U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS
DIVISION OF RULEMAKING, ENVIRONMENTAL, AND FINANCIAL SUPPORT

ENVIRONMENTAL ASSESSMENT FOR PROTECHNIC'S REQUEST FOR ALTERNATE ABANDONMENT OF AN IRRETRIEVABLE SEALED SOURCE

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1.0 Introduction

By letter dated August 22, 2022, ProTechnics, a division of Core Laboratories LP, submitted a request for alternate abandonment of an irretrievable sealed source in accordance with the requirements in title 10 *Code of Federal Regulations* (10 CFR) 39.15(c) (ProTechnics, 2022a). 10 CFR 39.15(c) provides that "[a] licensee may apply, pursuant to § 39.91, for Commission approval, on a case-by-case basis, of proposed procedures to abandon an irretrievable well logging source in a manner not otherwise authorized in paragraph (a)(5) of this section." The NRC may approve an exemption from the requirements of the regulations in Part 39 if it determines that the requested exemption is "authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest" (10 CFR 39.91). ProTechnics provided supporting information and documents to provide background details on the sealed source and well logging tool in question, and on the offshore Gulf of Mexico well in which the sealed source is located (ProTechnics, 2022a).

The NRC staff accepted ProTechnics exemption request for detailed review on August 26, 2022 (NRC, 2022a). On October 18, 2022 (NRC, 2022b), the NRC staff requested ProTechnics to provide additional information to support its request. ProTechnics provided the requested information on January 10, 2023 (ProTechnics, 2023b).

In accordance with 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," that implements the National Environmental Policy Act of 1969, as amended, the NRC staff's environmental review of the proposed action is documented in this environmental assessment (EA). The purpose of this document is to assess the potential environmental impacts of ProTechnics' exemption request.

1.1 Regulatory Background

Regulations concerning irretrievable sealed sources were initially proposed as amendments to 10 CFR Part 30 in the *Federal Register* (FR) on September 28, 1978 (43 FR 44547) and published as a final rule on August 29, 1983 (48 FR 39036). These Part 30 regulations required (1) sealing the source in place with a cement plug, (2) installing a whipstock or other deflection device above the cement plug, (3) mounting a permanent identification plaque at the surface of the well, and (4) reporting the circumstances concerning the irretrievable source to the Commission and to pertinent State agencies within 30 days after the source had been abandoned. In an August 9, 1983, memorandum transmitting the final rulemaking plan (NRC, 1983), the NRC staff discussed how a licensee, in meeting these criteria, has provided the maximum assurance possible that a well owner or operator would be adequately alerted if reentry into a closed well was necessary.

The NRC staff incorporated the Part 30 requirements into a new 10 CFR Part 39, in a final rule issued in the *FR* on March 17, 1987 (52 FR 8225). The criteria in 10 CFR 39.15(a)(5), "Agreement with well owner or operator," were subsequently revised in a final rule issued on April 17, 2000 (74 FR 20337). The final rule modified 10 CFR 39.15(a)(5)(ii) to allow a licensee the flexibility to determine the best method to prevent inadvertent intrusion on the sealed source, while still retaining the requirements for a cement plug and a permanent plaque, as provided respectively in 10 CFR 39.15(a)(5)(i) and (iii) (NRC, 1999).

Currently, the NRC's regulations in 10 CFR 39.15(a)(5) require the following for abandonment if the sealed source is classified as irretrievable after reasonable efforts at recovery have been expended:

> "(i) Each irretrievable well logging source must be immobilized and sealed in place with a cement plug.
>
> (ii) A means to prevent inadvertent intrusion on the source, unless the source is not accessible to any subsequent drilling operations; and
>
> (iii) A permanent identification plaque, constructed of long lasting material such as stainless steel, brass, bronze, or monel, must be mounted at the surface of the well, unless the mounting of the plaque is not practical. The size of the plaque must be at least 17 cm [7 inches] square and 3 mm [$^{1}/_{8}$-inch] thick. The plaque must contain--
>
> > (A) The word "CAUTION";
> >
> > (B) The radiation symbol (the color requirement in § 20.1901(a) need not be met);
> >
> > (C) The date the source was abandoned;
> >
> > (D) The name of the well owner or well operator, as appropriate;
> >
> > (E) The well name and well identification number(s) or other designation;
> >
> > (F) An identification of the sealed source(s) by radionuclide and quantity;
> >
> > (G) The depth of the source and depth to the top of the plug; and
> >
> > (H) An appropriate warning, such as, "DO NOT RE-ENTER THIS WELL." "

As discussed in section 1.0, ProTechnics is seeking NRC approval of alternate methods for abandonment of its irretrievable sealed source pursuant to 10 CFR 39.15(c).

1.2 Prior NRC Staff Analysis

In response to Commission questions regarding the 1978 proposed rulemaking to amend 10 CFR Part 30, the NRC staff conducted a risk analysis for previously abandoned sources that would not be covered by the rulemaking (NRC, 1981). This risk analysis concluded the probability of striking a source in the well was small, and that if a source was struck, the resulting dose would be 1.3 person-rem (NRC, 1981). A detailed discussion of this analysis is provided in the following paragraphs.

In the 1981 risk analysis, the NRC staff first reviewed NRC and Agreement State reports and records of sources abandoned downwell in the preceding 20 years. This review identified 248 occurrences, of which 57 had occurred in non-Agreement States (i.e., under NRC jurisdiction). The hazard presented to the public or a worker by an abandoned well-logging source is exposure to radiation if the radioactive material should reach the surface; using this information the NRC staff estimated the probability that the source would be struck by subsequent drilling and the source contents be brought to the surface. This probability was the product of (1) the probability that a reopened well contained an abandoned unmarked or unplugged source, and (2) the probability of striking a source if such a source was found in the well (NRC, 1981).

The NRC staff used data from the Texas Railroad Commission (TRC) to help estimate the first of these two probabilities. Based on TRC records for open, closed, and reopened wells in the State of Texas and extrapolating this data for the whole country, the NRC staff assumed that 47% of all wells were closed, with 0.8% of these wells re-entered annually, and that 70% of abandoned sources were in closed wells, with 8.4% of these sources not having been abandoned according to some procedure. The NRC staff then assumed random entry into a closed well and used a Poisson model to calculate a probability of 0.11 for re-entering a closed well with an abandoned unmarked or unplugged source (NRC, 1981).

For the probability of striking a source within a well, the NRC staff assumed a 50% probability, but considered this probability in practice to be lower due to (1) the considerable financial investment that logging tools represent and the serious efforts therefore made to retrieve them, and (2) the greater likelihood that sources would be lost in uncased wells that have a propensity over time to close in and cease to exist (NRC, 1981).

Should a source be struck and ruptured, the NRC staff considered the primary pathway for the source to reach the surface would be in the drilling mud associated with the drilling operations that struck the source. The NRC staff then assumed a worst-case scenario wherein the source and logging tool were completely demolished in a short time by a drill bit or milling tool, dispersed, and brought to the surface in a small volume of drilling mud. The drilling mud would entrain the demolished source, with pieces ranging in size from small particles to pieces of the source itself. Radiation exposure of drill-rig operator personnel would occur when the source contained in the small volume of drilling mud first reached the surface. The drilling mud would be continuously recycled as the drilling proceeded, with the source particulates and pieces becoming increasingly dispersed throughout the whole of the mud (NRC, 1981).

To evaluate potential radiation exposure, the NRC staff assumed that two operators were present at the well head within one meter of the drilling mud, two operators were on top of the drilling rig within five meters of the mud, and one operator was in the power plant within 10 meters of the mud. The NRC neglected any intervening shielding and any neutron shielding provided by the aqueous nature of the drilling mud and determined the dose rate at the various operator positions using a simple inverse square law given the dose rates at one meter. Noting that well-logging sources could include both a gamma source and a neutron source, the NRC staff determined that the worst-case dose rate would consist of a source composed of 2.0 curies (Ci) of cesium-137 (Cs-137) and 16.0 Ci of americium-241-berilium (Am-241-Be). For this worst case, the total population exposure would be 1.3 person-rem, with the likelihood of ingesting any significant amount of the material in the mud considered to be negligible (NRC, 1981).

2.0 The Proposed Action

ProTechnics is seeking an exemption to allow for alternate abandonment of an irretrievable sealed source in accordance with the requirements in 10 CFR 39.15(c). In its exemption request, ProTechnics stated that the sealed source had initially become lodged in the Gulf of Mexico well on June 29, 2022, and following attempts to retrieve it, ProTechnics declared the sealed source irretrievable on July 29, 2022 (ProTechnics, 2022a). The sealed source, together with its encasing well logging tool, is found within the borehole and is oriented 45 degrees off vertical, which ProTechnics states has contributed to its inability to retrieve the sealed source (ProTechnics, 2022a).

ProTechnics is proposing an alternate abandonment method for the sealed source that includes mechanical/technology, geographic, and administrative barriers (ProTechnics, 2022a). With respect to mechanical/technology barriers, ProTechnics identified mechanical hardware in the wellbore, the source orientation 45 degrees off vertical, and the location of the sealed source within the Gulf of Mexico well. ProTechnics believes that these mechanical barriers provide as much protection as that provided by ProTechnics' NRC-approved source abandonment procedures (ProTechnics, 2022a).

Geographically, as noted previously, the well containing the irretrievable sealed source is in the Gulf of Mexico. This location, plus the depth at which the sealed source is located, ProTechnics believes isolates the source from members of the public (ProTechnics, 2022a).

Regarding administrative barriers, ProTechnics identified actions and coordination before remedial work would be taken in the well, if ownership of the well changed, and during the development stages of the final abandonment plan for the well (ProTechnics, 2022a). Prior to reentry into the well, ProTechnics states that it would be involved in the communication concerning the reentry plans. These plans would likely include physical modifications to the inside of the wellbore to reach the depth where the sealed source is located, and prior to production from the well, the U.S. Bureau of Safety and Environmental Enforcement would need to approve and issue a Revised Permit to Modify that recognizes and permits physical modifications made by the operator to the original well design and hardware configuration inside the wellbore (ProTechnics, 2022a).

ProTechnics proposed additional administrative items to include:

- posting a permanent identification placard at the wellhead on the production platform, if feasible, indicating the downhole presence of an irretrievable sealed source, or if not feasible, placing a copy of the placard in the well owner's/operator's well file;
- annually contacting the well operator's Gulf of Mexico regulatory team to confirm that the well is still producing and has not been sold; and
- joining in the well operator's planning stages for the total abandonment of the complete wellbore at the end of the useful production life of the well.

2.1 The Need for the Proposed Action

ProTechnics submitted its request to seek NRC approval of alternate abandonment procedures for an irretrievable sealed source, pursuant to the requirements in 10 CFR 39.15(c). ProTechnics stated that between June 30 and July 28, 2022, multiple unsuccessful attempts were made to retrieve the sealed source. ProTechnics states that the wellbore's orientation off vertical and the location of the sealed source within the wellbore make it impossible to implement its standard procedures for abandonment of the sealed source (ProTechnics, 2022a).

3.0 Environmental Impacts of the Proposed Action

Given the location of the irretrievable sealed source inside a Gulf of Mexico wellbore and ProTechnics' proposal to abandon the sealed source at depth, the NRC staff does not expect potential environmental impacts to the following resource areas: land use, transportation, geology and soils, surface water and ground water, ecology, air quality, noise, historic and cultural resources, socioeconomics, visual and scenic resources, and waste management.

As a result, the NRC staff's analysis will focus on the potential radiological impacts to public and occupational health.

As discussed in the NRC staff's 1981 risk analysis of potential radiological impacts, the primary pathway for a source to reach the surface would be in the drilling mud associated with the drilling operations that struck the source. In the 1981 risk analysis, the NRC staff assumed a conservative probability of 50% for striking an abandoned source but recognized that the actual probability was much lower. To reduce the potential for its sealed source to be struck, ProTechnics identified mechanical hardware within the well, the orientation and location of the sealed source, and administrative items (e.g., a permanent identification placard at the wellhead, an annual contact with the well owner, and involvement in the final well abandonment planning stages). The NRC staff considers these barriers and items would tend to reduce the probability of striking ProTechnics' irretrievable sealed source to be substantially below 50%.

Despite this expected low probability of actually striking ProTechnics' irretrievable sealed source, the NRC staff considered the radiation exposure to operators and members of the public on the drilling rig. In the 1981 risk analysis, the NRC staff considered the potential dose rates on the drill rig from a variety of sources (e.g., Cs-137, Am-241, Cobalt-60, Iridium-192) and determined that the worst-case scenario would result in a total population dose of 1.3 person-rem. The NRC staff stated that this radiological impact would be comparable with the exposure allowed for a low probability release of radioactive material from products containing exempt quantities. The NRC staff further noted that its risk analysis did not reflect intervening shielding on the drill rig or any shielding that would be provided by the aqueous nature of the drilling mud, both of which would further reduce any exposure.

For these reasons, the NRC staff considers the potential radiological impacts of ProTechnics' proposed exemption request to abandon its irretrievable sealed source in the Gulf of Mexico well to be minimal and not significant.

3.1 Environmental Impacts of the Alternatives to the Proposed Action

An alternative to the proposed action is the no-action alternative. Under the no-action alternative, the NRC would not grant ProTechnics' alternate abandonment procedures for the irretrievable sealed source in the Gulf of Mexico well. With the no-action alternative, ProTechnics would be required to follow the procedures in 10 CFR 39.15(a)(5) for abandonment of the sealed source. The procedures in 10 CFR 39.15(a)(5) were previously analyzed by the NRC staff and determined to result in no significant environmental impacts (NRC, 1999; NRC, 1987).

4.0 Agencies and Persons Consulted

Given the expectation that the irretrievable source would remain within the well and the unlikelihood that the source would be struck by future drilling activities, the NRC staff has determined that the proposed action would have no effect on threatened or endangered species or critical habitat. Therefore, no consultation is required under Section 7 of the Endangered Species Act. Likewise, NRC staff has determined that the proposed action is not the type of activity that has the potential to cause effects on historic properties. Therefore, consistent with 36 CFR 800.3(a)(1), no consultation is required under Section 106 of the National Historic Preservation Act.

5.0 Conclusion

The NRC staff has concluded that, given the orientation and location of the sealed source, the mechanical barriers in the Gulf of Mexico well, and ProTechnics' identified administrative items, there would be no impacts to land use, transportation, geology and soils, surface water and ground water, ecology, air quality, noise, historic and cultural resources, socioeconomics, visual and scenic resources, and waste management. Additionally, the NRC staff evaluated the potential radiological impacts and found those to be minimal and not significant.

The NRC staff has prepared this EA to evaluate the potential environmental impacts of the proposed action to approve ProTechnic's alternate abandonment procedures for an irretrievable sealed source in a Gulf of Mexico well. Based on this EA, NRC has concluded that there are no significant environmental impacts, and the exemption request does not warrant the preparation of an Environmental Impact Statement. Accordingly, the NRC staff determined that a Finding of No Significant Impact is appropriate.

6.0 Sources Used

10 CFR Part 39. "Licenses and Radiation Safety Requirements for Well Logging."

NRC, 1981. "Risk Analysis for Previously Abandoned Well-Logging Sources." SECY-81-516. ML23158A257. August 28, 1981.

NRC, 1983. "Final Amendments to 10 CFR Parts 30, 70, and 150 – Irretrievable Well-Logging Sources." Legacy Library 8308260292. August 9, 1983.

NRC, 1987. "Licenses and Radiation Safety Requirements for Well Logging: Final Rule." Federal Register. 52 FR 8225. March 17, 1987.

NRC, 1999. "Environmental Assessment of Energy Compensation Sources for Well Logging and Other Regulatory Clarifications - Changes To 10 CFR Part 39: Final Report." ML003690504. December 1999.

NRC, 2022a. "NRC Response to ProTechnics Request for Approval of an Extension for Completing Abandonment Procedure." ML22237A317. August 26, 2022.

NRC, 2022b. "Request for Additional Information Concerning ProTechnics Application for Exemption Letter Dated August 22, 2022." ML22285A192. October 18, 2022.

ProTechnics, 2022a. "ProTechnics Division of Core Laboratories LP - 10 CFR 39.15(c) Exemption Request Letter." ML23116A328. August 22, 2022.

ProTechnics, 2022b. "Emails regarding Request for information -- Core Laboratories/ ProTechnics Formal Letter Requesting NRC Region IV Approval to Abandon a Sealed Source in a ENI US Operating GoM Well." ML23116A323. August 29, 2022.

ProTechnics, 2023. "Re: NRC Request Dated October 18, 2022, for Additional Information Concerning ProTechnics Application for Exemption Letter Dated August 22, 2022." ML23116A322. January 10, 2023.