



CARDINAL SURVEYS COMPANY

<http://www.cardinalsurveys.com>

P. O. Box 729
1704 Samson Rd.
Odessa, Texas, 79760-0729
(915) 580-8061
Fax: (915) 580-0547

P. O. Box 1966
900 S. Grimes
Hobbs, New Mexico, 88240-1966
(505) 397-1069
Fax: (505) 393-5836

"THE FLUID MOVEMENT SPECIALISTS"

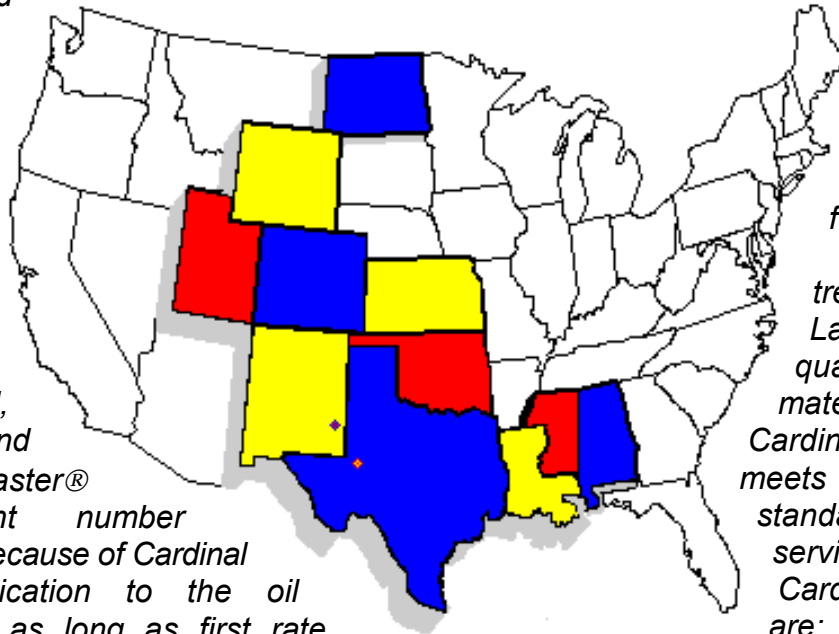
CARDINAL SURVEYS COMPANY

"The Fluid Movement Specialists"

In 1962, Cardinal Surveys Company began serving the Permian Basin area. Then, as now, Cardinal Surveys provides customers with innovative, dependable fluid movement and measurement technology. Cardinal surveys offers the best service available while continually striving to improve existing logging and tagging methods with better and more dependable tools developed by their research and design staff. With the technology from this research, Cardinal Surveys has developed the Temp Trol, the Gamma Trol, the Trac III and the Tagmaster® (U.S. patent number 4,199,680). Because of Cardinal Surveys dedication to the oil industry, and as long as first rate equipment, techniques and workmanship play a significant role in the world's energy investment, Cardinal Surveys Company will remain in the field...confident, strong and independent.

To better serve the oil and gas companies of the Permian Basin area, Cardinal Surveys Company offers many extras...extras that add up to exceptional service. One of the bonuses Cardinal Surveys has to offer is location. With operational offices in Odessa, Texas and

Hobbs, New Mexico, Cardinal Surveys can offer customers prompt and efficient service. In addition to convenient locations, Cardinal Surveys offers: a drafting department, which produces a more complete and professional log - an electronics lab, which maintains, researches, designs and develops the equipment used by Cardinal Surveys - and a radioactive materials lab which



produces the radioactive material Cardinal Surveys uses for tagging stimulation treatments. The Lab insures the quality of the materials used by Cardinal Surveys meets their high standards. Other services offered by Cardinal Surveys are: Production

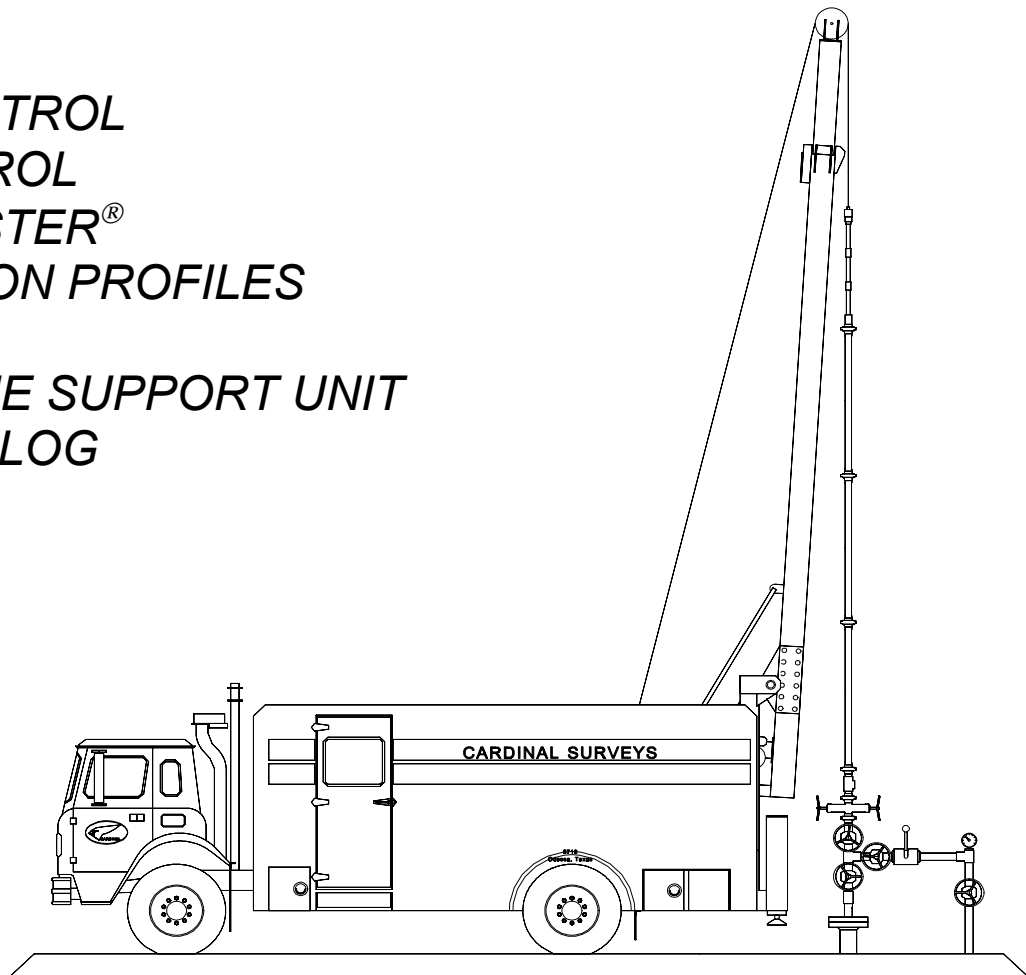
Logging (pumping or flowing wells), Injection Profiles (water, polymer, CO₂ or gas), Pump-In Tracers (identify channels and fluid loss), Stimulation Evaluation Surveys (temperature and gamma-ray), Tagmaster (high pressure in-line tagging system), Multi-Isotope Tagging, No-Wash material, High Pressure Control Equipment (Bowen 10,000 psi), 104 Foot Mast Unit, AutoCad® System & Custom Log Presentations (Macro*Log).

In addition to the Permian Basin, Cardinal Surveys Company also provides its services to companies in other areas of the United States. Cardinal Surveys is currently providing services to customers on the Texas Gulf Coast, East Texas, South Texas, Louisiana, Oklahoma, New Mexico, Colorado, Kansas, Utah and Wyoming. Because of Cardinal Surveys central location in the Permian Basin, they are able to provide these additional locations with their same dependable service and yet remain competitive with other service companies.

All of the extras Cardinal Surveys offers are important, but one takes precedence over all others - SAFETY. A commitment to safety, in the field, the shop and the office, has made Cardinal Surveys Company a respected name in the industry.

Cardinal Surveys Company is proud to introduce you to the following services, and takes this opportunity to thank you for considering their company:

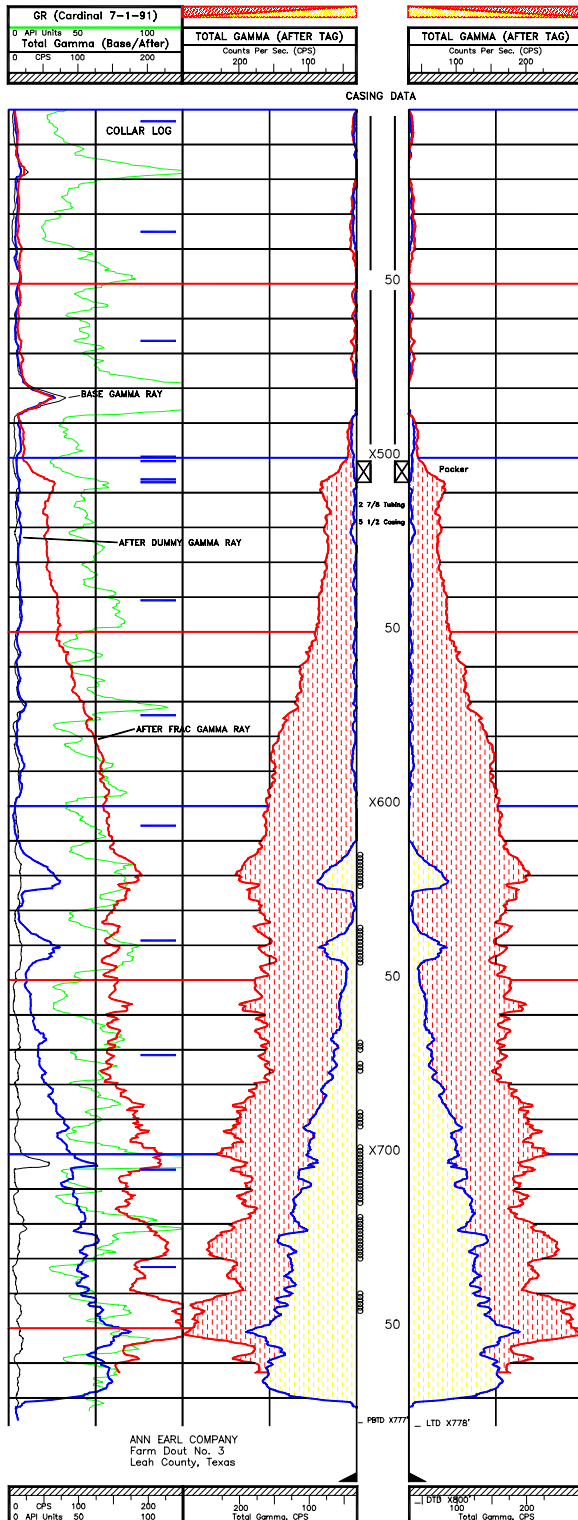
GAMMA-TROL
TEMP-TROL
TAGMASTER®
INJECTION PROFILES
TRAC-III
WIRELINE SUPPORT UNIT
MACRO*LOG



<http://www.cardinalsurveys.com>

GAMMA-TROL

Stimulation Evaluation Logging



Monitoring well stimulation treatments means better control, greater success and faster payback from costly well treatments. Combined with a radioactive tag, stimulation evaluation logging accurately determines treatment placement. Included in the service is either a temperature or gamma-ray log or both. Cardinal Surveys Company offers these services either separately or combined under the following names:

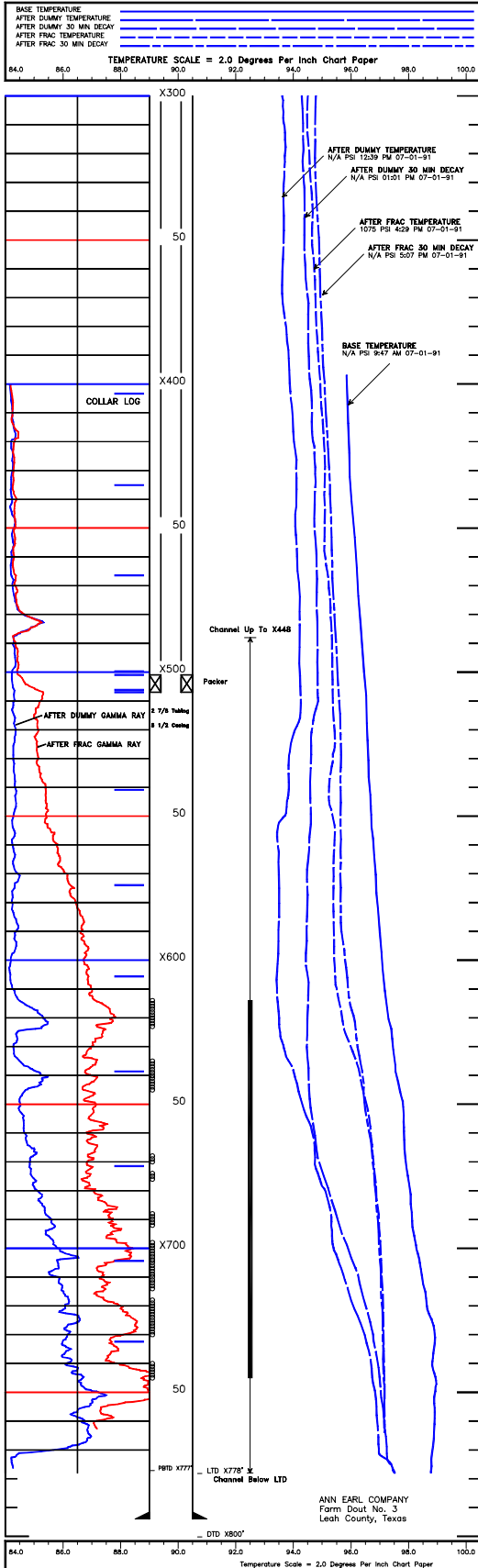
Gamma-Trol (Gamma-ray only)

Temp-Trol (Temperature only)

Gamma-Trol II (Combination Gamma-ray and Temperature).

Cardinal Surveys stimulation evaluation logs eliminate the guesswork in identifying placement of acid or polymer fracturing materials. By using state-of-the-art diagnostic equipment down-hole, the exact placement of stimulating agents is known and channeling in the casing annulus (due to poor cement bond) can be detected.

Fracture height can be accurately determined from the Gamma-Trol log. With a known actual value, fracture design assumptions can be cross-checked and verified. Fracture design software is, at best, only as good as the input assumptions.



For maximum treatment control, the Gamma-Trol service can be combined with a multi-stage treatment (selective staging of fracturing or acidizing treatments) to allow instant evaluation of each treatment stage. Accurate, on-the-spot interpretation combined with proper application of divert materials leads to precise and positive placement of stimulation agents. There is no better means to analyze and predict the results of a treatment program and plan a program for ball-sealers or solid diverting agent "on-the-fly".

In conjunction with a radioactive tag, the Gamma-Trol II (temperature and gamma-ray combination) provide the best means of evaluating stimulation procedures. While either the temperature log or gamma-ray log alone can provide sufficient information to determine treatment placement, the combination log (Gamma-Trol II) affords maximum utilization of available data and the best interpretation, the most information, and thus is the maximum value service.

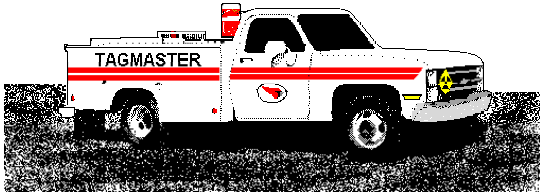
The Gamma-Trol II service can also be used to locate the top of cemented intervals. The cement can be tagged during the cementing process, and the temperature and gamma-ray log will accurately pinpoint the cement top.

Cardinal Surveys Gamma-Trol II and Tagmaster[®] represent the most advanced and complete package of services to evaluate oil well stimulation treatments available today. For all logging and tagging applications, look to Cardinal Surveys to provide the complete service solution.



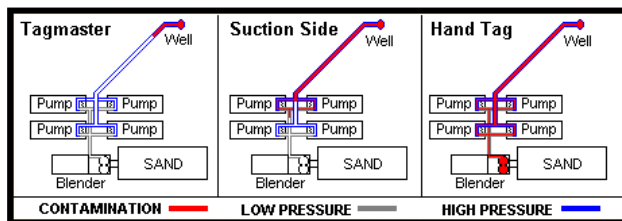
TAGMASTER®

U.S. Patent 4,199,680



A Safer, Better Way To Tag Your Well

Combined features of temperature and gamma-ray logs, (see GAMMA-TROL II), have a proven track record in providing on-site evaluation of well stimulation treatments. Cardinal Surveys Company's patented Tagmaster® (U.S. patent no. 4,199,680), a direct, in-line tagging procedure, is a safe and effective means of tagging well treatments. The problem of radioactive contamination of equipment and personnel has been effectively eliminated by the Tagmaster®.



Cardinal's Tagmaster® is an exclusive system which introduces gamma-ray isotopes directly into the high-pressure treatment line thus eliminating radioactive exposure to personnel and equipment.

The Tagmaster® utilizes a positive displacement injection system powered by an on-board air compressor. A horizontal plunger and vertical resilient check valve arrangement provides high

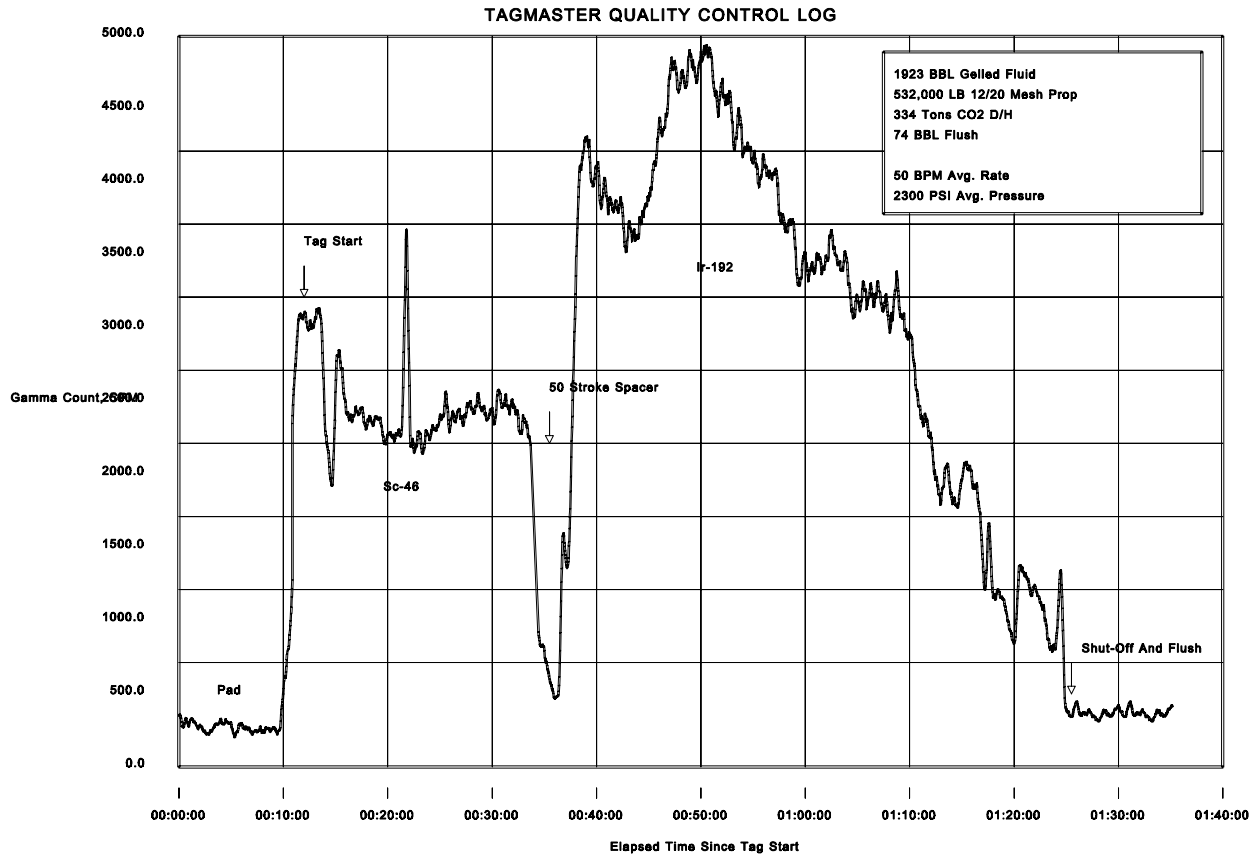
operating efficiency under any conditions. The process makes use of a multi-chambered, lead-lined steel tank. The chambers contain the radioactive material; and a flushing agent. An air agitation system maintains a constant mixture of radioactive material in the tagging agent to attain even distribution.

A unique manifold and valve system provides proper chamber selection, material circulation, and suction and discharge selection thus enabling the Tagmaster® operator to maintain positive control at all times. Tagging material is supplied through a flexible, multi-ply steel wrapped high-pressure feed hose. The complete assembly provides pumping pressure in excess of 10,000 psi with a four-to-one safety factor. This high-pressure hose is attached to a tee injection assembly mounted in the stimulation line. The tee, constructed of high grade alloy steel, is accepted by stimulation companies as the maximum safety design for an in-line injection system. Cardinal's assembly incorporates both a manual control valve and a check valve, which allows positive control of the material while preventing backflow into the system. The valves are state-of-the-art ultra high pressure valves.

Cardinal's Tagmaster® is designed to maintain a continuous, controlled stream of radioactive material to the well. Even distribution is enhanced by the use of NO-WASH material. The material readily mixes with the treatment fluid, flowing easily into the well bore through the perforations and into the zone being treated. With the manifold design, Cardinal can inject either a liquid isotope (for acid jobs) or NO-WASH solid material and can tag with single or multi-isotopes safely and effectively. When necessary, multiple hoses and tees are available.



The Tagmaster[®] is manned by a highly trained and qualified technician, with all mixing and tagging procedures are conducted under stringent safety standards. Before and after tagging, the Tagmaster[®] technician conducts a survey on four sides of the wellhead, and down the treatment line to the injection tee. Radioactive levels are observed, recorded and presented in copy form to the oil company and service company representatives. Combined with safety equipment and mandatory standards, the report serves as hard evidence that the radioactive portion of any treatment is conducted under utmost safety standards in compliance with all regulations.



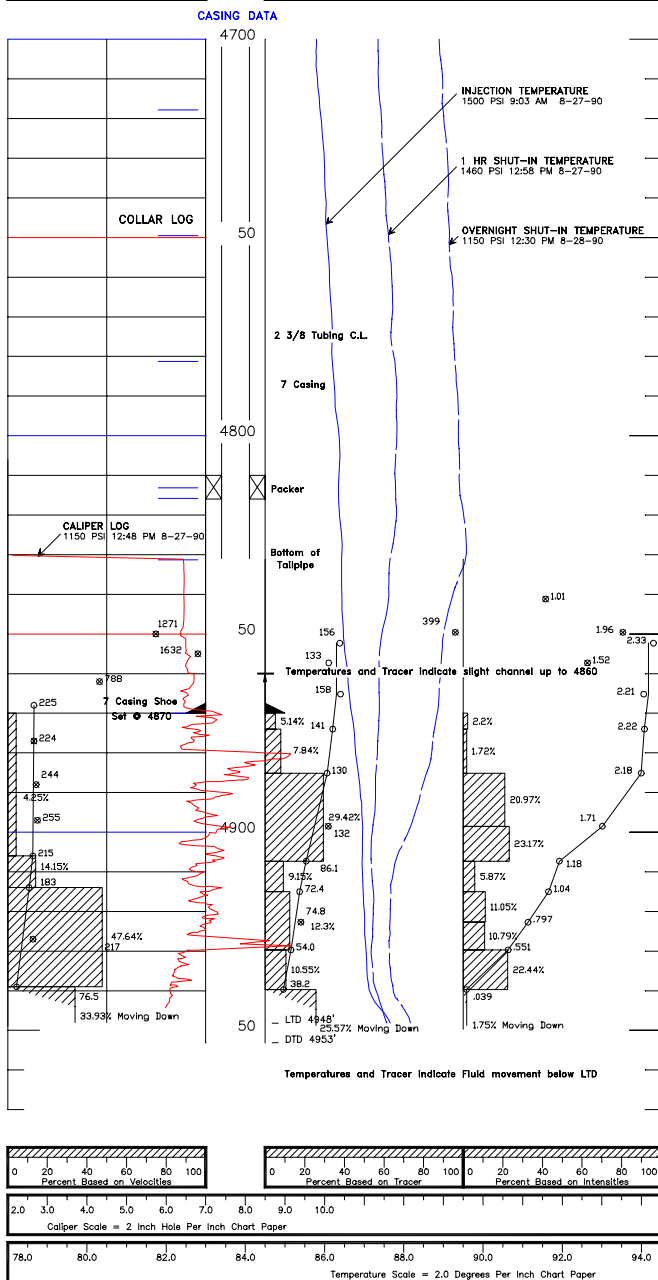
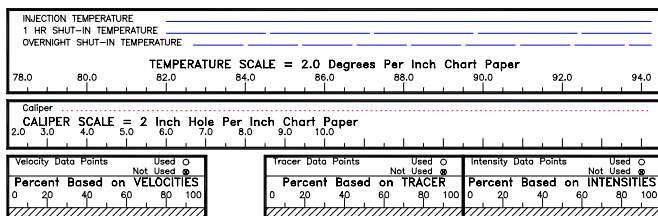
The Tagmaster[®] technician also provides the oil company representative with a Tagmaster[®] Quality Control Log. This is a real time log that is obtained by clamping a scintillation detector on to the treatment line. The detector is connected to a lap top computer equipped with modern data acquisition hardware and software. The QCL computer monitors the stimulation fluid before, during and after the fluid is tagged to prove that the fluid was, in fact, tagged.

The conventional methods of hand-tagging and low-pressure side tagging of well treatments have been superseded by Cardinal's direct, in-line procedure. Desired tagging is maintained by the positive control system which regulates the stream of radioactive material into the well, minimizing well bore contamination and assuring a better, more accurate gamma ray log.

Cardinal Surveys Company has a **SAFER, BETTER WAY** to tag your next well. There is no better tagging system available anywhere today!

INJECTION PROFILE

Radioactive Tracer Profile Logging



An accurate profile of the exact placement of injected fluids is essential for proper management of waterfloods.

The Injection Profile Log, usually consisting of a temperature log, two radioactive tracer logs (the intensity profile and a series of stationary velocity measurements), channel checks, packer checks, injecting temperature log, shut-in temperature logs and cross-flow checks (where applicable), is the ideal method for getting accurate profiles. Information obtained from the Injection Profile Log can be further enhanced when a Caliper Log is also run.

The primary application for the Injection Profile Log is on injection wells in waterflood units. This log is used to determine the placement of injection fluids in the formation. Of general interest is a profile of the zone-by-zone placement of injected fluids versus rate. A comparison of injection and shut-in temperatures can be used to qualitatively determine major storage (injected) zones.

In tertiary or Enhanced Oil Recovery (EOR) projects, the injection profile is applied in a similar manner. Sometimes special logging techniques are required due to the physical properties of the injection fluids. Many tertiary or EOR projects alternate injection of multiple fluids (Water After Gas-WAG, or vertical profile modifications such as polymer treatments). In these instances, it is desirable to log the well after each change in injection fluid to determine the relative impact of different fluids.



Company Name
Well Name & Number
Dawson County, Texas

While the primary application of the Injection Profile is on wells in waterflood units, it can also be run on wells where water is transported to the well site (the Pump-In Tracer Log). Stimulation of a well sometimes causes unexpected results (such as water breakthrough). The Pump-In Tracer is used to locate the cause of post-treatment problems. The log itself is similar to the Injection Profile, in that basically the same logging procedure is followed.

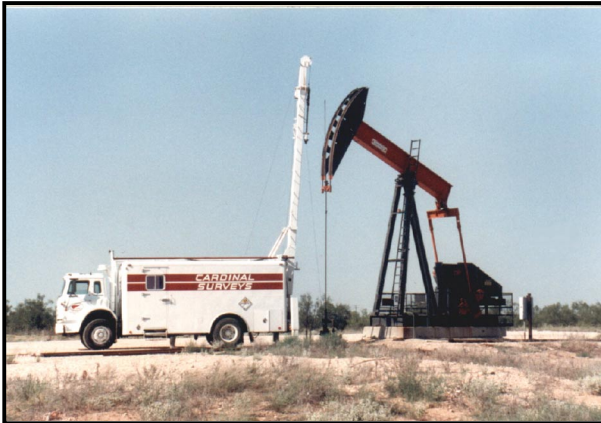
Because a radioactive tracer is used, the Injection Profile also affords other benefits such as location of casing annulus channels. Channels in the casing annulus can be seen when tagged fluid exits the casing through a perforation and continues in a path near the wellbore. The extent of the channel can be determined by following the tagged fluid as long as it remains near the wellbore. In a similar manner, communication between perforated intervals can be discovered. Other mechanical problems such as holes in the casing, unopened perforations, leaking packers or bridge plugs are readily identified by the radioactive tracer.

Due to the versatility of the radioactive tracer, it is the best and most accurate method of running a Mechanical Integrity Test (MIT) on disposal wells. Using the same logging procedures, the radioactive tracer can yield the zone-by-zone breakdown of fluids exiting the wellbore. Temperatures can also aid in identifying any upward or downward channels. Cardinal Surveys Company has successfully run MIT logs on salt-water disposal wells and chemical disposal wells for many years.

Whatever your application, Cardinal Surveys Company can provide dependable equipment and experienced personnel to plan and execute a log that is specifically designed to meet your unique situation. After decades of experience in profiling all types of wells, who else could do a better job?



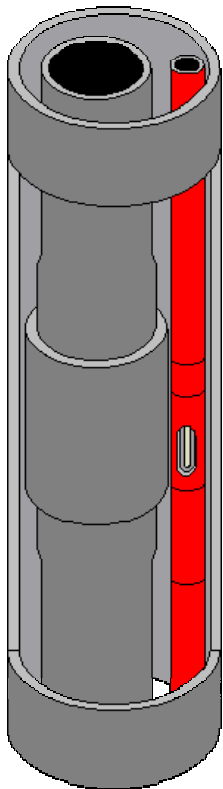
Dual Completion Injection Profile



TRAC III

Flowing and Annular Production Logging

In the late 1960's, Cardinal Surveys Company recognized a need to obtain production information from wells with rod pumps, while under stabilized producing conditions. The problem was how to convey tools to the production zone, since the production tubing was blocked by the rod string. The obvious answer was to enter the well in the tubing annulus, but this proposed method created the requirement for very small logging tools due to clearance constraints.



By the early 1970's the first of Cardinal Surveys 7/8" diameter production logging tools were introduced into the Permian Basin. Since three logs were normally required, the service was called the Trac-III log. Over the years the Trac-III log has been refined to become the best annulus logging service in the Permian Basin, and the world. The small tools are a truly unique and powerful weapon in Cardinal Survey's arsenal of services, incorporating an amazing blend of technology that no other logging company has been able to achieve.

The Trac-III production log provides the maximum amount of information possible while a well is under dynamic, producing (e.g., actual) conditions. The Trac-III includes either a temperature log, a capacitance log, or a radioactive tracer log, or any combination of the three. All logs can be run simultaneously during one trip in the well. With Cardinal Survey's 7/8 inch O. D. tools, wells with 5 1/2 inch casing and 2 7/8 inch tubing or even 4 1/2 inch casing and 2 3/8 inch tubing can be successfully logged.

The Trac-III allows for more positive monitoring of reservoir performance than is possible through analysis of surface data only. Without this detailed, zone-by-zone, information, changes in the down-hole conditions may go unnoticed (assuming the well was ever producing as originally expected) resulting in lost production for reasons other than normal reservoir depletion. The production log can prevent this, resulting in production increases for the well. One of the primary applications for the Trac-III log is to re-evaluate marginal production wells. Watered-out or gassed-out wells can frequently be profitably reworked based on information obtained from production logs. Information gained may also lead to recompletion of unproductive offset wells.

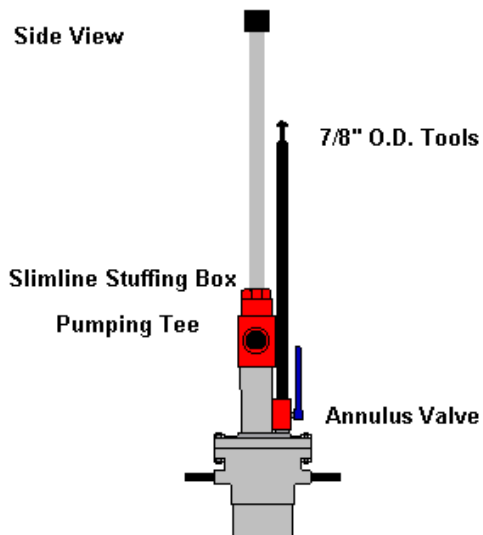
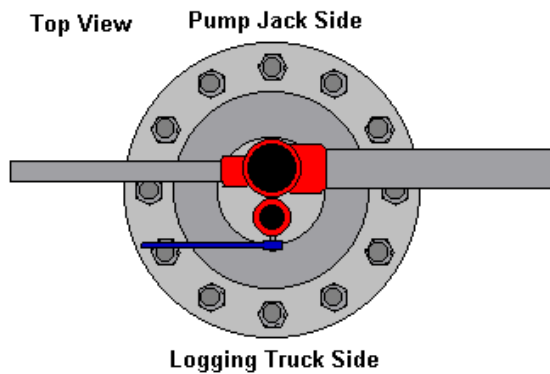
By helping with production management of reservoirs during primary and secondary depletion, the production log also provides essential guidance for remedial-workover designs. Reliable data allows accurate and precise design of remedial workover procedures. This leads to more efficient and cost-effective well recompletions, and, in some cases, results in workover designs that would otherwise be impossible. Knowledge gained from the production log may also lead to different completion techniques for future wells. The immediate verification of perforation accuracy and positive identification of the actual production intervals is invaluable.

On a new well, the evaluation from the production log allows confirmation of open hole log analysis and assumptions used in the initial completion. Even the most accurate, state-of-the-art primary log

analysis does not guarantee a successful completion. Cementing (cement bond), perforating efficiency, and initial stimulation treatment all play important roles in well completion and performance. The production log can accurately identify actual producing intervals, and pin-point mechanical problems.

Below are the six steps needed to prepare your pumping well for an annulus log:

1. Tubing anchor, if present, must be removed.
2. Pump should be set 50 to 100 feet above the perforated interval.
3. Dual well-head must be installed with the annular opening AWAY from the pumping unit.
4. Conventional stuffing box must be replaced with a slim line stuffing box and a small pumping tee.
5. The bridle guard on the horse's head must be removed.
6. Allow production to stabilize from 3 to 5 days.



ADDITIONAL INFORMATION AT:

<http://www.cardinalsurveys.com>



WIRELINE SUPPORT UNIT

**10,000 PSI Working Pressure
104' Crane Height
20,000 PSI Grease System
Lighting for 24 Hour Operation**

The Wireline Support Unit (WSU) consists of a National 800 Series crane, 85 feet of Bowen 10,000 psi (working) rated lubricator, 20,000 psi grease system, and a 6 KVA generator pack for lighting and power. The tool trap and blow out preventer are hydraulically actuated for safe, instantaneous control. This mobile support unit allows for rapid deployment and rig-up for your most demanding well-site applications.

Cardinal Surveys Company developed the WSU to compliment the logging operation. The WSU is normally used whenever there is an unusual situation such as a very tall well head, higher well head pressure, or other environmental reasons which require this additional piece of specialized equipment at the job site.

Cardinal Surveys Company is one of few production logging service companies that offer such a wide range of logging capabilities. From the world's smallest logging tools to specialized, high pressure equipment, Cardinal Surveys Company can do it all. Next time you need good information on a high pressure well, give us a call and request the Wireline Support Unit. The WSU is standing by!



More Information is available at:
<http://www.cardinalsurveys.com>



Cardinal Surveys Company

"The Fluid Movement Specialists"
<http://www.cardinalsurveys.com>

PRODUCTION LOGGING *Pumping or Flowing Wells*

INJECTION PROFILES *Water, Polymer, CO2 or Gas*

PUMP IN TRACERS *Identify Channels and Fluid Loss*

AFTER TREATMENT SURVEYS *Temperature and Gamma Ray*

TAGMASTER® *High Pressure, In-Line Tagging System*

MULTI-ISOTOPE TAGGING *No Wash Material*

HIGH PRESSURE EQUIPMENT *Bowen 10,000 PSI*

104 FOOT MOBILE CRANE UNIT *Wireline Support Unit*

DRAFTING DEPARTMENT *AutoCAD® System*

CUSTOM LOG PRESENTATIONS *Macro*Log*

ELECTRONICS LAB *In-house Design and Repair*



Cardinal Surveys Company

<http://www.cardinalsurveys.com>

ODESSA, TEXAS

Mail: Box 729, Odessa, TX 79760
Shipping: 1740 Samson Rd., Odessa, TX 79762
(915) 580-8061
Fax (915) 580-0547

James S. McLaughlin, smclaugh@cardinalsurveys.com, President
George Newman, gwnewman@cableone.net, Technical Development Manager
Charles Newsom, cnewsom@cardinalsurveys.com, Division Sales

HOBBS, NEW MEXICO

Mail: Box 1966, Hobbs, NM 88240
Shipping: 900 S. Grimes, Hobbs, NM 88240
24 Hr (505) 397-1069
(505) 393-6858
Fax (505) 393-5836