

Better decisions

The **Source Rock Analyzer (SRA)** pyrolyzes rock samples to deliver accurate source rock and reservoir data, such as total organic carbon (TOC), thermal maturity (Tmax), free oil content (S₁), and source potential (S₂). The SRA is a lab services instrument as well as the oil and gas industry's first routine wellsite pyrolysis instrument that can be used in both active and previously drilled wells for a variety of applications, including identifying net pay zones and bypassed pay. The SRA is particularly valuable in long, horizontal well sections where it helps characterize zones of optimal production.

Unique features of the SRA include its compact design and ruggedness, which translate to more accurate results and longer service life in adverse drilling environments.

Faster Results

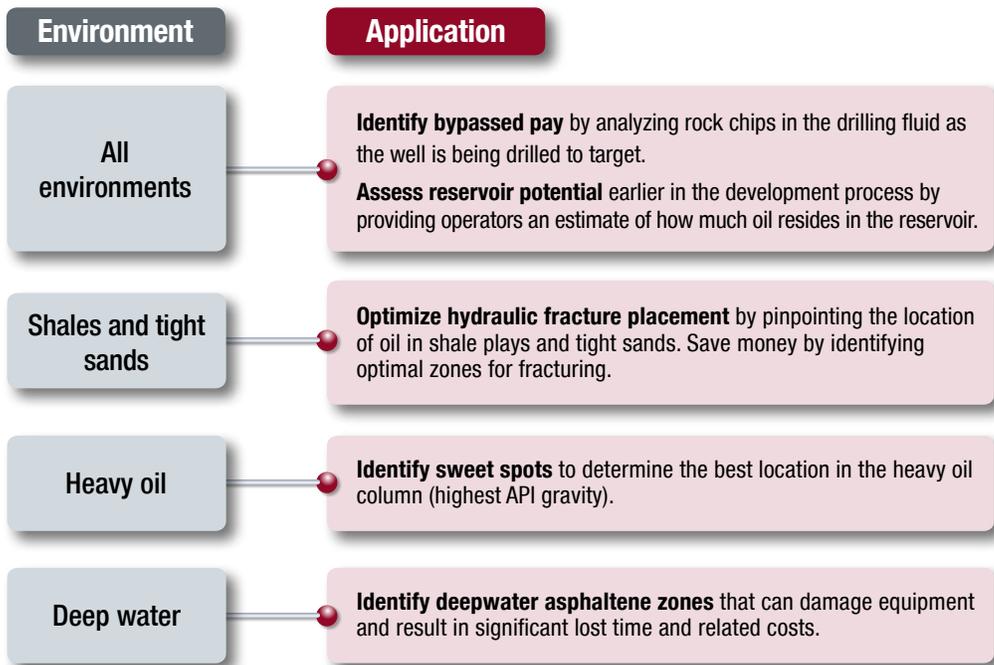
Prior to development of the SRA, pyrolysis calculations could be conducted only in off-site laboratories. The compact design of the SRA brings the lab to the wellsite. And, weighing just 40 lb (18.1 kg), it is easily transported from well to well.

The SRA's size opens up a whole new realm of wellsite applications for characterizing potential source and reservoir rocks.



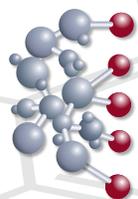


SRA applications

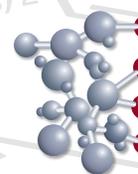


SRA Measurements

Source Rock Characterization

-  Organic carbon content
-  Oil content
-  Remaining hydrocarbon-generation potential
-  Thermal maturity
-  Organic CO₂

Reservoir Rock Characterization

-  Oil yields
-  Viscosity and API prediction
-  Tar, bitumen, pyrobitumen content
-  Pay zone identification

Site Remediation Studies

-  Total petroleum hydrocarbons (TPH)
-  Total organic carbon (TOC)

Better design

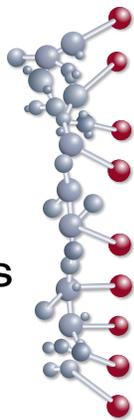
Beyond its compact size, the SRA incorporates a number of unique features to enhance reliability and accuracy.

A new take on a proven process

The SRA characterizes source rock and reservoir rock through pyrolysis—thermochemical decomposition of geologic samples such as outcrops, cuttings, conventional cores and sidewall cores to a programmed temperature in a stable, inert atmosphere.

Rock pyrolysis has been used for many years to evaluate organic richness, kerogen type, thermal maturity and generative potential, and to identify hydrocarbon-producing horizons. The SRA provides a cost-effective means of performing this analysis at the wellsite.

SRA Calculations and Measurements



S₁ – the amount of free hydrocarbons (oil)

S₂ – the amount of hydrocarbons generated through thermal cracking of nonvolatile organic matter, such as kerogen

S₃ – the amount of CO₂ produced during pyrolysis of kerogen

Tmax – the temperature at which the maximum release of hydrocarbons from kerogen cracking occurs during pyrolysis

TOC – total organic content

HI – Hydrogen Index

OI – Oxygen Index

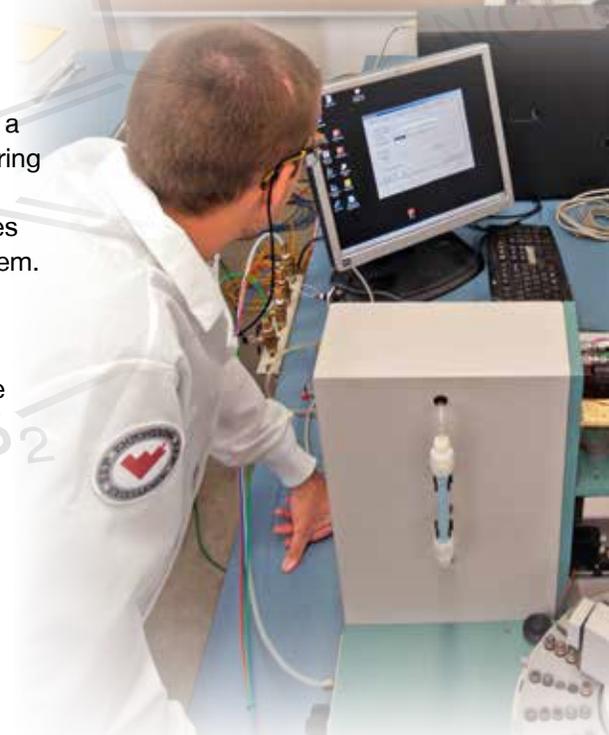
PI – Production Index

SI/TOC – oil or contamination indication

Streamlined, durable build

The SRA is streamlined and highly durable and it incorporates a **single-oven** and **dual-infrared (IR) cells** for constant monitoring of carbon monoxide and carbon dioxide. A solitary USB port facilitates instrument control and data acquisition and simplifies communication between the SRA and the computer data system. At the heart of the SRA is an **electronic circuit board** that measures just 5½ in. × 9 in. (14 cm × 23 cm).

The SRA's simple design contributes to its dependability in the field. The SRA has successfully endured adverse operational environments to provide reliable, reproducible data on-site in the Middle East on more than 94 wells, representing more than 10,000 man-hours over several years.



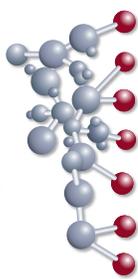


Accurate, reproducible measurements

The SRA is designed to ensure accurate and consistent results. A unique **pedestal** feature enables samples to be purged at lower temperatures, thus preserving more volatile components. A **double-seal** further protects sample integrity. Purging does not begin until samples are securely sealed in the oven, minimizing the potential for loss of volatile components and enhancing measurement accuracy and reproducibility.

In addition, the SRA's **flame-ionization detector (FID)** significantly improves sensitivity, linearity, dynamic range and reproducibility relative to conventional pyrolysis instruments; as a result, samples with elevated S_1 or S_2 concentrations are more accurate.

Design Advantages

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- Opens up new applications for pyrolysis and oxidative analysis
 - Enhances reliability and durability
 - Improves accuracy with highly advanced FID
 - Enhances safety by eliminating acid preparation of samples for TOC analysis
 - Improves low-end sensitivity for S_2 and S_3
 - Dramatically improves high-end linearity for S_2 , thus minimizing re-runs
 - Reduces downtime for recalibration

Safer method of determining TOC

The SRA does not require the use of dangerous acids to determine TOC. Instead, it uses a pyrolysis and oxidation cycle with the latest **solid-state electronic technology**. Not only is the process safer, but it reduces the need to store hazardous material such as used acid, which makes it more effective in a wellsite trailer.

Time-saving recalibration

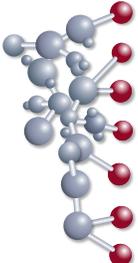
The SRA design enables users to **recalibrate IR cells in less than 30 minutes** in their own laboratories, eliminating months of downtime associated with sending a unit back to the manufacturer for recalibration.

Better options

The SRA can be configured in a variety of ways to meet specific needs and well conditions. The basic unit is the **SRA-TPH (total petroleum hydrocarbon)**, which provides S_1 , S_2 , and T_{max} calculations, including whether or not a particular zone is hydrocarbon-bearing.

The **SRA-TPH/TOC** configuration performs automated analysis of source and reservoir rock to evaluate organic richness, kerogen quality, thermal maturity and organic facies, and enables TOC calculations.

The SRA-TPH/TOC provides answers to critical questions about your reservoir

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- Does a rock in a particular zone contain sufficient organic matter to generate hydrocarbons?
 - Will the rock in this zone generate oil, gas or both?
 - Have the rocks already generated oil, gas or both?
 - Where are the source rock “kitchens” in relation to plays?
 - What is the oil saturation index within a conventional reservoir?
 - What are the trends in the reservoir for oil-water or gas-oil contacts?
 - What is the thermal maturity of the rock?

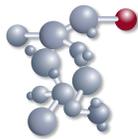


Better formation evaluation

Weatherford Laboratories is a global network of more than 40 laboratories that performs a range of advanced formation evaluation services, including geochemical analysis and core handling, storage and analysis. Our capabilities range from assessing the potential of shale plays to quantitatively allocating production from multiple zones in a commingled production stream. Mobile labs bring our offerings directly to your wellsite.

Weatherford is the only company that offers a full suite of formation evaluation services—including logging-while-drilling, surface logging and wireline services—in conjunction with a global network of geosciences laboratories.

Bringing the lab to your wellsite



Our wellsite geoscience services incorporate four core technologies—including our proprietary SRA and GC-TRACER® surface gas detector, and X-ray analysis instruments—to enable in-depth analysis of formation rock and gas samples at wellsite.

Applications include assessing reservoir potential and identifying brittle zones to optimize hydraulic fracturing and production in shale.





Source Rock Analyzer

Higher Standards

To learn more about the **Source Rock Analyzer** and other laboratory products and services that can help you build a rock-solid understanding of your reservoir, contact a Weatherford representative at **SRInstrumentation@weatherfordlabs.com** or visit **sranalyzer.com**.



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