

Californium-252 in
**Oil and Gas Well Logging
Applications**



Californium-252 (Cf-252) has the second-highest atomic mass of any element and is the only isotope that spontaneously emits neutrons – an ideal property for the identification and evaluation of materials and geological formations.



Scientists at the University of California Radiation Laboratory in Berkeley discovered this element in 1950, and since then Californium-252 has been applied towards nuclear fission initiation in nuclear reactors, material scanning (such as PGNAA in coal and cement), and more.

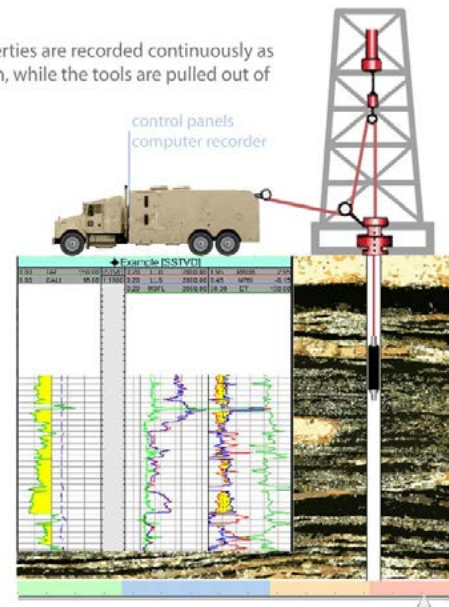
In addition to these, Californium-252 is very useful in analyzing geological factors at oil well logging and borehole sites. As an ideal neutron emissions source, Cf-252 can help geologists analyze boreholes and create specific plans for safely and efficiently drilling the area.

How Californium-252 Is Used in Well Logging

Before the use of Californium-252, the process of examining boreholes and the surrounding area was largely manual. In the 1800s, well loggers would scale derricks to hand-record information, but the process was slow and dangerous.

Later processes had oil companies extract a drill core and deliver it to a lab. Lithologists—scientists who study the physical characteristics of rock formations—would examine the physical and petrographic properties of the potential well site. This method was much more time-consuming, and the back-and-forth transportation involved was not always practical.

The physical properties are recorded continuously as a function of depth, while the tools are pulled out of the well.



Now, well logging processes have become more streamlined and instantaneous with Californium-252, which quickly analyzes boreholes on-site. The element emits neutrons into the walls and geological structures surrounding a borehole. The equipment involved in the application can then use the resulting electrical signals to form a digital map of the surrounding area. Using this information, geologists can plan a drilling route that considers factors such as:

- Underground formations
- The location of shale beds and hydrocarbons
- The porosity or permeability of the area surrounding the borehole

By the end of this analysis, operators will receive a detailed report of the borehole, enabling on-site, continual adjustments to be made based on local conditions and formations around the borehole.

A Powerful Data Source

Access to accurate geological data about a drill site is critical to the success of an oil well. Californium-252's neutron emissions can provide highly detailed breakdowns of a borehole's characteristics to determine its viability as a drilling site.

Oil and gas companies benefit from knowing how feasible and potentially valuable it will be to extract hydrocarbons from a given area.

The more information drilling companies have about a site, before they invest their full time and resources, the better. Cf-252 provides a wide range of lithological and geological information, including:



- **Borehole dimensional properties.** Measurable properties include the size and shape of the borehole. Cf-252 can also give operators more information about the borehole trajectory. Well logging processes that use Cf-252 can document the entire length of the borehole so there are no uncertainties or gaps in information.
- **Rock characteristics.** The success of an oil well often depends on factors other than just the presence of hydrocarbons, such as favorable drilling characteristics. Cf-252 neutron emissions can give geologists information about the rock's porosity, permeability, and likelihood of holding fluid. It provides much better information than off-site core analysis because the contents are still under pressure and reflect the area's temperature.
- **Rock composition.** Operators need to know how the composition of the rock changes at different levels throughout the borehole and the surrounding area. Californium-252 can provide raw data about the strata, including limestone, shale, and sandstone formations.

- **Rock integrity.** Unstable rock can be both catastrophic and costly, but the emissions readings from Cf-252 can inform geologists about any structural weaknesses in the area. They can use this information to predict the impact of drilling activity, measure the risk of cave-ins, and create a plan to avoid dangerous or unstable areas.
- **Potential presence of liquids.** Drill sites with detectable levels of fluid in the area demonstrate the greatest probability of success. Cf-252 can detect liquids in the borehole and measure their properties. Detailed information about a gas or liquid's pressure, salinity, saturation, and other features can help give operators more information about the presence of hydrocarbon fluids.

All of this detailed information can be gathered on-site through the application of Californium-252.

Additional Advantages of Cf-252 in Well Logging

Californium-252 comes with an additional set of advantages for well logging applications in the oil and gas industries. These include:

- **Compatibility with various types of equipment.** Cf-252 can be implemented in a wide variety of equipment. At FTC, our engineers can encapsulate Cf-252 in different size holders, which enable a perfect fit for each well logging instrument.
- **Time-effectiveness.** Cf-252 is a great alternative to the traditional back-and-forth lab examinations. Not only do Cf-252 analyses provide more accurate readouts based on environmental conditions, but the process involves far fewer resources and requires much less time.
- **Resistance to pressure and temperature damage.** Once Cf-252 is correctly encapsulated, it can withstand extreme pressure and temperature conditions underground.

- **Uniquely beneficial in detecting gas reserves.** Cf-252 can detect likely locations for gas reserves. The readouts can identify formations of porous and permeable sedimentary rock. Oil well loggers can use this information to predict the likelihood of finding hydrocarbons at those locations.

Cf-252 is a versatile, time-effective, and valuable tool that can make oil well logging processes more efficient. The source can be applied within a wide variety of instruments and is very adept and is well suited at resisting extreme conditions in the surrounding environment when properly encapsulated.

Californium-252 Neutron Sources at Frontier Technology Corporation

Not only does Californium-252 provide a clear record of boreholes, but it is also a highly versatile neutron source that works with many types of well logging equipment.

At Frontier Technology Corporation, our high-quality Californium-252 neutron sources can withstand extreme pressure and temperatures, a quality that is owed to our unique and highly tailored capsules. Our capsules and shielding holders are welded using TIG welding techniques to provide an equally high degree of safety, and our facility tests every piece of equipment with pressurized helium to detect any potential leaks. Our Cf-252 sources are manufactured under a strict Quality Assurance program to ensure superior performance and user safety at every step of the way.

Our processes and sources meet ISO 2919, ASTM, and ANSI regulatory standards, among many more. Since our start in 1984, we have been providing high-quality neutron sources, WEP shielding, and other Cf-252 solutions to clients in a range of industries.

[Contact us today](#) to learn how we can help with your next well logging project.



About Us

Frontier Technology Corporation (FTC) is the world leader in [Californium-252](#) neutron source manufacturing and design, and is the foremost expert in logistics and shipping of radioactive material.

Founded in 1984 by Treva Janzow and the late Edward Janzow, Frontier Technology is located in Xenia, Ohio. Frontier Technology has over 40 years industry experience in providing the highest-quality neutron sources, PINS sources, nuclear start-up rods, TYPE-A shipping containers, WEP shielding, and antimony-beryllium pellets.

Our goal at Frontier Technology is to provide our customers with high-integrity, cost-effective neutron sources and TYPE-A shipping containers. We are committed to safety, reliability, and customer satisfaction.

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