



A Guide to Replacing Nuclear Density Meters



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Although the reasons or timing may vary, every measurement process will at some point need to consider replacing its nuclear density meter. If you currently find yourself in this situation, don't worry – you have plenty of company.

A requirement for obtaining a nuclear density gauge license is for you to be aware of how you are going to dispose of your gauge when you are done using it. For most processes, the need to replace a nuclear density meter is driven by a specific event.



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Since the nuclear source within these density meters is hazardous, it is heavily regulated with requirements for licensing, controlling documentation, specialised training and leak testing. The company wanted to reduce their dependence on nuclear instrumentation to avoid having to comply with these regulations while increasing safety for their personnel.

- [EME]



Perhaps the gauge is too old and not worth fixing, or the job which you obtained the gauge has ended. Although for a small percentage of companies this may take the form of an unreparable system failure, the majority of businesses find themselves facing a replacement decision for one of seven key reasons:

01 Licensing & Permitting

Understandably, nuclear gauges aren't sold to just anyone. Licenses and permits must be acquired in order to possess, move or retain one. The process for obtaining and retaining licenses and permits are costly, time-consuming and in most cases extremely frustrating. This additional work ultimately drains valuable resources away from the company's core objectives.



02 Personnel

Due to the strict constraints around possessing a nuclear device, specialist personnel are required at all times. The number of personnel required depends on the process and number of nuclear gauges, but in all operations a special Radiation Safety Officer is required. This person is responsible for radiological safety in conjunction with the use, handling, and storage of radioactive materials in a program licenced by the Nuclear Regulatory Commission (NRC).

These specialists are unsurprisingly expensive to employ with an average annual salary of over \$135,000 and are in high demand according to Chron.

Source

<https://work.chron.com/average-salary-radiation-safety-officer-1187.html>

03 Safety

The owner of every nuclear device is responsible for ensuring the nuclear device remains contained and the strictest safety standards are met at all times. Tests are ongoing and become more frequent as the device ages and wear weakens both the core and casing.

According to the Office of Homeland Security & Emergency Coordination Radiation Safety Division:

“A sealed source is a contained source that has been constructed and tested to pass specific accident conditions without the release of radioactive material. NRC (or an Agreement State) performs a safety evaluation of each sealed source before authorizing a manufacturer (or distributor) to distribute the sealed source. A leak test of a nuclear gauge must be performed every six months to assure that the sealed sources are not leaking.”



04 Location Restrictions

Nuclear meters cannot be transported without proper paperwork, and most organizations have restrictions on the transport of nuclear materials. Many dredging industries cannot use nuclear density meters on ships because nuclear sensors are not built to be moved. During any transportation, the device must be removed from its home within the process and packaged within a special case with specific markings. Nuclear gauge manufacturers provide a carrying case designed, marked, and labeled to comply with Department of Transportation (DOT) regulations. The case is a US DOT Type-A container. There is also extensive paperwork that must be transported with the nuclear gauge including:

- USDA Radiation Use Permit
- USDA Radioactive materials license
- Transportation Declaration
- Emergency Response Guideline

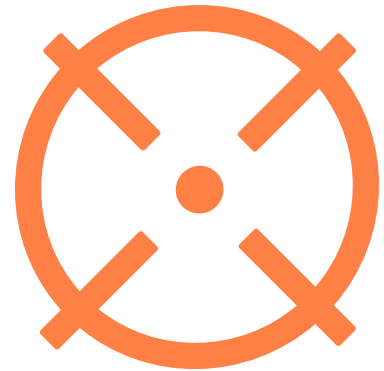
Due to the safety threats associated with “loose nukes” and theft of nuclear devices, there are strict transportation security protocols that must be followed in order to transport any nuclear device.

05 Measurement Accuracy

The nature of nuclear density gauge readings are completely random. Readings are taken at random times throughout the process with the assumption that a process slurry is uniform. We know, of course, that is not the case.

In addition to this, nuclear density gauges become less powerful over time, which inhibits the accuracy of the readings. As the power of the core weakens over time, the readings are less and less accurate.

Recalibration is required as the half-life of the device deteriorates, requiring more frequent recalibration and safety testing such as wipe tests as the device nears its end of life.



06 Maintenance

In order to maintain the safety and accuracy of nuclear devices, ongoing maintenance is imperative. This maintenance is not optional based on the preferences of the owner - but regulated by the USDA.

Furthermore, should any non-routine maintenance be required, it must be performed only by the device manufacturer.

07 Total Cost of Ownership

Because of all the reasons detailed above, the overwhelming motivator for replacing a nuclear density meter is the total cost of ownership. Acquisition cost for a single measurement device is a tiny percentage of the total cost of ownership. Within as little as a year, nuclear density meters prove to be more expensive than modern solutions.

Cost of ownership increases significantly as the device ages with the most expensive cost being at the end of the life of the device - disposal. As the half-life of the device deteriorates, the ownership costs and the accuracy deteriorate exponentially. What was seemingly an affordable solution initially can break the budget of even the largest operations.



Disposal

“The important thing to know is you can’t just throw the gauge in a dumpster or scrap yard. It must be properly disposed or transferred and you must generally know which of these actions you are going to exercise even before you buy the gauge.”

- American Portable Nuclear Gauge Association

So, you’ve decided to replace your nuclear density gauges - but where do you start? Firstly, you should be warned - this is neither a simple nor economical process. Albeit, these are simply contributing factors as to why you should be replacing your nuclear density gauges with modern solutions ASAP!

“Be careful, many independent disposal options can be very expensive.”

- American Portable Nuclear Gauge Association

Disposal of a nuclear density gauge is considered transportation or transfer. You cannot transfer for any reason, be it disposal, sale or service, unless you have first determined that the receiving party is authorized to accept this specific radioactive material.

In order to confirm the receiving party, you should view a copy of their license to see if they are licensed to accept this exact brand and model of gauge. Make sure the license has not expired. Obtain a bill of sale, a copy of the transferee’s license, make sure you have a current leak test on the gauge and make sure you amend your inventory. If you are getting out of the gauge business and are looking to decommission your license make sure you follow your agency’s requirements for decommissioning. This usually requires advance notice – you don’t want to wait until you are too close to your license renewal anniversary date – you may end up paying for an additional year. Keep good, solid records of any transfer. Notify your agency of any transfers and/or disposals.

In most cases, manufacturers of nuclear density gauges facilitate disposal. (The cost of which they likely do not share at the time of purchase!) There are, however, independent consultants who are also licensed to dispose of nuclear density gauges or you can also attempt to sell to another licensed user.

A nuclear gauge cannot be given away, placed on excess property lists, thrown away, or abandoned. Any of these actions is a serious violation of NRC Federal Regulations. If a Permit Holder leaves USDA without arranging for the proper transfer of a gauge, local management or the LRPO (Location Radiation Safety Officer) must maintain control of the nuclear gauge until the name of a new Permit Holder candidate can be submitted to the Radiation Safety Division.

The proper disposal of nuclear gauges is required. The original manufacturer will usually accept the return of the gauge. (Other nuclear gauge manufacturers may also accept the transfer of a nuclear gauge). A nuclear gauge may also be transferred to another USDA employee with a nuclear gauge Permit, or to any non-USDA person or organization that is licensed by the state or the NRC to have the gauge.

All gauge transfer methods must be done with the assistance and approval of the Radiation Safety Division. The Radiation Safety Division must verify the license or permit of the recipient and assure that the leak test requirement is current. A nuclear gauge can be trans-

ferred only upon the written approval of the Radiation Safety Division. Upon transfer of the gauge, a letter of receipt from the gauge recipient must be obtained and sent to the Radiation Safety Division. The gauge transfer is not considered complete until the Radiation Safety Division has received this letter. At that time, the Radiation Safety Division will update the permit and inventory data for the Permit Holder, and release the Permit Holder from responsibility for the nuclear gauge.

Theft or Loss

As soon as it becomes known that a nuclear gauge has been stolen, lost or misplaced, the Permit Holder, or the individual in possession of the nuclear gauge, must immediately call the Radiation Safety Division for assistance. Finding the gauge must be an urgent priority, which may involve law enforcement and the resources of the NRC.

Replacement

Thankfully, replacing a nuclear density gauge with a modern measurement device is much simpler and economical than disposing of a nuclear density gauge!

- 1 Assess how many nuclear devices are within your operation**
- 2 Determine your method for removing and disposing of your nuclear gauges**
- 3 Determine what measurement equipment or process control changes will replace the device.**

Popular replacement options include:

- **Sampling**

Economical, but highly inaccurate

- **Coriolis**

High accuracy, but only appropriate for liquids and dissolved solids on small pipe diameters

- **Red Meter**

- Unrivaled accuracy and repeatability
- Low total cost of ownership
- Appropriate for a vast range of pipe sizes and applications

- 4 Implement new density meter and, based on your replacement option, modernise your entire process.**

The Red Meters Solution

Thanks to a simple methodology and highly intelligent algorithms, the Red Meter was designed to empower process engineers by providing measurement data that empowers.

The Red Meter takes continuous readings of multiple measurement variables which are recorded and used to perform a range of calculations by its integrated computer. This data is then displayed on screen and can be output to third party systems. Measurements include density, media pressure, flow rate and solids accumulator.

Whether we are working with process control engineers on the front lines or industry associations that define best practices and standards, our disruptive technology aims to create a new standard for industrial measurement. This new standard breaks free of legacy limitations, breathing new life into industries and applications that are essential to our global economies.



Ready to modernise your process?

Speak to one of our experts today to get started

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