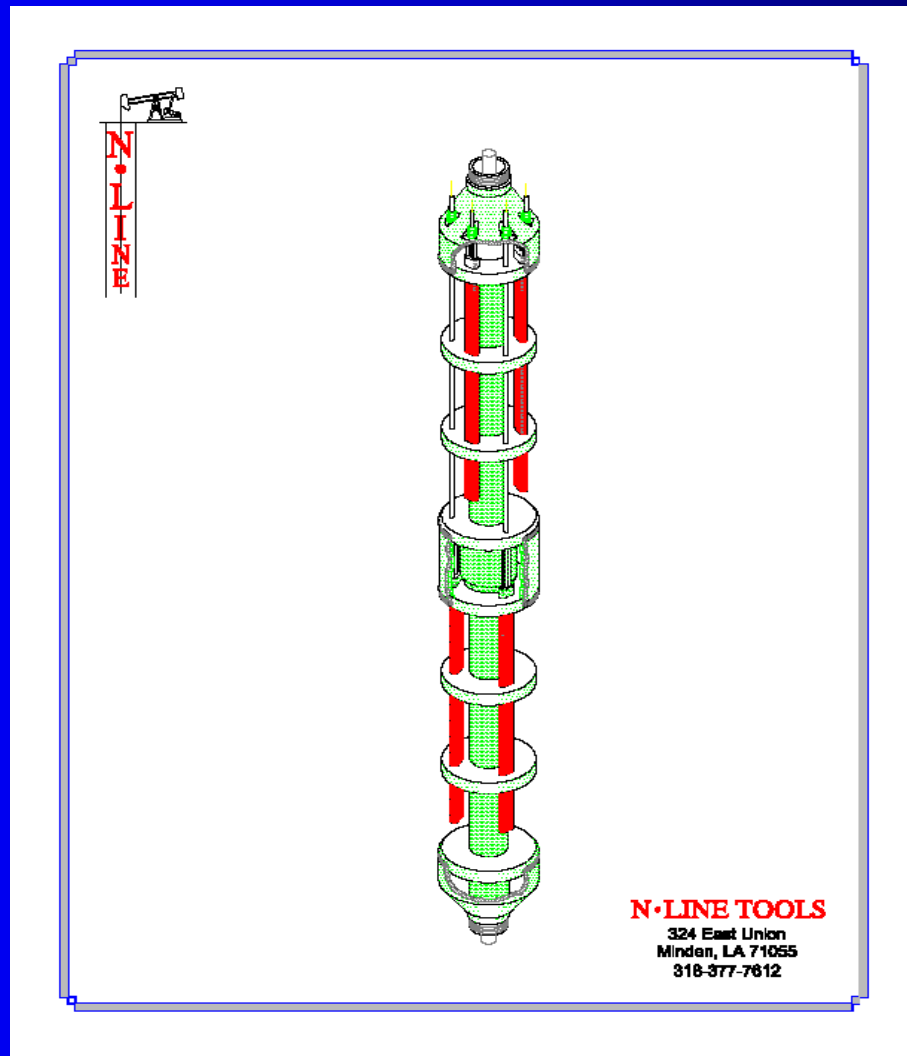
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N•LINE TOOLS

324 East Union
Minden, LA 71055
318-377-7612

ANNULUS HEATER



TANK SUPPLIED HEATER TREATER

N-LINE TOOLS
 324 East Union
 Minerva, LA 71055
 318-877-7612

N-LINE TOOLS
324 East Union
Minneapolis, LA 71055
318-877-7612

PLC



SCR Transformer for Efficient Operation



Buck / Boost Transformer



Heater Specifications

Volts

480

3 Phase

Flat Cable



ENERGY CONSUMPTION GUIDE

Rate of Flow	30bpd	50bpd	100 bpd	150 bpd	200bpd
Power	13.8 kW	22.9kW	47.5kW	68.8kW	91.6kW
Amps	16.6 A	27.57 A	57.2 A	82.85 A	110.3 A

- based on 480V 3 Phase service
- This is a base guideline for energy consumption.
Oil to water ratio and percent of gas production must be considered on an individual well basis for final calculations.

Water As A Test Median

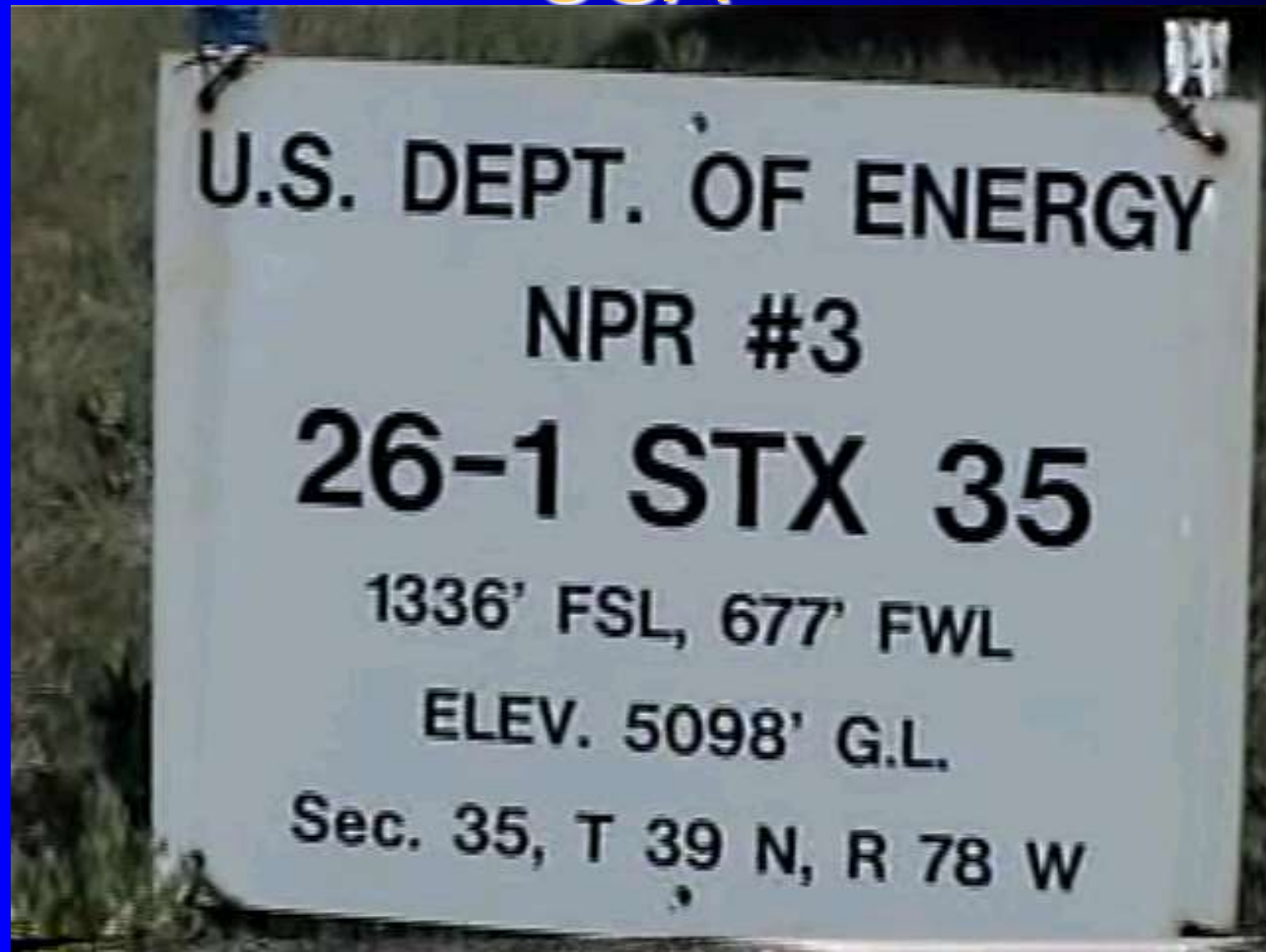
250°F Flow 8GPM



Steam



DOE- RMOTC Test Facility, Wy. USA



Control Panel at DOE Site



Installing N-Line Tubing Heater in DOE Well



Raising Heater In Derrick



Connecting Heater to Tubing String



Heater Connected to Tubing String



Preparing Cable Spool



Making Heater/Cable Wiring Connection



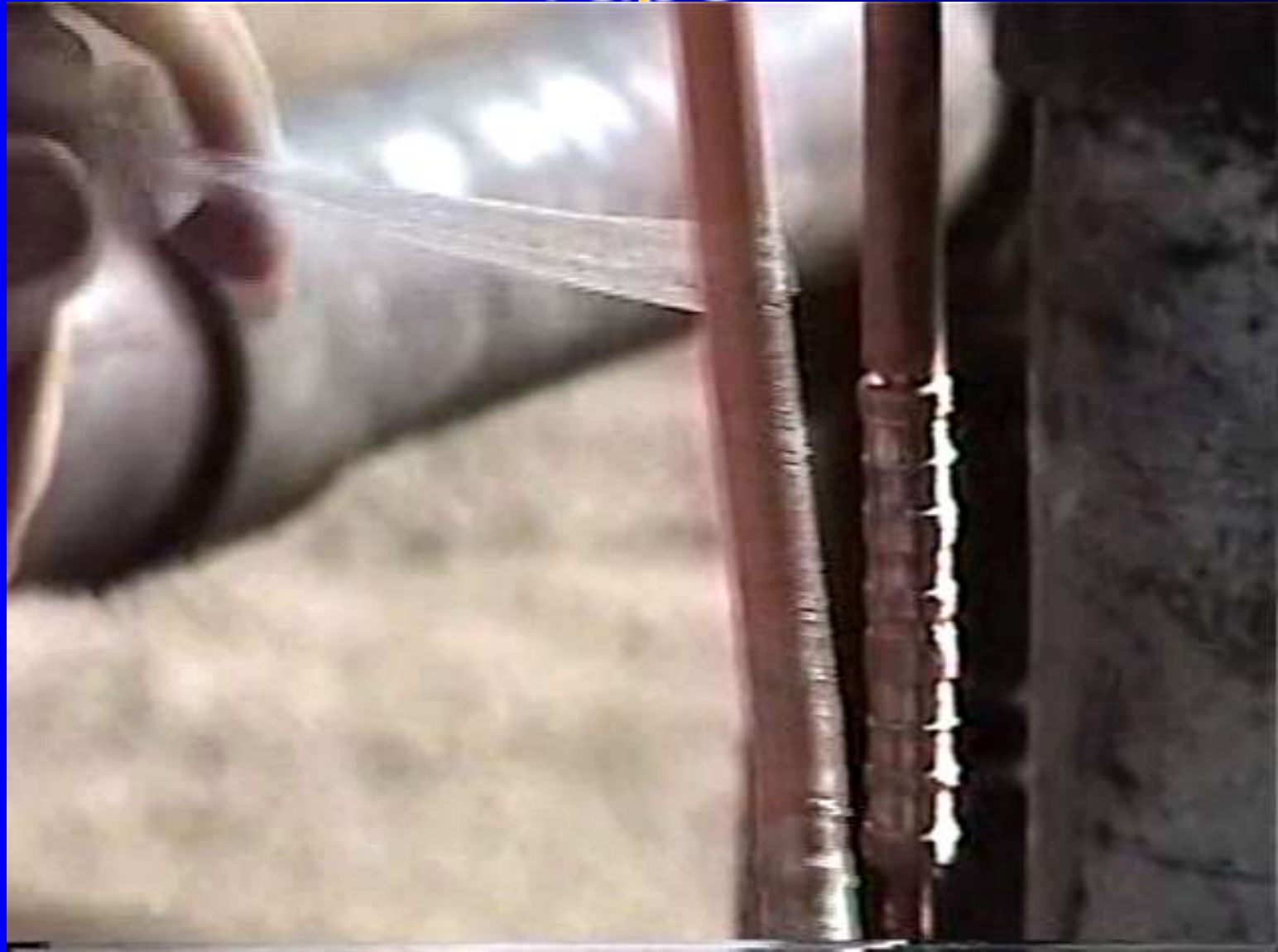
Splicing Power Cable



Crimping Wiring Connection



Heat/Fluid Resistant Seal Tape



Connections Completed/ Running Tubing String



Banding Cable To Production String



Banding Cable to Tubing



Tool Installed/ Control Panel Connected DOE



Fluid Temp 108° F at Surface



Down Hole Fluid Temp 190° F



Annulus Heater at The Department of Energy Well



Annulus Heater at The Department of Energy Well



WELL LOCATION: BAHIA, BRAZIL

WELL TYPE: VERTICAL, 3300 FT, 14 API oil, Zone Temperature 62°C / 143°F

PRE-INSTALLATION WELL HISTORY:

This oil well was drilled in the 1980's. The oil was heavy (14API) and had never been produced in marketable quantities.

In addition this oil had a very high paraffin/wax content.

N-LINE HEAT TECHNOLOGY APPLIED:

N-Line Tools provided an ANNULUS HEATER, COMPUTER CONTROL PANEL for surface control and monitoring, DOWN HOLE SENSOR AND SURFACE SENSOR.

The ANNULUS HEATER was installed at 3300ft near the perforations. The downhole fluid temperature was raised to 109°C / 228°F which stabilized the surface fluid temperature at 42°C / 107°F. The heat applied raised the API to 35 and allowed for an initial production rate of 4 BOPH(hour). 100 barrels of oil was produced in the first 18 hours of production. Production rates gradually stabilized at 6 BOPH (144 BOPD).

BRAZIL



BRAZIL



WELL LOCATION: INDIA

Essar Oil Limited has struck oil in its Mehsana onshore exploration block CB ON-3 in Gujarat. This is the second oil discovery in the block by Essar, the first being in March this year.

The in-place reserve of the first discovery was an estimated 18 million barrels of oil and oil equivalent with recoverable reserves in the range of 2.8 million barrels of oil equivalent. Essar is producing around of 500 barrels of oil a day from the March discovery.

Sources said the new discovery was also of the same magnitude, promising to produce 300-400 barrels of oil a day.

Confirming the move, sources in the Directorate General of Hydrocarbons (DGH) said the recent oil discovery had been notified by Essar on July 12.

"Essar has discovered oil in the well, ENM-1, in the Mehsana exploration block, using the N-LINE TOOLS heater treater technology. Oil flowed to the surface last week in the presence of Essar and ONGC executives. The well is expected to produce around 50-60 barrels of oil a day and the plan is to drill another 6-7 prospects shortly to produce around 300-400 barrels of oil a day," said a senior ONGC executive.

The crude oil discovered is heavy in consistency, unlike the medium-quality oil produced by Essar from its first discovery in the block . Essar has started selling 500 barrels of oil a day from its first discovery to Indian Oil Corporation's Koyali refinery in Gujarat.

The CB-ON3 block was awarded to Essar Oil in 1998 and is located in the petroliferous Cambay Basin in Gujarat. Essar, which is the operator, holds 70% in the block, while ONGC has the remaining 30%.

Earlier, Essar Oil was the 100% stakeholder of this block, with ONGC as the licensee. But, soon after Essar announced the first oil discovery in the block, ONGC exercised its right and picked up a 30% equity. The block is spread over an area of 500 sq km. Essar has already carried out 3D seismic surveys over 145 sq km.

India ESSAR Oil



India ESSAR Oil



India ESSAR Oil



India ESSAR Oil



India ESSAR Oil



India ESSAR Oil



India ESSAR Oil



Kazakhstan



Kazakhstan Tubing Heater Installation



Kazakhstan
46°C Surface Temp
Production Zone 6700'
Heater Placement 2600'



Mexico Truck Unload Facility

N-Line Tools, Inc USA, under the direction of Mike Carr, installed a 10,000 bpd Surface Heater system for Pemex.

PRE-INSTALLATION : Tankers required an average of 8 to 12 hours to unload heavy crude.

POST INSTALLATION: Unloading time was drastically reduced to 30 – 45 minutes.

In addition, the heaters supplied continuous heat to the facility tanks, keeping them heated for more efficient flow into the pipeline.

Mexico Truck Unload Facility



Mexico truck Unload Facility



Mexico Automation Center



South Texas Annulus Heater

WELL TYPE: Vertical WELL DEPTH: 2250 ft

PRE-INSTALLATION: Production zone temperature 92F, surface temperature 80F. Oil gravity: 15-20 API

Due to the high viscosity of the oil production was sporadic.

POST INSTALLATION: Annulus heater was installed below the pump. Downhole temperature is raised to 230F with surface fluid at 110F.

Production has doubled.

South Texas Installation



- ***N-LINE TOOLS***
- ***INSTALLATION PROCEDURE MANUAL***
- **This manual is a general guideline of the procedures to follow for pre-installation prep work and installation of down hole heaters.**
- ***PREP WORK***
- **Work over rig to remove production tubing.**
- **Run reamer, to clear all scale and to assure correct I.D. measurement of casing.**
- **3. Place feed-thru well head.**
- **4. Install Power Panel Control , Buck Boost Transformer and run all under ground cables to well head for sensor and electrical supply.**
- **5. Install 150 amp, 480 volt, 3 phase disconnect panel.**
- **6. Service company on site with: spool truck or spoolers, bands and banding equipment, splice kit (number 4, 3 conductor and 16 awg, 1conductor sensor wire) cable connections. Service company must supply 2 (total), 24" to 36" sheaves for power cable and sensor cable installation.**

- **INSTALLATION**
- **Strap tubing in preparation of installing N-LINE tool in correct position.**
- **Locate spool truck, place sheave's) in derrick. Install cable's) in sheave's. After cable is run through sheaves, connect 4' pup joint to top of heater tool. Splice cable's with N-LINE Tool heater and sensor. Properly band cable's at the splice location on heater.**
- **While splicing, **continuously test power and sensor cable for conductivity.**
- **After power splice is completed, using 4' pup joint for tong placement, raise N-Line Heater into derrick, *very carefully making sure tongs do not damage the splice or power connections on top of tool.**
- **Lower N-Line Heater into well.**
- **Sensor joint should be spliced and conductivity tested. Sensor pup joint can now be connected to heater pup joint and properly banded to avoid any damage to sensor and cable.**
- **Continue with normal installation of tubing. Properly banding cable's before and after each collar and 1 band at center of each tubing.**
- **Conductivity on power cable and sensor cable should be monitored during lowering of equipment into well.**
- **After N-LINE heater is placed down hole and the well head feed-thru is secure connect Power Cable and Sensor Cable to Computer Panel Board.**
- **After tool is placed at proper depth, turn power on at very low voltage and check. ***TURN POWER OFF.**
- **Run down hole pump and check fluid level before and after fluid has reached the surface. POWER TO TOOL IS OFF.**

- **Turn power on the heater. Power the amps up slowly monitor the rate of fluid flow and the temperature and pressure.**
- **Fluid checks should be run every hour for the first 24 hours of production.**
- **The temperature process controllers must be set for proper temperature verses rate of flow. All safety features correctly set.**
- **After 48 hours the pipe should be heated from bottom hole to surface. Check the temperature.*You may need to lower the power to keep the desired temperature.**
- **(For paraffin wells were a tubing heater is installed it may not be necessary to run the heater full time. After well is stable a timer can be installed on the heater panel. ** Example run 3 days off 5 days, *** each well will be unique, but this will reduce energy consumption and be more cost efficient.)**
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